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SwissTech Convention Center, Lausanne
25–28 October 2017

Abstracts

- Oral Presentations
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ABSTRACTS

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NEUROLOGIE & REHABILITATION

Neuroprotektion | Neuroplastizität | Neurologische Langzeittherapie

Organ der

DGNR | Deutschen Gesellschaft für Neurorehabilitation
DGNKN | Deutschen Gesellschaft für Neurotraumatologie und Klinische Neurorehabilitation
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BSRM	British Society for Rehabilitation Medicine
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DSNR	Dutch Society of NeuroRehabilitation
OeGNR	Österreichische Gesellschaft für NeuroRehabilitation
SGNR	Schweizerische Gesellschaft für NeuroRehabilitation
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ORAL PRESENTATIONS

OP01

Analysis of the effectiveness of acoustical parameters of vocal quality in patients with Parkinson's disease after speech therapy

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Introduction: Parkinson's disease (PD) is a neurodegenerative disease with changes in vocal quality, such as difficulties in varying frequency and intensity, reduced speech intensity, monotonous speech, prosody, and others. However, little is known about the more sensitive acoustic parameters to identify changes in voice quality in people with PD. Objectives: to analyze which acoustic parameters are efficient in the identification of voice quality changes of patients with PD after speech therapy intervention. **Patients and methods:** Twelve patients with a diagnosis of PD were selected, between stages 1 and 2.5 of the Hoehn & Yarh scale, with a mean 70.5 years. The patients are followed up in Physical Activity Program for patients with Parkinson's diseaseof UNESP/Rio Claro/Brazil. Participants underwent speech and voice evaluation pre and post-intervention, based on the "Dysarthria Assessment Protocol", being used for analysis the vowel /a/ sustained production and connected speech (counting of numbers and reproduction of the phrase "Smoking is prohibited here"). The acoustic parameters analyzed were Jitter, Shimmer, Cepstral Peak Prominence (CPP), Harmonic-to-noise-ratio (HNR) and H1-H2. The intervention used was the Lee Silverman Voice Treatment Extended (LSVT-X), adapted and applied in group with the participants, with 16 sessions (eight weeks). Statistical analysis was performed for pre and post-interview comparison with T Student test.
Results: In the analysis of the sustained vowel /a/ it was obtained differences in CPP (p=0.04) and Shimmer (p=0.008) parameters, and in the connected speech in the Shimmer (p=0.0001), in the pre and post-intervention analyses. Conclusion: The acoustic parameters that proved effective in detecting post-intervention vocal quality improvements in the PD population were CPP and Shimmer, which demonstrat a decrease in voice irregularity.
Keywords: Parkinson's disease; Voice; Vocal quality; Acoustic analysis; Speech, Language and Hearing Sciences.

OP02

Comparative study of four neurorehabilitation complexes in patients with diabetic polyneuropathy and diabetic foot

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Introduction: Most of patients with Diabetes mellitus /DM/ develop neurological complications, including diabetic polyneuropathy /DPNP/ and neuropathic diabetic foot /DF/.
Objective: The goal of current study was to effectuate a comparative evaluation of different neurorehabilitation /NR/ complexes in patients with DM, DPNP and DF; with detailed evaluation of the impact of some pre-formed modalities: low frequency electric currents, functional electrical stimulations /FES/ and Deep Oscillation /DO/.
Material and methods: During last years a total of 144 patients with non-insulino-dependent DM, DPNP and neuropathic DF were observed and investigated. The investigation was conducted with consideration for the protection of patients, as outlined in the Declaration of Helsinki, and was approved by the appropriate institutional review boards and ethic commissions. All patients gave written informed consent before undergoing any examination or study procedure. Patients were randomized into four treatment groups of 36 each one. All patients received a complex NR programme including physical therapy and patients' education. Patients of group /gr/ 1 received only these procedures. In other groups we added some preformed physical modality: gr 2 – low frequency electric currents (iontophoresis and functional electrical stimulations /FES/), gr 3 - DO. Patients of group 4 received complex NR, including combination of procedures of groups 2 and 3. For statistical evaluation we used t-test (ANOVA) and Wilcoxon rank test (non-parametrical correlation analysis), performed using SPSS package. The treatment difference was considered to be statistically significant if the P value was < 0.05. Results: The comparative analysis of results shows a significant improvement: pain relief (visualized by the Visual analogue scale, and evaluation of muscle tenderness), increase of muscle force (Manual muscle test), reduction of dystrophic foot signs, and amelioration of quality of life (McGill QoL questionnaire). We received best results in group 4.
Discussion and conclusion: The combination of iontophoresis and FES is the most effective complex in cases with peripheral paresis. Deep Oscillation is the most analgesic agent. We suggest a conception of mechanisms of physical analgesia. We could recommend the complex program for treatment of DPNP and DF.

OP03

Comparison of the effects of whole body vibration training and exercise training on treatment goals of cerebellar ataxia individuals

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Introduction: Whole body vibration (TVV) applications have become increasingly popular over the last decade to increase muscle strength, power and postural control in various healthy and diseased populations. However, evaluation of treatment success is not sufficient to explain only with clinical or laboratory measurements. In particular, expectancies of treatments in social functions depend on individual's lifestyle/desires, and standardized measures are insufficient to assess them.
Objectives: The aim of the study is to compare the effects of TVV training and exercise training on the treatment goals of cerebellar ataxic subjects.
Materials and methods: Twenty patients with cerebellar ataxia diagnosed were included in the study. The demographic information of patients were obtained and treatment goals were assessed with the Goal Attaintment Scale. Exercise trainings consisting of trunk stabilization, balance and functional exercises were performed taking into account individual needs of patients along with whole body vibrations or alone. Cases were treated for 1 hour in 3 days for 8 weeks.
Results: The average age of patients participating in study was 34.00±9.15. It was found that the level of reaching treatment goals improved after both exercise programs (p<0,05) but it improved more after exercise program with TVV (p<0,05).
Conclusion: The treatment goals most frequently chosen by our cases in study were reduction of balance problems, development of independent walk, decreased difficulty of ladder activities, increased walking distance. Goal setting is integral part of rehabilitation approaches in terms of encouraging patients to

set their own goals/priorities, supporting team communication-coordination but it is often ignored in studies. If rehabilitation goals belong to patient itself, individual will have more motivation and therefore rehabilitation benefits will be more likely to continue.

OP04

Effects of an intensive, multidisciplinary inpatients rehabilitation programme in people with multiple sclerosis with different levels of disability – preliminary data

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Introduction: Multiple sclerosis (MS) is a chronic disease leading to progressive disability among young adults. Motor rehabilitation strategies in MS patients are heterogeneous and the optimal duration and intensity of physical treatment are not yet standardized.
Objective: To investigate the effects of a tailored intensive multidisciplinary rehabilitation (MDR) on disability and health-related quality of life (HRQoL) in MS patients with different levels of disability.
Patients and methods: 30 MS patient (14 male, 16 female, aged 18-65 years; expanded disability status scale (EDSS) ≤8.5) were hospitalized in our Department of Brain Injury and Parkinson's Disease Rehabilitation for an inpatient MDR. Rehabilitation protocol (3hours/day, 6 days/week) included front-to-front physiotherapy, mechanical rehabilitative devices, robotic devices (Lokomat, Hocoma) and occupational therapy, and was individually designed for each patient according to the clinical features and severity of disability. Before and after the intervention, participants were evaluated with: EDSS, functional motor tests (Functional Independence Measure (FIM), Trunk Control Test (TCT) for all patients; Dynamic Gait Index (DGI), Berg Balance Scale (BBS) only for ambulating patients), self-assessed measurement of disability (12-items MS walking scale, 12MSWS), fatigue (Modified Fatigue Impact Scale, MFIS) and HRQoL (Multiple Sclerosis Quality of Life, MSQoL-54).
Results: all participants completed the rehabilitation protocol. Mean MDR duration was 54.8±33.7 days. At the end of rehabilitation period, an improvement of both the self-assessed and functional motor scales was recorded ($p<0.05$ for EDSS, FIM, TCT, DGI, 12MSWS respect to baseline). A positive effect was also observed in self-perception of global health status and fatigue after treatment ($p<0.05$ for MSQoL-54 and MFIS).
Conclusion: we suggest that an intensive multidisciplinary rehabilitation protocol is feasible in MS patients with variable disability level and effective in improving motor abilities and quality of life. Further studies are needed for determining the duration of the described beneficial effect over time.

OP05

Effects of rhythmical auditory stimulation on gait in patients with Parkinson's disease measured through a wearable ad-hoc setup

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Introduction: Gait disturbance is a primary symptom of Parkinson's Disease (PD). A large number of studies investigated the use of Rhythmical Auditory Stimulation (RAS) to improve gait quality [1]. However, results of those studies are sometimes discordant and the identification of an optimal frequency of stimulation is still an open challenge. In addition, they often lack in the evaluation of the joint kinematics.
Objectives: To analyze the effect of RAS at different frequencies, using an ad-hoc developed wearable setup to perform a 3D gait analysis.
Patients and methods: We enrolled 31 PD patients (AGE=70±9 years, UPDRS-III OFF=28±8, UPDRS-III ON=19±6) and 11 age-matched healthy subjects. The setup consisted of 4 force resistive sensors, 7 Inertial Measurement Units, and a wireless FM headset. Subjects were asked to perform 4 walking trials along a 20 m long straight path, under the following conditions: (1) self-paced walking with no external cue (PW); (2) RAS matching PW (RAS100); (3) RAS at a tempo 10% slower than PW (RAS90); (4) RAS at a tempo 10% faster than PW (RAS110). All patients were evaluated twice in the same day, under the following pharmacological conditions: (a) OFF: in the morning 12 hours after the last medication, and (b) ON: one hour after the intake of dopaminergic drug. Data processing consisted in the evaluation of spatio-temporal parameters, joint angles and gait phases, the latter evaluated through a novel global index (GI), to quantify difference between gait phases in PD patients and in healthy subjects. Statistical analysis was performed for the whole sample, and for patients with an higher degree of gait impairment (UPDRS-III OFF Gait ≥2), by using a three-way repeated measures ANOVA test (Pharmacological Conditions*RAS frequency*side).
Results: In the most affected patients, almost all the spatio-temporal parameters along with GI improved significantly during the RAS110 condition, when compared to the PW ($p<0.05$), both in ON and OFF state.
Conclusion: RAS administration, at a frequency of 110% of the preferred walking frequency, is able to improve significantly gait parameters mainly linked to the hypokinesia and bradikinesia, both in OFF and ON status, and to restore a more physiological gait pattern in PD patients. The proposed wearable set-up could be easily adopted both to monitor and improve motor capabilities of patients with PD in a day-living scenarios.

[1] Nombela et al, Neurosci Biobehav Rev 2013

OP06

Efficacy of aquatic physiotherapy in the treatment of peripheral neuropathies – a randomised clinical trial

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Introduction: Rehabilitation is considered as an effective strategy in the management of patients affected by peripheral neuropathies, but the benefit of an aquatic approach has never been documented.
Objective: To compare the effects on gait and balance of aquatic physiotherapy versus on-land training in the context of an in-patient rehabilitation treatment tailored for neuropathic patients.

Patients and methods: Consecutive patients affected by peripheral neuropathy were randomized in two groups. All started a 4-week rehabilitation program composed by daily sessions of conventional physiotherapy and 3 sessions/week of specific treatment (aquatic or on-land). Primary outcome measures were Berg Balance Scale (BBS) and Dynamic Gait Index (DGI). Secondary outcome measures were Neuropathic Pain Scale (NPS), Overall Neuropathy Limitation Scale (ONLS), Functional Independence Measure (FIM), Functional Ambulation Classification (FAC), Conley Scale and Medical Research Council (MRC) Scale score for the strength of hip and ankle flexor and extensor muscles.
Results: Forty patients were enrolled: 21 in the water-based rehabilitation group and 19 in the land-based one. Patients were similar between groups. All outcome measures significantly improved after treatment, except ONLS in the "in-water" group and NPS in the "on-land" group. When comparing the size of improvements between groups, we found a significant difference only for DGI (better in the "in-water" group, p=0.0433), FAC and MRC for hip flexors (better in the "on-land" one, p=0.0386 and p=0.013 respectively).
Conclusion: Aquatic physiotherapy is helpful in the rehabilitation of gait and balance dysfunctions of neuropathic patients, with an effect comparable to the one obtained with the land-based rehabilitation alone.

OP07

Fatigue in patients with low-grade glioma – systematic evaluation of assessment and prevalence

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Background: Fatigue is the most prevalent and disabling symptom in cancer patients. Fatigue is even the most important cause of loss of quality of life both for the patient and the care giver. Cancer-related fatigue is defined as a "persistent, subjective sense of tiredness related to cancer and cancer treatment that interferes with usual functioning". Scientific literature on this topic is scarce and reports disparate results. This study systematically reviews how fatigue is assessed in patients with low-grade glioma and evaluates its prevalence in LGG patients.
Methods: A systematic literature search was performed in PubMed, Embase and PsychINFO for articles reporting on fatigue in patients with LGG. Inclusion criteria were: 1) adult patients with LGG and 2) fatigue was assessed as primary or secondary outcome measure.
Results: In total, 19 articles were selected, including 971 patients. Seven self-assessment instruments were identified. Prevalence rates ranged from 39% to 77%. Fatigue was found to be a common side effect of treatment. The prevalence rates ranged from 20% to 76% when fatigue was reported as a mild or moderate side effect and fatigue was prevalent in 4% when reported as a severe side effect.
Conclusion: Despite the growing awareness of cancer-related fatigue, there is still a lack of knowledge of the exact pathophysiology of fatigue and the underlying mechanisms of fatigue in LGG patients. This review shows that fatigue is a common problem in LGG patients. It must be taken into account that even multidimensional fatigue instruments not yield insufficient insight in potential causes or consequences of fatigue, like a decrease in physical and cognitive performance. We suggest research to analyse the factors of fatigue in low grade patients with subjective and objective measurement outcomes to developing individualized (rehabilitation) treatment programs in LGG patients.

OP08

Investigation of the effects of postural control training on disease severity and quality of life in ataxic individuals

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Introduction: Ataxia; is defined as a syndrome characterized by the influence of one or more of the components of movement as a result of the damage to the cerebellum and related nervous system structures. Findings such as coordination problems, postural disorders and gait problems negatively affect quality of life (QoL).
Objectives: The aim of this study is to examine the effects of postural control training on disease severity and quality of life in ataxic individuals.
Materials and methods: Twenty patients with cerebellar ataxia diagnosed were included in the study. The demographic informations of patients were obtained in detail. In context of postural control training, exercise training consisting of trunk stabilization, balance and functional exercises was performed taking into account individual needs of patients along with whole body vibrations. The cases were treated for 1 hour ina day, 3 days in 8 weeks. QoL was assessed by the Nottingham Health Profile (NSP) and disease severity was assessed by the International Ataxia Rating Scale (ICARS) before and after treatment.
Results: The average age of the patients participating in study was 34.00±9.15 years. ICARS, NSP total score, energy level, pain, sleep and physical activity subheadings improved statistically after training ($p<0.05$), while emotional reactions, social isolation subheading scores did not change ($p>0.05$).
Conclusion: People with cerebellar ataxia have lower health-related QoL than people with general population and many other chronic diseases (such as HIV/AIDS/stroke). While mental and psychological dimensions are affected at a relatively low rate, this is particularly evident in the physical dimensions of QoL. Consistent with the literature, with the decrease in the severity of the disease physical dimensions of QoL have been improved by the applied postural control training, while there has been no change in mental and psychological dimensions that are less affected.

OP09

Relationship between daily use and motor impairments of the paretic upper limb in chronic stroke – a cross-sectional pilot study

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Introduction: The reduced use of the paretic upper limb after stroke leads to dependency in activities of daily living and to limited participation in social life. Assessments measuring participation in the context of ICF are rarely used in therapeutic rehabilitation. Furthermore, despite improvements of motor function of the paretic upper limb, the amount of use is not automatically increasing.
Objective: The purpose of this study was to examine the self-reported upper limb use in chronic stroke and to determine the relationship to motor impairments of the paretic upper limb.
Patients and methods: Community-dwelling people with chronic stroke (n=7) were recruited. The upper limb use was measured by the Amount of use scale (AOU) and the Quality of use scale (QOU) of the Motor Activity Log (MAL). The Motricity Index (MI) and the Jebsen-Taylor Hand Function Test (JHFT) were used to assess the motor impairments of the affected side.

Results: On average, participants scored 2.5±1.05 (5.0 maximum; from rarely to half pre-stroke) in the AOU scale and 2.7±1.03 (5.0 maximum; from poor to fair) in the QOU scale. The average score of the MI of the paretic upper limb and average duration of the JHFT were 77.50±9.79 of 100 (normal strength) and 61.35±29.96 sec, respectively. The relationship between upper limb use and motor impairments of the paretic arm was weak (strength and AOU r=-.26, strength and QOU r=-.36; hand function and AOU r=-.08, hand function and QOU r=-.37).
Conclusion: The affected upper limb use of the community-dwelling stroke survivors in our sample is reduced compared to pre-stroke. The weak relationship between daily arm use and motor impairments after stroke confirm the necessity to assess both. Only the investigation of motor function does not provide information about arm use in daily life. In general, assessments investigating participation level should be used more frequently in neurological rehabilitation.
Key words: Stroke; Upper limb use; Motor Activity Log; Motor impairments

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OP10

The effects of whole body vibration (WBV) on postural control in patients with ataxia – cross-over study

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Introduction: An increasing number of researchers claim that WBV applications support the rehabilitation of elderly and patients with neurological disorders by improving muscle strength and postural control in recent years.
Objectives: This study was designed to evaluate the effects of an individual exercise programs supported by WBV on components of postural control: biomechanical constraints, movement strategies, control of dynamics, cognitive processing, sensory strategies, orientation in space.
Materials&Methods: 20 cerebellar ataxic individuals whose mean age was 34.00±9.15 were included in the study. The study designed as cross-over, cases were separated into 2 groups and treated for 3-days in a week, 1-hour in each day for a total of 16-weeks(8×2). In the first protocol, WBV and exercise program were applied together for 8-weeks and after the 1-week wash-out period, only the exercise program was applied for 8-weeks. In the second protocol, only the exercise program was applied for the first 8-weeks and after the 1-week wash-out period, the WBV and the exercise program were applied together for 8-weeks. Stabilization, balance and functional exercises, which were created by considering the individual needs of the patients, were applied in exercise programs. The assessments were administered by a blind physiotherapist for 4-times, before-after both treatment programs. Pain and fatigue severity of individuals, postural control components were assessed by Computerized Dynamic Posturography, Sensory Organization Test, Adaptation Test, and Stability Limits Test. Also disease severity, trunk control, functional mobility skills, stability limits, walking performance, performance-based balance, daily living activities, quality of life were measured.
Results: Stability limits, adaptive reactions, three different versions of functional mobility skills, walking performance, pain and fatigue severity, and quality of life were improved only after exercise program with WBV (p<0,05). Disease severity, combined balance score of SOT, trunk control, performance based balance and participation in daily life activities were improved after both exercise programs (p<0,05), but it was found that after exercise program with WBV, more improvement was observed (p<0.05). **Conclusion:** Exercise programs supported by WBV has been shown to play an important role in the improvement of postural control of cerebellar ataxic patients and increasing levels of activity and participation.

OP11

Benefits of outdoor interdisciplinary neurosensory approach in patients with disorders of consciousness – ongoing research and preliminary results

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Introduction and objectives: The use of natural environments to promote health and prevent illness is widely recognised. However, in the case of individuals experiencing disorders of consciousness (DOC), little is understood about the use of contact with nature in treatment and rehabilitation (Annerstedt and Wahrborg, 2011) The aim of this study is to investigate the effects of outdoor therapy in relation to the awareness and wakefulness levels of this population.
Patients and methods: this study is a non-randomized cross-over pilot trial. It is set within the Acute Neurorehabilitation Unit (University Hospital, Lausanne). Participants are adults diagnosed with DOC and to date, 17 inpatients from the unit have been included in the study. They participated in an indoor-outdoor neurosensory interdisciplinary therapy programme. As the primary outcome awareness and wakefulness were measured by an adapted behavioural grid. Functioning and disability were recorded as secondary outcomes.
Results: the difference in scores between indoor and outdoor therapy was computed. Preliminary results show a solid positive trend in favour of the outdoor therapy. We can clearly detect the improvement of several points such as visual fixation and exploration, intentional movements and communication. It is noteworthy that these, clinical items which are involved in in the determination of DOC diagnosis.
Conclusion: outdoor therapy may provide a beneficial complementary treatment option for DOC. The promising preliminary results of the study show the need to develop further interdisciplinary research in this field.

OP12

Cognitive ecological test of San Pellegrino Terme

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Question: We tested 100 people, 80 men and 20 women: 50 affected by traumatic brain injury, 30 affected by haemorrhagic stroke and 20 had brain surgery. Each patient had a physiatric, neurological and neuropsychological evaluation. Each patient was tested by a member of our staff outdoors along the main street in San Pellegrino Terme. The test is based on 10 activities.
Methods: 1. Walking on the sidewalk; 2. Crossing the street at pedestrian crossing; 3. Crossing the street at a traffic light;
4. Asking people for information; 5. Changing money at the bank; 6. Ordering something to drink at the pub; 7. Writing and sending postcards; 8. Buying newspaper at newsstand; 9. Using a mobile phone; 10. Shopping

The score for each activities:

The activity is carried out correctly without help	3 Points
The activity is carried out correctly without help but with difficulties	2 Points
The activity is carried out only with help	1 Point
The activity is not carried out	0 Point

During the test the staff will focus the attention on possible cognitive problems. Any collected information is shared by the staff.

Results: We achieved a better overall evaluation of our patients including emotional and behavioural. Our patients can improve their consciousness about difficulties in everyday life activities and recover their independence in everyday life activities at home, at school or at work.

Conclusions: The test can be defined "ecological" because it involves everyday life activities outdoor; it's easy to use; the test can be done weekly both in order to show the learning abilities and to record improvements; the test completes both the work done during motor training in the gym and the cognitive training carried out during the occupational therapy; it helps to verify whether the goals are achieved and it also gives useful advices to patients' relatives when they go back home again. Last but not least patients like this test because it is performed outdoors.

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OP13

Early dose of upper limb motor rehabilitation using embodied virtual reality – a case series study

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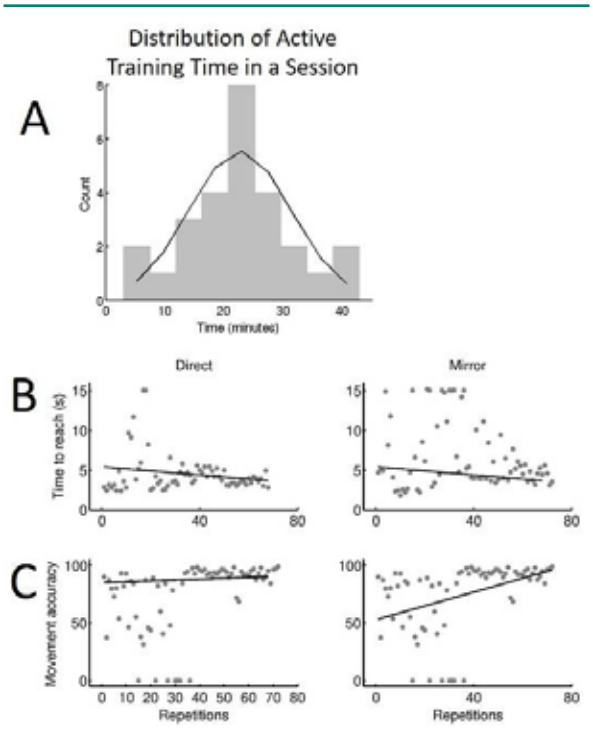
Objective: Recent studies support delivery of early rehabilitation starting a few days post stroke. AHA/ASA (2016) guideline suggests repeated administration of individualized functional task-specific training, and NICE-2010 guideline recommends an upper limb training of 45 minutes per day. However, administration of such motor training early post-stroke is not trivial (typically at acute rehabilitation unit), because the patients in this phase are hemiparetic, cognitively low functioning and often in a depression. A technology-mediated solution that integrates evidence-based training such as mirror therapy (MT) and constraint-induced movement therapy (CIMT) through gamified exercises could be a valuable solution for delivering the appropriate dose early on. In this article, we evaluate dose levels of early post-stroke upper limb motor rehabilitation in using a medical-grade portable Virtual Reality (VR) platform (MindMotionTM PRO, Switzerland) at an acute neurorehabilitation center.

Methods: We report results of an observational case series study conducted between December 2013 and April 2014 with ten inpatients (16-86 years; 10 male & right-handed; 5 right paretic) with mild to severe hemiparesis at the Acute Neurorehabilitation Unit of Centre Hospitalier Universitaire Vaudois (Lausanne, Switzerland).

Results: Six patients started the VR-mediated upper limb training between 4–6 days after hospital admission in Direct (CIMT) and Mirror modes (CIMT+MT). The training was delivered under a real-time embodied feedback on an avatar on a computer screen that imitates arm movements in the first-person perspective, engaging shoulder, elbow, forearm and wrist movements **(Fig. 1 A-B)**. The remaining four patients initiated the treatment after six days post admission, as they were hospitalized either due to a second stroke or an active co-morbidity. An average of 22.7±8.5 minutes of intense training with some patients up to 40 minutes **(Fig. 2 A)**, in line with the NICE-2010 guideline. The patients also showed trends increased movement accuracy and decreasing reach-times **(Fig. 2 B-C)**.

Conclusions: We found that the mild-to-severe hemiparetic patients can soon get acquainted with the MindMotionTM PRO technology within a week after hospitalization, which may be within the optimal neuroplasticity window. A randomized, single-blind controlled clinical trial (MOVE-Rehab: ClinicalTrials.gov: NCT02688413) is underway in evaluating the clinical and effectiveness of this intervention.



OP13 **Fig. 1:** Distribution of Active Training Time in a Session

OP13 **Fig. 2:** Embodied (Mirror) Visual Feedback using real – time in First Person Perspective for post-stroke hemiparesis training

OP14

Early neurorehabilitaton in neurooncology – an observational study

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Background: Survival of patients diagnosed with brain tumors has increased over the past 10 years due to the improvement of neurosurgical, radio- and oncological therapies, pointing to the view of neuro-oncological disease as a chronic medical condition. Strategies to improve quality of life in these patients have gained therefore great relevance. In this respect the role of neuro-rehabilitation is rarely considered and data on its effectiveness are very limited.
Objective: To assess the feasibility and the usefulness of an early neuro-rehabilitation program for neuro-oncologic patients after surgery.
Patient and methods: Two-hundred and fifty-seven patients affected by a neuro-oncological pathology causing a neurological deficit (sensori-motor, cognitive or combination thereof) were consecutively identified from 01/2015 to 02/2017. Among these 250 patients, 55 were selected for the neurooncological rehabilitation program at La Ligniere as early as possible after surgical procedures and before adjuvant oncologic treatments (starting typically 3-5 weeks after surgery). Primary end-point was the early neuro-rehabilitation effectiveness assessed by Modified Rankin Scale (MRS) and Barthel Index modifications. The predictors of neuro-rehabilitation efficacy were evaluated by multivariate analysis including age, intervention type, tumor classification, surgical complications, Barthel score pre-rehabilitation, MRS score pre-rehabilitation in the model.
Results: Primary end-point: MRS showed an increase of the proportion of patients with none or moderate disability (i.e score range 0–2) from 35 to 79% after neuro-rehabilitation. The mean Barthel Index increased from 68.6 to 84.6 ($p<0.0001$; Paired Samples T-Test), showing improved performances in 80% of the patients. The multivariate analysis showed that only deficit severity (i.e. pre-rehabilitation Barthel Index) predicts rehabilitation efficiency.
Conclusions: Although preliminary and uncontrolled, our data show that early neurorehabilitation in neuro-oncological patients is feasible and determines an improvement in the functional conditions of patients allowing a high degree of independency regardless age, tumor type, surgical intervention and complications. Our results strongly support the view of an integrated approach including neurosurgery, radiation and medical oncology, but also early neuro-rehabilitation to improve quality of life in these patients

OP15

Early rehabilitation reduces time to decannulation in patients with severe acquired brain injury

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Introduction: Early decannulation is considered a main rehabilitative goal in tracheostomized patients.
Objectives: To evaluate whether a very early rehabilitation protocol helps to reduce the tracheostomy duration in patients affected by an Acquired Brain Injury (ABI).
Patients and methods: Data about consecutive tracheostomized patients admitted in our Neuro-Rehabilitation Unit (NRU) were retrospectively collected. We defined two groups: Early Rehabilitation Group patients came from our ICU, where they started the rehabilitative treatment; Delayed Rehabilitation Group patients arrived from external ICUs and started rehabilitation in our NRU. Primary outcome was the time from tracheostomy to decannulation. Secondary outcomes were: ICU length of stay, time from NRU admission to decannulation, Glasgow Coma Scale, Disability Rating Scale, Coma Recovery Scale revised and Levels of Cognitive Functioning scores at NRU discharge and the re-cannulation rate.
Results: We enrolled 66 patients, 40 in the Early Rehabilitation Group and 26 in the Delayed Rehabilitation Group. 70% of patients for each group could be decannulated ($p=0.73$) and were analyzed. Only one patient was re-cannulated. Early Rehabilitation Group showed a shorter tracheostomy duration (61.0 vs 94.5 days, $p=0.013$), a higher probability of occurrence of decannulation ($p=0.008$) and a lower ICU length of stay (30.0 vs 52.0 days, $p=0.001$). The time to decannulation in NRU was similar between groups (30.0 vs 45.50 days, $p=0.14$). All the scale scores had a significant improvement in both groups ($p<0.0001$ all).
Conclusion: The present study shows that an early neuro-rehabilitation protocol helps to reduce the time to decannulation in tracheostomized patients affected by ABI.

OP16

Economic impact of SwissDRG on acute neurorehabilitation

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Introduction/objectives: The purpose of this study is to assess the economic impact of introducing the Swiss Diagnosis-Related Group (DRG) financing system in 2012 on the Acute Neurorehabilitation Unit (ANRU) of an area Hospital, using a sample consisting of 47 patients admitted to this ANRU in 2012 and 2013. Patients and methods: The related characteristics, costs, and revenues were retrieved from the hospital accounting system. In 2012, among the 23 patients admitted, 20 were coded A43Z (which can be billed for patients who are admitted to an early rehabilitation facility for coma recovery), while in 2013, from the 24 admissions, only eight had that specific code ($p<0.01$).
Results: The average length of stay increased from 45.5 days in 2012 to 49.5 days in 2013. Similarly, the average costs per patient increased by CHF 19,994, from CHF 183,634 in 2012 to CHF 194,629 in 2013. Finally, the average revenue per patient diminished by CHF 11,392, from CHF 193,153 in 2012 to CHF 181,760 in 2013.
Conclusion: The negative impact on the cost–revenue balance is linked to both the increasing costs due to longer length of stay and the decrease in revenue due to the lower number of patients being coded A43Z.

OP17

Initial report from a retrospective study of 251 patients with severe, acquired brain injury (ABI) admitted to a combined multidisciplinary, highly specialised rehabilitation and intensive care unit

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Introduction: Specialized Neurorehabilitation(SN) of patients with severe ABI has been a part of the Danish healthcare system for two decades. The SN has been managed by specialized centres applying multidisciplinary teams and the WHO conceptual framework of rehabilitation. Traditionally, these centres are not able to manage patients in need of mechanical ventilation(MV). A new unit (2011) called "Neuro Intensive Stepdown Afsnit" (NISA) handles both SN and MV, in close collaboration with Hammel Neurorehabilitation and Research Centre(HNC). The evidence supporting SN on these patients is sparse.
Objective: To describe the patient population of NISA, and their change in function during the course of early neurorehabilitation. Furthermore, to explore indicators obtained in proximity to admission to NISA and their association with early vs late referral from NISA to the general SN at HNC.
Patients and methods: 251 ABI patients admitted at NISA from November 2011 to July 2016. Statistical methods include multivariate logistic regression and paired tests.
Preliminary Results: Age mean (SD) 52(16), 35.7% female, diagnoses: 34% stroke, 30% traumatic brain injury, 19% non-traumatic subarachnoid haemorrhage, 9% encephalopathy, 4% polyneuropathies, 2% Central Nervous System (CNS) infections, 1% CNS primary neoplasms, 1% other, median (IQR) of time from injury to NISA admission 24 (18–33) days, Medians (IQR) of FIM (Functional Independence Measure) and EFA (Early Functional Abilities) on admission and at discharge: FIMadm 18 (18–21), FIMdis 22 (19–45), EFAadm 37 (32–46), EFAdis 51 (43–66). Wilcoxon signed rank test between admission- and discharge-scores showed a significant positive change on the FIM ($p<0.01$, n=68/251 with complete data) and on the EFA ($p<0.01$, n=123/251 with complete data). Predictor analysis is pending.
Conclusion: The patients increased their functional scores during admission. Results are potentially biased by natural remission and selection due to scoring practice.

OP18

Subtle motor behaviour assessment in the acute phase of disorders of consciousness improve the predictability of outcome

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Introduction: Reaching accurate diagnosis remains one of the most challenging tasks when facing patients with Disorders of Consciousness (DOC), which in turn is crucial for prognosis validity and appropriate medical management. Despite recent advances in neuroimaging and electrophysiological methods having demonstrated covert cognition in behaviourally non-responsive and non-communicative patients (Goldfine et al., 2011; Soddu et al., 2009),conventional diagnostic assessment of DOC in the acute phase remains based upon behavioural evaluation. Neurobehavioural rating scales, such as the Coma-Recovery-Scale-Revised (CRS-R, Giacino et al., 2004), can lead to an underestimation of the content and amount of consciousness and to frequent diagnostic error (Schnakers, 2009).
Objectives: To determine various clinical signs that lead to a more accurate conscious awareness assessment in the early phase, allowing more reliable outcome prediction. Patients and methods: A total of 33 in-patients (Acute Neurorehabilitation Unit, University Hospital, Lausanne) were enrolled in this study. DOC diagnosis was established according to the CRS-R. Twenty patients were initially diagnosed with Unresponsive Wakefulness Syndrome (UWS), 13 were in a Minimally Conscious State (MCS). Behavioural assessment over time was conducted using the CRS-R scale and complementary clinical items of a new observational Motor Behaviour Tool (MBT, currently under validation) jointly assessed from the first evaluation. Patients were divided into 2 groups according to DOC status at unit discharge: having emerged from DOC, and remaining in DOC; and into 6 subgroups detailing the outcome of UWS and MCS respectively.
Results: First, statistical prediction of the first CRS-R scores did not permit outcome differentiation between groups; longitudinal regression modelling of the CRS-R data identified distant outcome evolution, but not earlier than 19 days. Second, the MBT yielded a significant outcome predictability in the acute phase. Third, a statistical comparison of the CRS-R subclass weighted by MBT became significantly predictive for DOC outcome.
Conclusion: The association of MBT and CRS-R scoring improves significantly the evaluation of consciousness and the predictability of outcome in the acute phase. We will discuss how subtle motor behaviour assessment provides accurate insight in the amount and the content of consciousness even in the case of potential cognitive motor dissociation.

OP19

Systematic and adaptive cueing improve activities of daily living in patients with neglect — a double-blinded randomised controlled trial

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Introduction and objective: Neglect is a common syndrome after stroke with unilateral visuo-spatial attention deficits, resulting in severe impairments in activities of daily living (ADL) and longer inpatient rehabilitation. Cueing is a method to link scientific research on visuo-spatial attention to actual deficits in spatial neglect. Further, it is a possible treatment method, since neglect symptoms can be improved by providing a cue. Here, we inform about the first results of systematic and adaptive cueing in reading tasks on ADL in patients with severe neglect treated at an early rehabilitation unit.
Patients and methods: Using a crossover design, twenty-four patients with left-sided neglect were randomized to receive either first intervention then control (n=14) or first control then intervention (n=10). They were examined twice before (T1–T2), once after three weeks of intervention/control with 15 sessions (T3) and three weeks after they switched conditions with the same amount of sessions (T4). The control condition was a neuropsychological treatment not targeting visuospatial attention, which was added to the established treatment of the rehabilitation unit. To evaluate improvements in ADL, the Catherine Bergego Scale was used by the nursing staff of the hospital, which was blinded to the study.
Results: The patients improved significantly more after intervention compared to the control condition ($p=.002$) showing a reduction in the Catherine Bergego Scale score. After intervention the patients improved 9.3 score points compared to the baseline condition. In contrast, after unspecific therapy the

improvement was around 2.1 score points. This result underlines a clear reduction of difficulties in ADL with a possible clinical relevance.
Conclusion: This double blinded randomized controlled trial shows that systematic and adaptive cueing in reading tasks leads to improvements in ADL of patients with severe neglect.

OP20

Transcranial repetitive magnetic stimulation versus peripheral repetitive magnetic stimulation in superior limb rehabilitation of ischemic stroke patients

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Introduction: Repetitive magnetic stimulation is relatively a new method applied in different way in patients with ischemic stroke. This method is possible to applied transcranial or in periphery directly on the muscle. In transcranial (rTMS) application the magnetic stimulus acts directly on the nervous centre and determines rehabilitation of arm. In peripheral stimulation (rMS) the stimulus acts on the muscle and determinates the rehabilitation by muscular stimulating.
Objectives: Our aim is to demonstrate the efficiency of this different therapies in benefit of rehabilitation in patients with ischemic stroke.
Materials and methods: We included in our study 158 patients with ischemic stroke at a maximum 6 months from debut. We divided the patients in 2 groups: the 1-st group A which included 92 patients, received rTMS and the second group B with 56 patients who received rMS at superior limb extensors muscles. The treatment was applied for 14 days repeated after 3 months. Certain parameters were chosen, and we are concentrating to obtain the right movement at stimulation. All the patients had to follow an adequate kinetic programme at 30 minute after repetitive magnetic stimulation. The evaluation of the patients was made at the beginning and the end after the second stage of rMS and rTMS. We used for evaluation segmental muscular forces (SMF) and Grasp score with three domains: strength, sensibility and prehension.
Results: We observed that the A group had 22.3% less results at SMF evaluation than the B group (p=0.00011), but globally evaluating the grasping we noticed an increase of 45.6% at the A group (p=0.00012).
Conclusion: rTMS has the advantage to accomplish a better rehabilitation through the inducted neuroplasticity . Even the SMF had better results in patients that received rMS peripheral, the functional capacity is better in patients that received rTMS. The neuroplasticity produced by rTMS leads to a superior functional rehabilitation.

OP21

A new tool to assess responsiveness in disorders of consciousness (DoC) – a preliminary study on the Brief Post-Coma Scale (B-PCS)

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Introduction: The most successful scales to assess coma and outcome are respectively the Glasgow Coma Scale (GCS) and Glasgow Outcome Scale (GOS), both easily and rapidly administered.
Aim: The Brief Post-Coma Scale (B-PCS) is a brief and easy diagnostic tool for individuals with disorders of consciousness (DoC), that could distinguish the minimally conscious state (MCS) from unresponsive wakefulness syndrome (UWS), formerly defined as vegetative state (VS). The B-PCS consists of 7 items assessing eye tracking, command-following, spontaneous motility, decerebrated and decorticated posturing, psychomotor agitation, the ability of safe oral feeding, and the presence of recurrent infections and/or hyperthermia.Aim of the study was to assess the diagnostic validity of the B-PCS in comparison with the Coma Recovery Scale-Revised (CRS-R),the Disability Rating Scale (DRS),the Level of Cognitive Functioning (LCF)and the GOS.
Methods: In an Italian Multicenter Study on patients with DoC, 210 post-acute rehabilitation wards,384 long term care centers, and 8 family associations participated to data collection. The sample consisted of 545 patients (mean age±SD=56.06±17.26, years,59%males,70%diagnosed as UWS) and the median interval from injury to assessment time was 27 months (Interquartile Range, IQR:42months).
Results: Statistically significant correlations were found between B-PCS and the other clinical scales: R=0.586 (p<0.001)with LCF,R=-0.566 (p<0.001)with DRS,R=0.622 (p<0.001)with CRS-R. The B-PCS scores resulted significantly correlated with the time from acute event (R=0.117,p=0.006). For patients with a GOS score=2 the meanB-PCS was1.84±1.19,and for GOS score=3 it was significantly higher 3.88±1.71 (p<0.001). Similarly, for patients in vegetative state/ UWS the mean PSC score was 1.71±1.09,significantly p<0.001) lower than that for patients with minimally conscious state (PSC=3.83±1.29). Finally, the agreement of B-PCS and clinical diagnosis was of 84.4% (variance explained), with an odds ratio OR=3.781 (95%CI=3.026 – 4.725,p<0.001). A threshold of PSC=2.5 resulted to have a sensitivity of 87.7%and specificity of 79.4%with respect to diagnosis.
Conclusion: Since the importance of long-term follow up outcome studies on large populations of persons with DoC, the B-PCS could be proposed as an easy and brief tool to be administered, also by telephone interviews, to monitor the possible long-term responsivity changes.

OP23

Activities of daily living, life satisfaction and psychosocial post stroke – What influence and predict outcomes? Preliminary results from a multicentre study at nine clinics in seven countries – Sunnaas International Network (SIN) stroke study

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Objective: The purpose of the present study was to evaluate Activities of Daily Living (ADL),life satisfaction and the psychosocial situation in persons with stroke, at nine specialized rehabilitation clinics in seven countries.
Methods: A prospective, descriptive study. ADL was assessed with the Barthel Index (BI) and/or the Motor Functional Independence Measure (M-FIM) and Life satisfaction checklist (LiSat-11) on five occasions, on admission, 18-22 days into rehabilitation, at discharge, and at six and twelve months post discharge. A structured questionnaire related to the psychosocial situation was performed as an interview at 6 and 12 months post discharge from the rehabilitation.
Results: A total of 230 persons with stroke were evaluated. There were significant differences at the standardized time point 18-22 days into rehabilitation between the nine institutions in change scores of ADL (p<0.001, eta square 0.19). The differences remained, also when controlled for baseline severity and

disability, at discharge (p<0.001, eta square 0.18; p=0.001, eta square 0.18 respectively). ADL was maintained for the majority of participants six and 12 months post discharge. Lifesatisfaction measured with LiSat-11 was perceived as dissatisfying by 89% on admission, 79% at discharge, 75% at six and 69% at twelve months post stroke. The items "Sexual life", "Physical Health", "Mental Health" and "Vocational situation" were reported most dissatisfying on the various reported time points. The majority were not able to return to work, the financial situation depended on existing health care insurance and family support. Return to work at 6 and 12 months was significantly related to age, educational level, disability and country.
Conclusion: Different rehabilitation models influence improvement in ADL in specialized rehabilitation. A positive predictive factor on improvement in ADL was found to be hours of therapy, negative predictors were level of disability at baseline and LOS. The perceived life satisfaction was scored low/ dissatisfying in the majority of the domains at the four measured time points in all participating clinics. Four items were especially vulnerably post stroke, vocational situation, sexual life, and physical and mental health. Both internal and external factors contributed to life satisfaction. Return to work at 6 and 12 months was related to age, educational level, disability and country.

OP24

Effectiveness of temporary deafferentation of the arm on somatosensory and motor functions following stroke – a systematic review

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Question: After stroke, chronic motor impairment and reduced somatosensation in the stroke-affected body parts are common. Temporary deafferentation (TD), induced either by ischemic nerve block (INB) or with an anesthetic cream, has been used to voluntarily reduce the somatosensory input in a body part by temporary anesthesia in order to improve sensorimotor functions in the affected limb after stroke. The objective of this systematic review, based on a protocol [1], was to determine whether TD improves the outcome of upper extremity rehabilitation after stroke.
Methods: From the 10942 non-duplicate titles of potential relevance, 8 (6 quasi-RCT, 2 descriptive studies) were selected for final analysis and were rated using standardized critical appraisal assessment forms. Data were organized according to the side of deafferentation (more affected or less affected limb) and the reported outcomes (motor function and activity, sensory function). Because of significant heterogeneity in the included studies, the findings have been presented in a narrative form. **Results:** The included studies involved a total of 148 patients. All outcome parameters related to the primary outcome (motor function and activity of the more affected upper extremity) showed an improvement during or after TD. The sensory functions also significantly improved during or after TD.
Conclusions: There is evidence supporting the use of TD of the upper extremity in adults after stroke. While deafferentation induced by INB (inflation of blood pressure by cuff) was perceived as painful and with discomfort by patients, the TD with anesthetic cream was better tolerated by the patients with only minimal side-effects. Interventions involving TD after topical application of anesthetic cream appeared to be a promising approach in physiotherapy to promote recovery of motor function of the more affected upper arm after stroke.

[1] Opsommer, E., Zwissig, C., & Weiss, T. (2013). Effectiveness of temporary deafferentation of the arm on somatosensory and motor functions following stroke: a systematic review protocol. JBI Database of Systematic Reviews Implementation Reports, 11(11), 112-124.

OP25

Effects of high-intensity robot-assisted training in upper limb function recovery and ADL independence in individuals with multiple sclerosis – a randomised controlled single-blinded trial

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Introduction: Functional impairment of upper limb (UL) plays a significant role in the daily activities in patients with Multiple Sclerosis (MS) and strongly influences their quality of life (QoL). There has been an increasing a research interest in UL rehabilitation in MS.
Objective: The primary aim was to compare the effectiveness of high-intensity robot-assisted training vs. conventional treatment on sensorimotor UL recovery. The secondary aim was to evaluate the training effects on fatigue, strength, tremor and muscle activity.
Methods: This single-blind, randomized, controlled trial involved 43 outpatients (age mean 50±11 yrs, EDSS 2-8) with MS-RR. The experimental group (EG, n=21) received a robot-assisted training using AMADEO (Tyromotion); the control group (CG, n=22) received conventional rehabilitation. Treatment lasted ten 45-minute sessions, twice per week). Before (To), after treatment (T1), and at 1-month posttreatment (T2), patients were evaluated by a blinded rater.
Primary outcome: Action Research Arm Test (ARAT). Secondary outcome: Tremor Severity Scale, Nine Hole Peg Test (NHPT), Motricity Index (MI), Visual Analog Scale for tiredness and fatigue, and surface Electromyography (sEMG). sEMG was performed on 7 UL muscles of the paretic side (deltoid anterior/ posterior, biceps/triceps brachii, grand pectoral, extensor/flexor radialis carpi) during two tasks: "Hand to mouth" and "Grasp a 10cm-wooden-block" (ARAT sub-test). 14 healthy age-matched controls underwent one session of sEMG acquisition to collect normative data. The sEMG signals were processed by using an adaptive pre-whitening filter and the approximated generalized likelihood-ratio (AGLR) algorithm to detect the muscle activity. The onset and offset of muscle activity were analyzed as the percentage of the movement cycle.
Results: Preliminary analysis in 34 patients showed no significant between-group differences in the primary outcome. In the EG significant Within-group effects were noted on the ARAT (p<0.05) and the NHPT (p < 0.05). At T1 sEMG showed improvements on biceps-triceps activity pattern in the EG.
Conclusions: A robot-assisted UL training can promote UL functional recovery in patients affected by MS. The sEMG analysis may contribute to the understanding of the mechanism underlying UL recovery, which is crucial to identify effective strategies for UL rehabilitation.

OP26

Effects of high-intensity robot-assisted training on upper limb function and spasticity – a randomised controlled single-blinded trial in 24 chronic stroke patients

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Background: Robotic technologies for the upper limb (UL) rehabilitation in stroke patients is developing rapidly. To date, evidence of the effect of robotic training combined with OnabotulinumtoxinA focal treatment for spasticity is limited.
Objective: To compare the effects of high-intensity robot-assisted UL training against conventional rehabilitation on functional recovery and spasticity in chronic stroke patients with UL spasticity.
Methods: This single-blind, randomized, controlled trial involved 24 chronic stroke outpatients (age mean: 57 yrs; range: 22–77). The experimental group (n=11) received high-intensity robot-assisted UL training using the Armotion/Motore (Reha Technology AG,Olten,Switzerland). The control group (n=13) received conventional rehabilitation. Treatment lasted ten 45-minute sessions, twice per week. All patients have been treated with Botulinum Toxin injection in the UL. Before (T0), after treatment (T1), and at 1-month post-treatment (T2), patients were evaluated by a blinded rater.
Primary outcome: Fugl-Meyer Assessment Motor Scale (FMA).
Secondary outcome: Action Research Arm Test (ARAT), Modified Ashworth Scale (MAS), Medical Research Council Scale (MRC) and surface Electromyography (sEMG). sEMG was performed on 7 UL muscles of the paretic side (deltoid anterior/posterior, biceps/triceps brachii, grand pectoral, extensor/flexor radialis carpi) during the functional task: "Hand to mouth" (ARAT subtest). 14 healthy age-matched controls underwent one session of sEMG acquisition to collect normative data. The sEMG signals were filtered and processed by using the approximated generalized likelihood-ratio algorithm to detect the muscle activity. The onset and offset of muscle activity were analyzed as the percentage of the movement cycle.
Results: Preliminary analysis in 17 patients showed no significant between-group differences on primary outcome. The EG showed greater improvements than the CG on the MRC for elbow flexion (p<.05). Significant within-group effects were noted on the FMA in both groups (p<.05). sEMG showed improvements on proximal muscles activity pattern in favor of the EG.
Conclusions: A high-intensity robot-assisted UL training combined with botulinum toxin injection can promote UL functional recovery in chronic stroke patients with UL spasticity. The sEMG analysis may contribute to better understand the mechanism underlying UL recovery, which is crucial to identify effective strategies for UL rehabilitation

OP27

Efficacy of Intrathecal Baclofen Therapy compared to the conventional oral treatment in post-stroke spasticity – an international multicentre randomised controlled trial (SISTERS)

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Introduction and objectives: Intrathecal Baclofen (ITB) is an effective treatment for managing severe spasticity. SISTERS, a randomized, controlled, open-label multicenter study compared the efficacy of the ITB therapy versus oral anti-spastic medications (conventional medical management, CMM) in stroke patients with severe spasticity.
Method: Sixty stroke patients who presented with spasticity in at least two extremities and an Ashworth Scale (AS) score ≥3 in a minimum of two affected muscle groups in the lower limbs were randomized to ITB or CMM arms. Both groups received physiotherapy.
Results: After 6 months of treatment, the mean (SD) AS in the affected lower limbs decreased by 0.99 (0.75) in the ITB group compared to 0.43 (0.72) in the CMM patients (P<0.05). Decrease of AS in upper extremities was 0.66 (0.59) versus 0.17 (0.70) in ITB and CMM groups, respectively (P<0.05). Functional Independence Measure improved in the ITB group by 2.68 (10.31) compared to a worsening in CMM arm (-2.58 (11.00), P=0.054). In addition, ITB patients showed a reduction in actual, least and worst pain. Difference in the change from baseline to month 6 between ITB and CMM was statistically significant in least and actual pain (P<0.05). Seven serious adverse drug reactions (SADR, constipation, fecal impaction, epilepsy, peripheral edema, hypotension, 2 urinary retention) and 4 serious device reactions (device dislocation, infection, catheter occlusion, intracranial hypotension) were observed in the implanted patients (24 % and 16 % of patients, respectively) versus 1 SADR (epilepsy) in the CMM group (3 %). All serious events related to the device or drug were treated and resolved. In the ITB arm, almost half of treatment related adverse events (45 %) occurred during implant and titration phases.
Conclusions: This is the first clinical evidence showing superior efficacy of ITB therapy compared to conventional oral medication in decreasing lower and upper extremity spastic hypertonia in post-stroke patients.

OP28

Gait training with images in cards minimises the effects of freezing gravity in gait pattern of individuals with Parkinson's disease

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Introduction: Freezing of gait generates important functional repercussions in individuals with Parkinson's disease (PD), even in individuals under drug control. Therefore, treatments that generate patient awareness about the necessary adjustments in movement are increasingly relevant.
Objectives: To verify the relationship between freezing gravity and kinematic parameters of gait after a card training.
Patients and methods: This is a quasi-experimental study in which 20 individuals with idiopathic PD in the mild to moderate phases of the disease (mean 2.4±0.4 on the Hoehn and Yahr Scale) were evaluated in relation to the gait pattern (angular and spatiotemporal), through the Qualisys Motion Capture System, and in relation to the freezing of gait severity with the Freezing of Gait Questionnaire (FOG). The gait training occurred in a

OP28 **Fig. 1:** Cards with sequential images of normal gait phases

single session, divided into 4 stages: 1st) the patients were made aware of the changes in gait due to the disease; 2nd) 9 cards **(Fig. 1)** were used with images of the phases of the normal gait so that the patient learned and memorized the characteristics of each one of them; 3rd) physical gait training was performed, with attention in the main elements of the sequence, in 3 blocks of 10 repetitions, 8 steps in each repetition, totaling 240 steps; 4th) The training was repeated with obstacles, then in a situation of double task. They were instructed to correct the gait pattern according to the guidance provided in the card stage. The patients were reassessed shortly after the end of the training and 7 days later, only with respect to the biomechanics. Kinematic data (before and after training) were correlated with the FOG score using Spearman's Correlation.

Results: Mean age between participants was 61.35 (±9.2) years. Before training, the FOG scores correlated negatively and moderately with the step length (P=0.01; r=-0.53), signaling that the smaller the step length, the greater the freezing gravity even in the phase "on" medication. Immediately after training, this relationship ceased to exist (P=0.32, r=-0.24) and remained after 7 days (P=0.14, r=-0.35), indicating an improvement in gait pattern. There was no correlation of the FOG with the other kinematic gait parameters.

Conclusion: The relationship between gait freezing and step length is positively affected by training with the aid of cards. It is suggested that this training can improve the walking pattern, even in patients with freezing.

OP29

Improvements of motor functions of a stroke patient using a brain-computer interface (BCI) and functional electrical stimulation – a single-case study

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Introduction: A BCI detects the neuronal activity of patients' motor intention and controls external devices to provide appropriate sensory feedback via peripheral nervous system to central nervous system (CNS). When the feedback is timely sent to CNS according to the motor intention with multiple training sessions, the neuronal network in the brain is reorganized due to the neuroplasticity.

Objectives: The goal of this study is to investigate any motor improvement of a stroke patient after BCI rehabilitation training with avatar and functional electrical stimulation (FES).

Patients and methods: One male stroke patient (53 years old, 11 months since stroke onset, and paralysis in his right upper limb) participated in the training. A BCI controlled an avatar and FES to provide the visual and proprioceptive feedback respectively. The expected task was to imagine either left or right wrist dorsiflexion. Then, the BCI classified the brain activity acquired by EEG. The avatar and FES were triggered only upon correct classification. The avatar of forearms was presented to patients in the first-person point of view, and FES produced a smooth passive dorsiflexion of the patient's wrist. The training was designed to have 25 sessions of BCI feedback sessions over 13 weeks. Two days before and after the BCI training intervention, five clinical measures were used to observe any motor improvement: FMA, MAS, FTRS, BI, and 9HPT.

Results: The UE-FMA jumped from 25 to 46 points after the intervention and his behavioral improvement was also detected in other measures. The BI increased from 90 to 95 points, meaning that he could be more independent in his daily activity. MAS and FTRS decreased from 2 to 1 and from 4 to 3 points respectively, implying less spasticity and tremor in his hand. Although he could not conduct the 9HPT until 18th training session, he was able to complete the test from 19th session in 10 mins 22 secs and the time was reduced to 2 mins 53 secs after 25th session.

Conclusion: This BCI with avatar and FES can be a new paradigm for rehabilitation for stroke patients. However, this approach should be further investigated in randomized controlled studies with higher sample size.

OP30

Progressive resistance training for treating people with idiopathic Parkinson's disease – a practice guideline

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Question: How should progressive resistance training (PRT) be applied in persons with parkinson's disease in order to increase muscle strength?

Methods: The following databases had been searched: PubMed, Cochrane Library and PEDro. Randomized controlled trials, investigating the effect of PRT compared to no or any other training, were included. Strength had to be measured with the one or four repetition maximum (1RM, 4RM) or maximum voluntary contraction (MVC). Furthermore, key parameters of the training had to be mentioned: training intensity and frequency, number of sets and repetitions, and progression. The methodological quality was assessed with the PEDro scale.

Results: Six studies1-6 (PEDro score 4-8/10) met the inclusion criteria. Training was performed over a period of 71-122-4 weeks (25-31-4,6 times a week). Muscle strength changed by 0 %1 to+44 %5. Exercises aimed at training the hip (extensors, flexors, abductors), the knee (extensors, flexors), and the ankle (plantar- and dorsiflexors) muscles. Individual exercises were performed for 6-8 repetitions/4 sets4 up to 15-20 repetitions/3 sets1. Progression was performed based on a reassessment of the 4RM5 or on training performance 1-4,6.

Conclusion: A combination of 5-12 repetitions and high training intensities (≥70 % of the 1RM) seems to be most beneficial. Training duration should be at least 8 weeks. Based on the research question, no conclusions can be drawn whether PRT has an impact on functional abilities.

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OP31

A versatile virtual reality system for motor rehabilitation – a case series study

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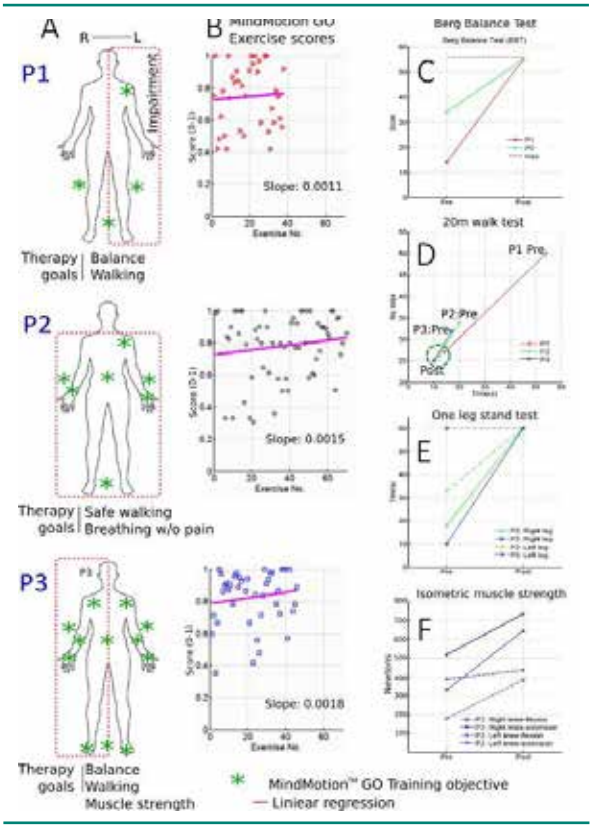
Objective: Virtual reality (VR) and video game technology-based therapies are emerging as potentially valuable adjuncts to traditional neurological rehabilitation. The current single case series study demonstrates the versatility of a medical grade VR system **(MindMotion™ GO; Fig.1)** for motor rehabilitation that offers gamified goal-oriented movement therapy. The software design was guided by therapists and clinicians and consists of activities targeting hand, arm, trunk and lower limb. It can be customized to the patient needs regarding level of difficulty, Range of Motion and body part for game control.
Methods: Three patients (P1: 70 yrs female, subacute ischemic stroke; P2: 35 yrs male, post one month parenchymal bleeding associated with traumatic brain injury; and P3: 22 yrs male with sensorimotor hemisyndrome & ataxia of unknown etiology used the VR system 5–7 sessions over 2–3 wks. They demonstrated different motor impairments and hence were assigned individual therapeutic goals **(balance and walking; Fig.2A)** defined by therapists. They received standard therapy (physical, sports and occupational therapy) 3 hours per day as well as VR exercises (balance, standing stability and weight shifting) chosen by the therapist to match their goals. A total of 88, 187 and 92 minutes of active training was administered for patients P1, P2 & P3 respectively. We recorded the exercise scores computed using real-time motion data in achieving the targeted movement objective) along with functional outcome (FO) measures (eg. Berg Balance Scale (BBT), 20m walk test) at admission (Pre) and discharge (Post)
Results: Focussing at the therapy goals of the individual patient, it was possible to administer VR exercises as an adjunct to standard treatment. All patients showed a rise in exercise scores, confirming an active engagement **(Fig. 2B)**. They also had FO gains at discharge (**Fig. 2 C-F**; 41 and 19 pnt increase in BBT for P1 and P2 resp; 20, 8 and 7s faster with 23, 8 and 7 lesser steps in 20m walk test for patient P1, P2 and P3 resp; P3 showed improvements: 20.4N for right & 4.7N for left knee flexion and of 33.4N for right & 21.7N for left knee-extension; P2 walked 4 times more distance; P2 and P3 stood on each leg for at least a minute, whereas P1 walked without walker).
Conclusion: The VR system allows a therapist to choose goal relevant exercises that may complement standard therapy. Patients were acquainted with the technology and even show a trend in improvement in scores.

OP31 **Fig. 1:** MindMotion™ GO



OP31 **Fig. 2**

OP32

Comparison of pain induced by ultrasound and electrical guidance during a first intramuscular injection of botulinum toxin in spastic adult patients – a prospective randomised study

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Introduction: Even if ultrasound (US) guidance has many advantages compared to electrostimulation (ES) guidance, there is little evidence of its value in reducing pain induced by intramuscular injections of botulinum toxin (BT) in adults.

Objectives: Firstly, to compare pain induced by a first BT injection session, using US or ES guidance, in spastic limbs of adult patients. Secondly, to compare the spasticity and functional improvement.
Patients and methods: Prospective, randomized and controlled study including 124 patients (mean±SD age=52.5±17 years; 56.5% of male; 47.6% of stroke). After a pre-allocation for injections with/without nitrous oxide (31%/69% respectively), patients were randomized to US (n=18/43 respectively) or EL (n=20/43) guidance. Pain was assessed blindly with a vertical visual analogic scale (/100) immediately after the BT injections, which were carried out by a single operator. Reduction of spasticity (Tardieu scale) and functional improvement (quotation with the goal attainment scale) were assessed blindly before and with an average of 7.2±1.7 weeks after BT injections.
Results: Intention to treat analysis showed no difference between US and EL groups concerning pain induced by BT injection (mean±SD=22.0±18.4 vs. 24.4±22.2; p=0.45). Nitrous oxide use was significantly associated with an increase average pain score (10.3, p=0.02). A post-hoc analysis of patients using nitrous oxide and receiving more than 10 injections showed a significant reduction of induced pain in favour of US guidance (median±IQR=12±20 vs. 55±44; p=0.023). No difference between US and EL groups was found nor for decrease of the angle of spasticity, nor for the muscle reaction, nor for the percentage of patients at least achieving the initially fixed functional objectives.
Conclusion: The US guidance seems to be of interest to reduce pain induced by a first session of injection only for patients requiring the use of nitrous oxide with at least 10 injections site.

OP33

Effects of combined neural stem cell therapy and treadmill training on the functional recovery after cervical spinal cord injury

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Introduction: Neural precursor cell (NPC) transplantation after spinal cord injury (SCI) has shown beneficial effects on neuroregeneration in animal models. However, functional recovery may be limited due to astrogliosis and cyst formation. Treadmill training (TT) following SCI is thought to reduce these negative posttraumatic effects.
Objective: We hypothesized that combining NPC transplantation and TT after SCI would improve functional recovery.
Materials and methods: 40 Wistar rats received cervical clip-compression SCI at C6 level. Animals were randomized into 4 treatment groups (NPC + TT, NPC only, vehicle transplantation, sham). NPCs were injected into the spinal cord of immunosuppressed rats 10 days after SCI. Daily treadmill training as well as weekly neurobehavioral tests were initiated after NPC injection until the animals were sacrificed for immunohistochemical analysis 8 weeks post SCI. Statistical analysis was performed (p<0.05 was considered significant).
Results: Animals who received NPCs and TT showed a faster recovery and a significantly higher locomotor function compared to NPC only and vehicle animals 8 weeks post injury in the BBB Score. Gridwalk testing revealed significantly better fine motor skills in the NPC + TT group. Tactile sensitivity seemed not to be pathologically altered as examined by the von Frey test. Histologically, NPC + TT treatment lead to a significant reduction of astrogliosis and cyst size compared to vehicle animals.
Conclusion: Although the level of regeneration was limited in all injured animals, the combined NPC + TT treatment lead to significant better outcomes in the BBB score and Gridwalk test. Astrogliosis and cyst sizes were significantly reduced when treatment with NPC was enhanced with TT. Collectively, our data suggests that TT may be a beneficial addition to NPC transplantation after SCI.

OP34

Efficacy of robotic and action observation therapy for upper limb rehabilitation after stroke – preliminary results of a multicentre trial

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Background and aims: Recovery of upper limb function after stroke is still one of the major heats for clinicians involved in the rehabilitation process. The acute to subacute phase after stroke is the optimal time window to promote the recovery. The current study concerns an approach to address this shortcoming, through evaluation of the Gloreha Idrogenet® (GI), a robotic device that enables intensive and repetitive practice of hand and fingers by stroke survivors with moderate to severe upper limb impairment.
Method: Participants are adult stroke survivors (>18 years) with a primary diagnosis of first-ever unilateral stroke (ischaemic, haemorrhagic, subarachnoid haemorrhage) less than four months previously, confirmed radiographically or clinically. Participants receive 5 sessions a week with 30 minutes per session of Action- Observation therapy and robotic assistive treatment composed by 5 different types of hand exercises through (GI), and at least 60 minutes of usual physiotherapy for five days per week for four weeks.
Evaluation timig: before the 1st app. (To), after the 20th app. (T1) and after 26 weeks (T2)
Results: The total of 33 post stroke patients at the Rehabilitation Center Kladruby and Domus Salutis Rehabilitation Clinic received a 20- session Gloreha Treatment (GT) added to task oriented physiotherapy and occupational therapy. The primary outcome measures were Motor Assessment Scale (MAS) for Basic and Advanced Activities and Motricity Index (MI) at a time of To and T1 for GT. Motor Assessment Scale items 7 (hand movements) (0.8±1.2 vs 2.2±2.5, p<0.05) and 8 (advanced hand activities) (0.3±1.6 vs 1.5±2.0, p<0.05) has been performed to monitor for any carryover improvement in hand function at the post intervention time period and at follow up (4 weeks). The Box and Block showed a significant improvement after the intervention (1.2±5.3 vs 8.0±10.9, p<0.05). According to Motricity Index we registered an improvement in pinch (10.2±11.3 vs 16.7±10.1, p<0.05) and elbow flexion (13.2±8.5 vs 17.4±8.5, p<0.05).
Conclusion: Gloreha Idrogenet® has been easily introduced in the clinical setting during subacute rehabilitation phase of post-stroke patients. The robotic device contributed to maintain under control spasticity and promoted hand and fingers motor recovery. A trial is now at the final steps and more complete results will be available after September 2017.

OP35

A randomised blinded study of vagus nerve stimulation (VNS) during rehabilitation for improved upper limb motor function after stroke (MT-St-02) – follow-up through 90-days

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Introduction: Vagus nerve stimulation (VNS) paired with rehabilitation improves forelimb function in rodent models of stroke. A first-in-human PROBE study (n=20) showed VNS paired with upper limb rehabilitation was safe and feasible in patients with arm weakness up to 5 years after stroke. Upper-limb Fugl-Meyer (UEFM) scores improved by more in VNS treated patients compared to controls in the per-protocol analysis. This blinded sham-controlled study was performed to further assess use of VNS paired with upper limb rehabilitation prior to commencing a pivotal study.
Methods: Participants with chronic moderate to severe arm hemiparesis secondary to ischemic stroke were enrolled (3 US, 1 UK site). All participants were implanted with a VNS device and then randomized to either paired-VNS (0.8 mA) or sham control (0.0 mA). All received the same intensive and task-specific rehabilitation and had 18 therapy sessions (2-hourly, 3 per week for 6-weeks, ~50 repetitions per task and 300-400 repetition movements per session). Outcomes were assessed on days 1, 30 and 90 days following completion of the 6-week therapy course. The primary outcome was change in Upper Extremity Fugl-Meyer (UEFM) score and a ≥6 point increase from baseline was considered clinically meaningful.
Results: Seventeen participants (8 female) were implanted (8 VNS, 9 control). Mean age (SD) was 59.8 (10.4) years. The mean (SD) time from stroke was 1.5 (1.0) years. Study related serious adverse events included a wound infection that resolved with antibiotics, dysphagia that resolved within a week after implant surgery, and two vocal cord paralyses (1 clinically recovered, 1 ongoing). There was a clinically meaningful improvement in UEFM scores at 1, 30, and 90 days in 75%, 88% and 88% of the VNS group compared to 25%, 38% and 22% respectively in the sham group (p=0.05 at day 90). Average UEFM improvement for the VNS group at Post 1, 30, & 90 was 7.6±4.8 (mean±SD), 8.0 + 4.7, and 9.5+6.5 respectively, while the average change in the rehab-only group was 4.9 ±3.1, 5.5+3.4, and 3.3+4.6 (p=0.05 at day 90).
Discussion: VNS appears feasible and safe in adults with chronic stroke and may improve arm function.
Conclusions: A phase III clinical trial is required to definitively assess this technique.

OP36

Introduction of a comprehensive robot-assisted gait training to improve gait and vital parameters in stationary neurological rehabilitation – a cohort study

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Introduction: Current reviews show the efficacy of robot assisted gait training in the rehabilitation of patients who are unable to walk, but what does the daily practical use in neurological rehabilitation clinics actually look like in 2017? This study examines the implementation of a modern state of the art robot equipped gait lab into standard neurorehabilitative care with regard to functional outcome measures.
Methods: In a prospective observational cohort study, data from consecutive patients who participated in the standard rehabilitation program as an add-on therapy from May 2015 to August 2016 were evaluated at the "Klinik Bavaria" in Bad Kissingen, Germany. The information recorded included patient characteristics, physiotherapeutic assessments, vital parameters and end effector robot assisted gait training data. Primary outcome data of ischemic stroke (STI), hemorrhagic stroke (STH) and Critical Illness Polyneuropathy/Myopathy (CIPM) were analyzed and a predictive analysis of the different outcomes in the gait rehabilitation was calculated. In addition, the lung capacity and blood pressure were measured to determine the connection between preexisting cardiovascular complications and gait outcome. Furthermore we examined cardio-pulmonary outcomes in patients who were unable to reach walking ability through robot-assisted gait training in order to prevent cardiopulmonary complications due to lack of walking ability.
Results: 743 patients with a neurological primary diagnosis could be included. 329 patients with STI, 131 patients with STH and 74 patients with CIPM were analysed. Additionally, another 93 patients who stayed unable to walk from the beginning to the end of the rehabilitation were included in the analysis. In the subgroup STI, the largest improvement in walking ability with a gain of 1.3 FAC points could be seen in patients with a starting FAC of 1. In STH, patients with starting FAC scores between 1 and 3 showed highest improvements with a gain of 1.5 FAC points respectively. Patients in the CIPM subgroup with starting FAC scores of 1 (improvement of 1.8 points), 2 (improvement of 2.2 points) and 3 (improvement of 2.6 points), benefited significantly.
Conclusion: The analysis describes the clinical use and benefit of end effector robotic gait systems as part of a systemic gait lab approach in standard neurorehabilitative care. Possibilities as well as limitations of gait lab interventions in neurorehabilitative care are reported.

OP37

Measuring physical activity with wearable sensors to assess functional recovery after stroke

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Introduction: Miniature inertia sensors worn on the body can measure various aspects of movements and can provide detailed information of a patient's physical activity in daily life. The information gained with wearable sensors could complement clinical assessments of motor function and result in a more complete picture of a patient at the level of activities and participation. The objective is to test the main hypothesis which says, that data about the physical activity in daily life gained with wearable sensors reveal clinically relevant information about patients after stroke.
Patients and methods: In a longitudinal, observational study, the physical activity of 20 patients with recent stroke is recorded by body-worn miniature sensors at several stages of functional recovery, both in the clinical environment during in-patient rehabilitation and in the home environment after discharge. The duration and frequency of basic activities (e.g. sitting, standing, walking, and laying), several aspects of walking (temporo-spatial parameters of gait, measures of symmetry of gait) and the amount of upper limb usage are assessed.
Results: The preliminary results show that patients with good clinical function generally have a better performance in daily

life. For example, patients with well recovered gait function walk more in daily life, than patients with poor gait function, as expected. However, some patients show a low performance in daily life despite good clinical function. On the other hand, some patients with low clinical function are more active than expected.

Conclusion: The preliminary results indicate that data from body-worn sensors provide clinically relevant information about the physical activity in the daily life of stroke patients that complement the clinical assessment.

OP38

Right caudate nucleus is crucial for consolidation of motor skills in patients with Parkinson's disease

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Procedural memory refers to the learning and consolidation of a new motor skill through practice and is impaired in patients with Parkinson's disease (PD). The basal ganglia associative loop, which is affected in PD, has been suggested to be specifically implicated in procedural memory. However, it is unknown how striatal dopamine uptake in PD correlates to procedural memory. Nine patients with PD and 10 healthy age-matched controls completed a computerized mirror-tracing skill learning task, in which right-left movements with the mouse were reversed on the screen. Participants were again tested for offline consolidation 24h later. Dopaminergic ^{123}I-FP-CIT SPECT imaging obtained in PD patients for diagnostic purpose and their semi-quantitative uptake values were compared to age-dependent reference values previously established on a cohort of subjects with non-degenerative conditions and normal visual SPECT (Nicastro et al, Mol Imaging Biol 2016). Patients were not impaired during learning of the motor skill task, but showed significantly weaker offline consolidation compared to controls. This offline consolidation measure was positively correlated with right caudate nucleus dopaminergic uptake. Our results show that consolidation of procedural memory is affected in PD and indicate that in-vivo caudate nucleus uptake is associated with consolidation of motor memories.

OP40

Effects of mechanical-assisted training in patients with upper limb paresis after injury of central nervous system – preliminary report

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Introduction: A significant factor supporting recovery after injury of the central nervous system is the neuroplasticity of brain. It is the ability to improvement through intensive, repetitive motor tasks. These exercises are carried out, among other things, using modern devices such as Armeo Spring.

Objectives: The aim of the study was the assessment an innovative algorithm of rehabilitation used in patients with upper limb paresis as well as to evaluate the efficacy of the use of mechanical-assisted device ARMEO Spring.

Material and methods: The study group consisted of 15 patients (8 men, 7 women), one to four weeks after stroke or traumatic brain injury in the age from 45 to 60 years. In the subgroup of Armeo was 8 patients, in the control group - 7 patients. Each patient was tested by muscle strength test, Frenchay Arm Test and The 9-Hole Peg Test. In both groups patients were treated with special program according to the algorithm of rehabilitation over a period of two months. In order to investigate the effect of using Armeo Spring training, patients from the second group were not using the above equipment in the first study period. The Armeo Spring was introduced only in the second month of recovery. Training using Armeo Spring has been held 3 times a week for 30 minutes.

Results: The average value of muscle strength of the study group in the first and the second attempt was lower than in the control group (1.125 vs. 1.429 and 1.75 vs. 1.8571). In the third attempt, there was a significant progress in value of muscle strength in patients from study group compared to the control group (3.125 vs. 2). In Frenchay test the average value of the results in study group was higher than in the control group: 1.375 vs. 1 in the first attempt, 2.75 vs. 1.8571 in the second attempt and 4.75 vs. 2.7143 in the third attempt.

Conclusion: The study showed that the use of innovative management algorithm for patients with upper limb paresis has positive impact on the final results of rehabilitation. The application of an additional device support treatment (Armeo Spring) contributed to an even better end-effects of therapy.

OP41

FEES analyses to determine the effect of various textures on penetration-aspritation in patients with neurogenic dysphagia

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Question: Increasing viscosity of fluids has been described to improve swallowing safety and has been qualified as an important strategy in dysphagia managment. The aim of this study is to describe the effect of texture modification and of protective reflexes on swallowing safety for pureed and solid food as well as for saliva in relation to fluids/ thickened fluids.

Methods: Analysis of standardized FEES protocols obtained during a 2 year observation period in a neurologic acute and rehabilitative hospital. FEES exams were included in the analysis if multiple consistencies (saliva, fluids, jelly and solids) could be tested (n=724). Penetration Aspiration Scores (PAS) were determined in a consensus procedure by 2 raters who had completed a rater training.

Results: Protective reflexes were intact in 47.4% of the patients (tilting of the epiglottis; glottal closure reflex: 94.0%; reflexive cough: 74.4%). PA values differed significantly between consistencies with jelly being the safest consistency (mean PAS=2.5) followed by solids (mean PAS=3.0). The highest risk of aspiration was associated with fluids (mean PAS=5.3) and saliva (mean PAS=4.5). Thickening of fluids reduced the mean PAS to 3.9. Intact protective reflexes contributed significantly to a reduction in PAS. Safe water swallows were predictive for jelly and solid food, but not for saliva. PAS correlated highest with laryngeal residue (r=0.776) but did not correlate with Barthel Index (r=-0.097).

Conclusions: Variation of textures is an important means to avoid deoralization of patients with neurogenic dysphagia. Penetration/ Aspiration of saliva is frequent and possibly a more important threat to patients than aspiration of liquids or food. Testing of multiple consistencies should be an integral part of instrumental and clinical assessments. In clinical practice, early use of solid food is recommended if reflexive cough is productive. Residue (i.e. laryngeal residue) is the most powerful predictor of PA.

OP42

Gait in multiple sclerosis – the impact of dalfampridine

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Purpose: Assessment of the impact of fampridine on walking, balance, functional level and perception of walking capacity in Multiple Sclerosis patients.
Material and methods: A prospective, unicentric, open-label, non-controlled and non-randomized study, on Multiple Sclerosis (defined by McDonald criteria and a EDSS between 4 and 7 patients) treated with 10mg fampridine twice daily. Standardized protocols and questionnaires were used to evaluate the impact of Fampridine: Multiple Sclerosis Walking Scale 12 (MSWS-12), Timed 25-Foot Walk (T25FW), Timed Up and Go (TUG), Berg Scale, Locomotion Functional Assessment Measure (L-FIM+FAM), 9-Hole-Peg Test (9HPT) and Symbol Digit Modalities Test (SDMT) before medication, at day 14, first, third, sixth and twelfth month. Response criteria are defined with one objective test positive response and a positive subjective response. The results were statistically analysed using Statistical Package for the Social Sciences, with statistical significance set to p<0,05.
Results: A total of 32 patients were included in study. 25 of 27 patients (92,59%) were found to be responders and 17 concluded the study. Responders mean improvements at M12 were 13,22% (±35,12) on T25FW, 8,45% (±28,04) on Berg Scale, 31,29% (±25,11) on TUG and 12,39% (±11,00) on MSWS-12. The increase in balance, gait velocity and improvement on perception on walking capacity were statistically significant with p=0,004 on TUG and p=0,002 on MSWS-12. This study showed a positive correlation between all the objective tests, with a strong and statistically significance correlation between TUG and T25FW (r= 0,884, p<0,001); on the other hand, it shows a negative correlation, but not statistically significant, between subjective walking capacity and the objective test T25FW (r=-0,377, p=0,166).
Conclusion: The results show fampridine potential for gait, balance improving and improvement on perception of walking capacity in Multiple Sclerosis patients. Further research is needed to identify and characterize predictors of responsiveness, to spread the scope of application in other pathologies and evaluate other potential functional outcomes.
Keywords: Multiple Sclerosis, Dalfampridine, Gait, Balanc

OP43

Improvements of language processing induced by prefrontal non-invasive transcranial direct current stimulation in progressive supranuclear palsy

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Progressive Supranuclear Palsy (PSP) is a progressive neurodegenerative disorder impacting the basal ganglia, the brain stem, the cerebellum and the prefrontal cortex (Paviour et al., 2006). Its most visible clinical features are postural instability, axial and limb rigidity, impairments of vertical eye saccades, dysarthria and dysphagia (Litvan et al., 2003). More recently, language dysfunctions correlated to frontal cortex damage (Schofield et al., 2012), such as impairments in the initiation and fluidity, diminution of lexical access and occasionally phonological/phonetically distorted and agrammatic speech have proven particularly disabling in these populations. Using a double-blind sham-controlled cross-over design and a set of language tasks (letter fluency, picture naming, and category judgment) we studied the ability of single tDCS sessions to modulate language deficits in a cohort of PSP patients. Capitalizing on the principle of inter-hemispheric rivalry between the right and left prefrontal cortices, we tested two therapeutic strategies: (1) anodal tDCS stimulation delivered over the left DLPFC to boost excitability of language-related prefrontal regions and facilitate language processing and/or production, and (2) cathodal tDCS stimulation delivered over the right DLPFC to suppress excitability in prefrontal systems networks, that inhibits transcallosally their left counterparts. Both interventions were compared across and with sham tDCS condition, all tested in separate days at least 1 week apart. Our analyses revealed significant improvements of semantic categorization performance after right cathodal tDCS, and also increases of verbal initiation/fluency following left anodal tDCS. Our findings contribute novel pre-clinical evidence, showing significant language modulation in PSP patients via non-invasive neurostimulation delivered over prefrontal regions. Furthermore, they provide proof-of-principle and proof-of-feasibility for tDCS interventions in PSP patients, setting the stage for clinical trials aiming to engage plasticity leading to longer lasting therapeutic effects on language dysfunction by means of multi-day stimulation regimes.

OP44

Internal model of verticality – neuromodulation through body-weight support in a tilted virtual environment

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Question: The development of rehabilitation techniques modulating the sense of verticality is a major challenge in balance disorders related to lateropulsion or retropulsion (Stroke, Parkinson, etc.). Through this pilot study in healthy participants, we tested two techniques that are likely to modulate verticality perception: immersion in tilted virtual environment (visual cues) and walking with body weight support (somesthesic cues).
Methods: Among 20 recruited healthy participants, 12 were studied (53.3±7 years old) for the following criteria: normal visual vertical (VV) in baseline, sensitive to an immersive virtual tilted room (VTR) without dizziness. Their VV (8 trials) was tested in 3 postural conditions (sitting, treadmill walking and treadmill walking with 30% of body weight suspended by a vertical rope (BWSW), combined with 2 visual conditions (darkness and VTR). VTR was produced by an Oculus Rift® head mounted display (HMD), and tilted 18° clockwise. The study design aimed at introducing a VV bias through the VTR, then testing the immediate and after-effects of postural conditions. Data were treated using ANOVA.
Results: Regarding VV it was found a main effect of VTR (11.0±4.4; $F(1,10)=158.5$;$p<0.001$), with an after-effect of several minutes recorded in darkness. It was also found a strong effect of the postural setting ($F(2,20)=5.4$, $p<0.05$). Post-hoc analysis showed that VV was 0.6° more vertical in the condition BWSW than in sitting ($p<0.05$).
Conclusions: Being immerged in a tilted environment induces a powerful bias in verticality perception, stronger than that reported by studies using non-immersive tilted clues. Overall walking on a treadmill being supported by a vertical cable is a mean to recalibrate a biased vertical. This modulation of the internal model of verticality is likely due partly to a reweighting of somaesthesic input, and to an implicit direction of the Earth vertical given by the cable which supports the body. This might open an interesting track for the rehabilitation of patients with postural disorders due to a biased internal model of verticality.

OP45

Neurofeedback as a new tool to treat dysphagia

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Question: Our aim is to develop and evaluate a new and innovative technique to treat symptoms of dysphagia based on neurofeedback (NF). Using NF, individuals can learn to modulate their own brain activity. Brain signals are recorded, processed in real-time, and fed back to the user. NF training can foster neural plasticity, which is essential in motor recovery after a brain lesion. However, prior investigations only focused on the effects of NF on the recovery of limb functions. For instance, there is evidence that imagination of a hand movement activates comparable brain areas than hand movement execution. Providing the user feedback about the level of activation in the motor cortex during motor imagery can lead to a more specific and effective activation of the motor cortex and consequently to an improved recovery of the hand function. We extend this principle to the motor rehabilitation of muscles involved in voluntary control of swallowing.
Methods an results: In a first step, we showed that execution and imagery of swallowing movements lead to comparable brain activation patterns in healthy individuals and stroke patients with dysphagia using near-infrared spectroscopy (NIRS) measurements [1, 2]. In a second step, we could demonstrate that healthy adults can learn to voluntarily modulate the activity in the swallowing motor cortex using motor imagery strategies during repeated NIRS-based NF training [3]. The next step will be to test whether dysphagia patients are also able to control activity in the swallowing motor cortex by means of NF training and whether successful NF training can improve the swallowing function in dysphagia patients. Successful modulation of the activity in swallowing related brain areas during NF training should lead to a functional reactivation of affected brain areas and consequently to an improved swallowing function.
Conclusions: Our results might greatly improve the treatment of dysphagia symptoms in neurologic patients and go beyond the state-of-the-art.

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[3] S.E. Kober, B. Gressenberger et al., Voluntary modulation of hemodynamic responses in swallowing related motor areas..., PLoS ONE 10 (2015) 1–17.

OP46

Repetitive transcranial magnetic stimulation in treatment of leg spasticity and gait disorders in patients with chronic progressive multiple sclerosis

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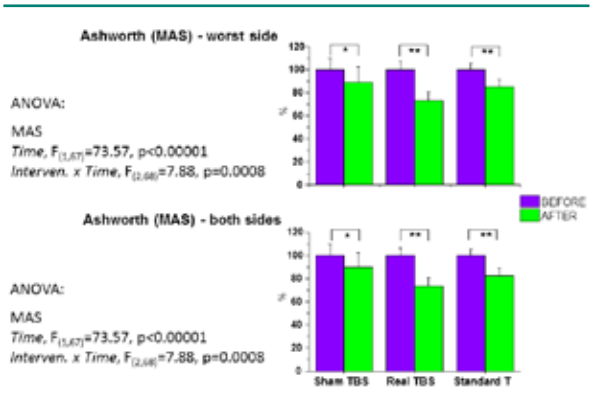
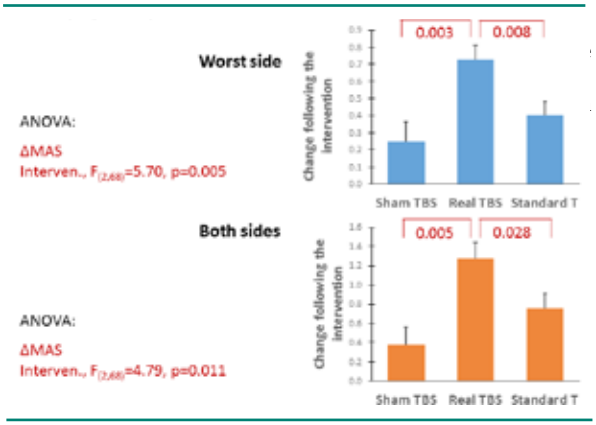
Background: Leg spasticity is common problem encountered with a large proportion of patients suffering with multiple sclerosis (MS). Leg spasticity often interferes with patients' mobility and significantly influences their quality of life. Exercise therapy (ET) has been recommended as beneficial for reducing leg spasticity and improving mobility in MS patients. Excitatory repetitive transcranial magnetic stimulation (rTMS) applied over



OP46 **Fig. 1:** Results 1



OP46 **Fig. 2:** Results 2

bring more improvement in leg spasticity than ET treatment alone. 2) To explore the hypothesis in chronic progressive MS patients.
Methods: We studied 70 MS patients with secondary progressive or primary chronic-progressive type of the disease and EDSS score 2–6.5. The main inclusion criteria were complaints of leg spasticity and impaired gait. All patients received 3 weeks of daily ET: 20 had rTMS before each ET session (experimental group), 15 had sham rTMS (placebo group), while 35 had ET only (control group). For rTMS intervention, we used the intermittent theta burst stimulation (iTBS) over M1 leg area for the worst affected leg. The groups did not differ regarding their age, disease duration, and EDSS, NRS, and Beck Depression scores. Spasticity was measured by the modified Ashworth scale (MAS). In addition, Timed-25-foot walk was measured, and Multiple Sclerosis Spasticity Scale (MSSS-88) and The Multiple Sclerosis Quality of Life (MSQoL-54) scores were collected. Data were analyzed by two-factor (Intervention, Time) repeated measures ANOVA.
Results: Significant improvement was recorded in all measures for all groups. ANOVA showed significant group effect for improvement in two composite MAS scores for leg spasticity: the worst leg score, and the total score for both legs. Post-hoc tests disclosed that improvement in the experimental group was significantly larger that improvements in both, placebo and control groups; there was no difference between placebo and control groups. Improvements in other measures did not differ among groups.
Conclusions: Addition of rTMS, iTBS in particular, to the standard ET has a potential to significantly improve the beneficial effects on leg spasticity in MS patients.

OP47

Sound object segregation in stroke patients

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Previous studies reported a double dissociation between deficits in explicit sound localization and in sound object segregation on the basis of spatial cues, suggesting the existence of a position-linked representation of sound objects that is distinct from the position-independent representation within the ventral auditory stream and from the explicit sound localization processing within the dorsal stream. Here we provide evidence for the anatomical substrate of spatial-cue based sound object segregation. Fifty-seven participants (17 controls; 20 patients with left and 20 with right hemispheric damage) were assessed for explicit sound localization and for the effect of spatial release from masking (SRM). The latter used two simultaneous environmental sounds; the position of the masker varied (a central and 2 positions within each hemispace, simulated with interaural time differences) whereas the target remained central. Voxel-based Lesion-Symptom Mapping (VLSM) was applied to either task. Performance in the explicit localization task depended critically on the right parietal cortex, confirming the role of the right dorsal auditory pathway in explicit localization. For the SRM task, separate VLSM analysis was performed for each of the 5 masker positions. It highlighted the critical role of a large temporo-parieto-frontal region within the left hemisphere, independently of the position of the masker. In addition, a smaller parieto-temporal region was highlighted, more specifically when the masker was central or to the right. Thus, explicit sound localization and implicit use of spatial cues for sound object segregation depend on at least partially distinct neural networks. The involvement of a left temporo-parieto-frontal network in the SRM effect is in agreement with the role of a left temporo-frontal network in position-linked representation of sound objects, which was reported in a previous EEG study.

OP48

Comprehensive assessement of motor imagery ability after stroke with and without neglect – a pilot control case series study

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Question: Stroke can lead to a sensory-motor deficit and/or an unilateral spatial Neglect (USN) and/or a reduced ability to mentally simulate a movement (motor imagery – MI). To our knowledge, no study completely investigated one individual's MI ability by combining assessments investigating visual/kinesthetic modalities and internal/external perspectives. The objective of this study was to investigate the effect of stroke, with and without USN, on MI ability compared to healthy subjects. Methods: We assessed explicit MI (EMI) using 3 questionnaires (Movement Imagery Questionnaire-RS – MIQ-RS, Kinesthetic and Visual Imagery Questionnaire-20 – KVIQ-20, Vividness of Movement Imagery Questionnaire-2) and 2 tests (Time Up and Go, Box and Block test) during which we measured vividness, electrodermal activity and we timed and compared duration of MI and physical practice (PP) to address temporal equivalence. We also studied implicit MI (IMI) using a hand laterality judgment task hence measuring response time and percentage of correct responses.
Results: We included 12 patients in the experimental group (EG, n=¹ with USN) and 12 healthy subjects in the control group (CG). For both KVIQ-20 and MIQ-RS, EG showed significant difference with CG including reduced vividness and increased MI duration regarding PP. In addition, for the MIQ-RS, EG exhibited decreased electrodermal activity during MI but not PP. For IMI, EG had increased response time and decreased percentage of correct responses as compared to CG. Interestingly, the patient with USN displayed the lowest vividness and the longest MI duration regarding PP but IMI performance remained similar to the one of other patients.
Conclusions: We show that stroke reduce both EMI and IMI abilities confirming previous report. Interestingly, USN appears to sharply decrease EMI but spare IMI, albeit such result cannot be generalized due to small sample size. Importantly, stroke patients without USN seem still able to imagine movements despite poor MI ability. These preliminary results advocate for inclusion of stroke patients without NSU in MI rehabilitation programs. Exclusion in case of NSU requires further investigations.
Keywords: explicit motor imagery and implicit motor imagery, stroke, Unilateral Spatial Neglect, vividness, functional equivalence.

OP49

Cortical functional connectivity in post-traumatic/hemorrhagic hydrocephalus (PTHH) before and after shunting procedure – a proof-of-concept study

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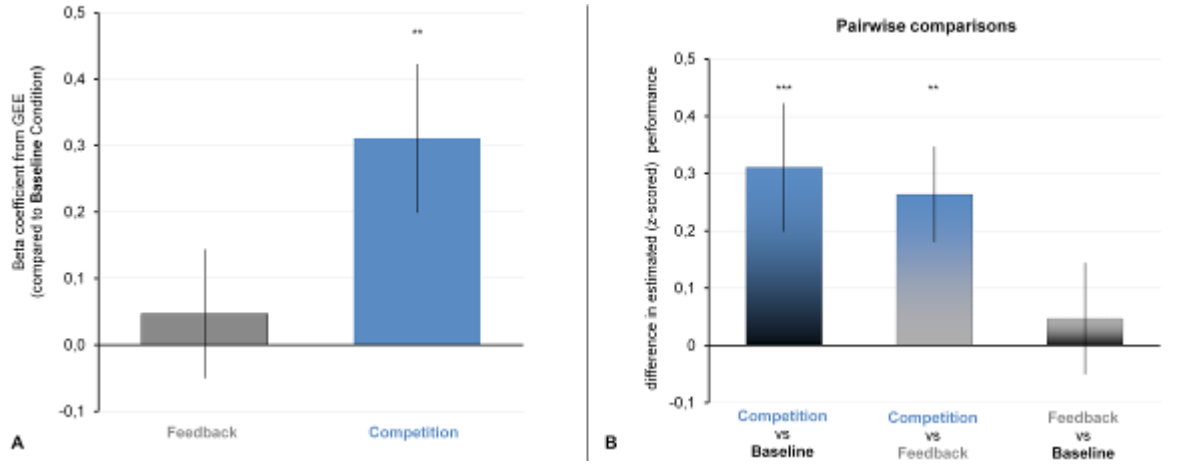
Introduction: PTHH often hampers the recovery of brain functions in patients with severe disorders of consciousness. Although shunting procedures can restore the cerebrospinal fluid circulation, they improve the functional status of patients only in carefully selected cases. Unfortunately, at present there is no a "gold standard" presurgical assessment to predict the outcome of the shunt in this patient population. Cortical functional connectivity and the topological analysis of the brain network have been proposed as promising neurophysiological tools to estimate quantitatively both the level of consciousness and the efficiency of brain functional networks.
Objectives: In this ongoing proof-of-concept study, we tried to identify neurophysiological biomarkers of the clinical efficacy of tap test and ventriculoperitoneal shunt (VPS).
Patients and methods: Patients were candidate to VPS according to the available radiological and clinical criteria. They underwent a resting-state 64-channel EEG recording five days before and fourteen days after the shunt implantation. Patients with skull defect were excluded.
Results: We observed improvements in functional network organization only in patients showing a clear-cut benefit from shunt implantation.
Discussion: Functional connectivity and brain network analysis have recently been proven useful in the clinical evaluation of individuals with severe brain damage. However, further studies are needed to confirm the role of this analytical approach in predicting the outcome of a shunt implant.



OP50 Fig. 1

OP50

Motivation through competition – increasing self-directed training in stroke patients

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Recovery after stroke requires high-intensive neurorehabilitation training: The more training patients conduct, the larger their functional recovery (Lohse et al. 2014, Stroke). One strategy to maximize training intensity during neurorehabilitation is to complement therapist-directed with "self-directed" training. But, self-directed training demands high levels of motivation and drive, which in turn are frequently diminished following stroke. Indeed, neurorehabilitation patients' adherence to self-directed training schedules is often low. Our research tested whether competition can be used as a motivation and training enhancement tool. In two consecutive studies, stroke patients undergoing inpatient neurorehabilitation conducted self-directed endurance training on a (wheelchair-compatible) bicycle trainer repeatedly under a competition condition and two non-competition control conditions ("Baseline" and "Feedback", randomized within-subject design). The first study (n=93) tested whether competition lead to a significant increase in patients training performance. This was indeed the case: Patients exercised significantly more intensively under competition than in the two noncompetition control conditions (see **Figure 1**, taken from Studer et al. 2016, Progress in Brain Research). Furthermore, training performance was particularly high during rematch competitions and (winning a) competition positively influenced subsequent performance. The second study (n=63) assessed whether effectiveness of competition was modulated by patients' age, sex, depressiveness, anxiousness, and trait competitiveness. The motivational effect of competition was remarkably robust: A significant performance-increase under competition was found in both female and male patients, older and younger patients, patients with higher and lower depressiveness scores and patients with high and low trait competitiveness. Quantitative analysis of MRI lesion data testing whether competition effectiveness is dependent upon intactness of the neural reward system is ongoing, with promising interim results. Together, this body of work demonstrates that competition is a potent motivational tool to increase training in neurorehabilitation, and provides first insights into the neurobiological mechanisms of the motivator competition.

OP51

Neuroanatomical and functional changes in response to one month of intensive balance training

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Introduction: Training of balance and posture causes neuroplasticity in related brain regions, including sensory-motor cortices. Persons with acquired bilateral vestibular loss show selective brain atrophy, whereas those who employ their vestibular system professionally on a daily basis, such as ballet dancers and slackliners, show selective hypertrophy in the medial temporal lobe, responsible for spatial orientation function.
Objectives: The aim of this study was to determine whether an intensive slackline-training, aimed on improvements in vestibular system function, can lead to simultaneous enhancement of balancing and spatial navigation skills, together with neuroanatomical alterations in related cortical and subcortical structures.
Methods: Fifty healthy young subjects (mean age=23.8 years; SD=2.7 years; 24 females) were recruited for this study. The subjects were divided into training group (T) (n=5, mean age=23.2 years; SD=2.5 years; 12 females) and control group (C) (n=25, mean age=24.4 years; SD=2.8 years; 11 females). Professional instructor was hired to teach training group to slackline over four consecutive weeks with three 60-minute-trainings in each week. Data acquisition was performed at two time points: 1) baseline, 2) after the training.
Applied tests:

- Clinical balance tests (CBT)
- Triangle completion test (TCT)
- MRI – volumetric-based analysis

Results: Significant interaction effects: 1) CBT-closed eyes (1.64±0.46 vs. -0.07±0.64, p=0.02) and 2) TCT-wheelchair (21.29±5.95 vs. 1.09±8.33). Significant increments within the training group (Family-wise error corrected to p<0.05) were observed in the sensory-motor regions bilaterally, and decrements in several subcortical structures, including left pallidum, putamen and cerebellum. At uncorrected level (p<0.001), increments were also observed in the right hippocampus and left inferior temporal lobe.
Conclusion: Intensive balance training in the form of slackline learning can significantly improve vestibular system function and thus to enhancement in balancing skills and in one's ability to orientate in space without visual input, with related neuroanatomical alterations. Modifying this method can be beneficial for various groups of patients who suffer from a loss of spatial navigation skills or reduced balancing abilities.

OP52

Non-pharmacological treatment of chronic pain – a multimodal approach

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Introduction: Chronic pain, such as low-back pain or facial pain, is a highly disabling condition degrading people's quality of life (QoL). It is well known that not every patient respond to pharmacological therapies thus alternative treatments have to be developed. The chronicity of pain can lead to a somatic dysperception, meaning a mismatch between patients' own body perception and its actual physical state. Since clinical evaluation of pain relies on patients' subjective reports, a body image disruption can be associated with incorrect pain rating inducing incorrect treatment and a possible risk of drug abuse.
Objectives: To define a multimodal neurorehabilitative strategy to reduce chronic pain using innovative technologies to help patients regain a correct body image.
Patients and methods: Patients presenting with chronic low-back pain (n=5) and facial pain (n=5) were included. Before and after treatment, patients underwent: neurological exam; neuropsychological evaluation testing cognitive functions (memory, attention, executive functions) and personality traits, QoL and mood; pain ratings; sensorimotor abilities. Patients underwent a 6 week-neurorehabilitative treatment (total 12 sessions) using virtual reality (VRRS-EVO). Treatment consisted on teaching patients to execute correct movements with the painful body parts to regain a correct body image, based on the augmented multisensory feedback (auditory, visual) provided by the VRRS.
Results: Our preliminary results showed improvements of QoL in the domains of role limitations due to physical health and mental issues, social functioning and pain; a reduction in pain rating scale scores (mean numerical rating scale score before: 5,7±2,3; after: 3,4±4,2); improvements in functional scales, mood and reduction of analgesic drugs intake.
Conclusion: This non-pharmacological approach improves patients' QoL, reduces pain and drug intake by restoring a correct body image.

OP53

Postural and gait disorders in subacute stroke patients – Lateropulsion is the key

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Introduction: Recent researches suggested that postural disorders after stroke may be partly caused by a wrong referential of verticality, expressed by a lateropulsion behavior. The role played by lateropulsion in the postural and gait disorders after stroke remained to be investigated, which was the objective of the present study.
Methods: Retrospective cohort study (2012–2017) of 147 consecutive patients investigated in a neurorehabilitation ward in average at 32.7 days after a first hemispheric stroke: age 62.8±12.6 years, 41 females, 120 with infarction, 57 with right lesion. Trained physiotherapists assessed: lateropulsion with the Scale for Contraversive Pushing (SCP,0–6), Balance disorders with the Postural Assessment Scale for Stroke (PASS,0–36), and gait disorders with Lindmark Scale (0–6). Brain imaging were carefully checked (138 MRI,9 CT). Patients with a malignant stroke, dementia, instable medical status that could interfere with balance and gait recovery, or those who refused the assessments were not included. Descriptive data are given in the form median (first-third quartile).
Results: One month post-stroke, postural and gait data were: SCP 0 (0–0.25), PASS 32 (25–35) and Gait score 4 (2–6). Fifteen patients were pushers (10%), among them 80% had a right hemisphere stroke. A first result was to confirm that lateropulsion was more severe in right hemisphere stroke than in left (right 46% vs left 10%, x2=47.7; p<0.001). As a corollary postural disorder and gait disorder were also more severe after right hemisphere stroke. In patients with a right hemisphere stroke, lateropulsion explained 77% of the variance of postural disorders (p<0.001), and 76% of the variance of gait disorders (p<0.001). Postural disorders explained 81% of the variance of gait disorders (p<0.001).
Conclusions: Lateropulsion, which is a sign of biased representation of the vertical, is a primary cause of postural and gait disorders at the subacute phase after right hemisphere stroke, explaining almost 80% of balance and gait disabilities. A greater attention should be focused on the assessment and the rehabilitation of the post-stroke lateropulsion.

OP54

Sleep over it – Left parietal resting state connectivity predicts skill learning and offline consolidation

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Procedural learning, including learning of a new visuo-motor skill, is subject to fast training-induced plasticity and offline consolidation. Previous studies have reported changes in resting-state functional connectivity (FC) following a short motor sequence training, but how changes in the resting brain relate and predict learning and offline consolidation during a mirror-tracing task has not yet been investigated. The mirror tracing task calls for proprioceptive and visual feedback to control movements, akin to motor-skill learning following a brain lesion. Twenty-four healthy participants were assigned to one of two groups: The experimental group (Exp) performed a computerized mirror-tracing skill learning task, in which right-left movements with the mouse were reversed on the screen. The control group (Ctrl) performed a similar task but with concordant cursor movements. High-density 156-channel resting state EEG was recorded before and immediately after training. Subjects were again tested for offline consolidation 24h later. The Exp group, but not the Ctrl group, showed behavioral improvements during training and offline consolidation. Increased FC in the alpha-band (α; 8–12 Hz) between the left parietal cortex and the rest of the brain before training and decreased α-FC during training predicted mirror-tracing learning. Reduced α-FC in the left parietal cortex after training predicted offline consolidation. None of these effects were present in the control group. These findings demonstrate that visuo-motor skill learning - but not simple motor execution – modulates left parietal connectivity in accordance with the visuo-spatial processing requirements of mirror-tracing.

OP55

Somatosensory cortex volume changes after spinal cord injury

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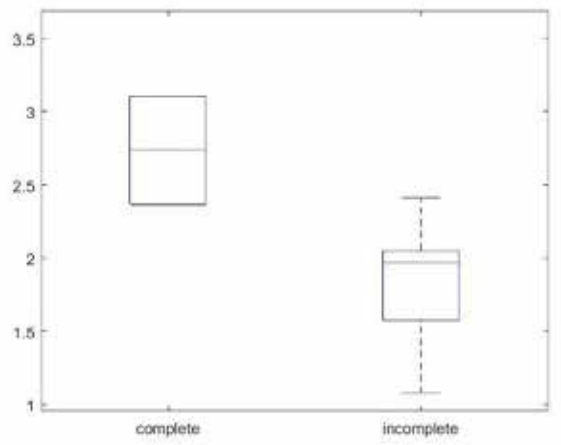
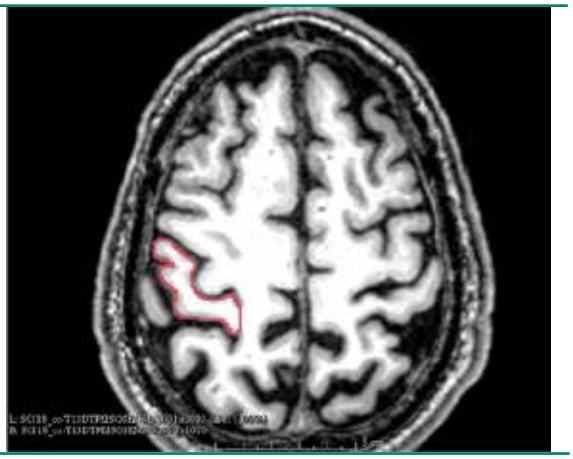
Question: Spinal cord injury (SCI) leads to severe impairments such as paraplegia or tetraplegia, but also to central nervous system changes. Neuroplasticity is induced because of the lack of afferent information. Accordingly, white matter volume



OP55 **Fig. 1:** Normalized volumes for cervical and complete vs. and thoracic/lumbal injury with complete or incomplete injury



OP55 **Fig. 2:** The omega-sign in the central sulcus and the outlined somatosensory cortex

changes and grey matter atrophy have been observed after cervical SCI. In this study, we want to present preliminary results on the differential effect of the subtypes of SCI.

Methods: Patients with SCI were included with cervical (N=5) and thoracic or lumbal (N=6) injury. Among these subjects, most patients suffered from incomplete injury (N=9, 3 cervical, 6 thoracic/lumbal) and two sufferd from complete injury (both cervical). Time since injury varied between <1month and 312 months. We performed manual segmentation of the left and right gyrus postcentralis, thus, the somatosensory cortex, from structural magnetic resonance images and normalized the calculated volumes against the sum of volumes of an automated whole-head segmentation.

Results: No correlation with time since injury was found, and there was no difference in volume between the localization of the injury (cervical vs. thoracic/lumbal). Nevertheless, the two patients with complete cervical injury showed higher volume of the somatosensory cortex than 88% of the other patients for the left hemisphere, and than 100% of the other patients for the right hemisphere. This effect did not depend on time since injury.

Conclusions: Our preliminary results encourage further research on volumetric changes in the acute and chronic stage of SCI, in order to document the moderating effect of type and location of injury on neuroplastic changes. A better understanding of neuroplastic changes in the sensorimotor cortex after SCI is detriemental in order to design efficient rehabilitative measures.

OP58

Action observation training for the rehabilitation of gait after stroke – a systematic review

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Background and purpose: Stroke is among the leading causes for death and long-term disability worldwide (GBD, 2015a and 2015b). For those who are affected the loss of walking ability represents one of the most serious impairments and its improvement is one of the goals most often stated in neurorehabilitation (Bohannon et al., 1988; Lord et al., 2004). Based on findings in neuroscience new approaches for therapy have been developed (Dettmers et al., 2012), one of them being Action-Observation Training. This treatment combines the observation and practice of certain movements and leads to more functional gains than motor training alone (Celnik et al., 2008). Since Action-Observation Training has already been successfully applied in rehabilitation (Buccino, 2014) it is interesting whether it can also be used for improving the walking ability in patients after stroke. Therefore, the aim of this thesis is to summarize the evidence for Action-Observation Training in gait rehabilitation after stroke and to give an overview of the work published in this field.

Method: systematic review (literature research in PubMed, CENTRAL, and PEDro)

Results: Seven studies examining the influence of Action-Observation Training on walking ability of 193 patients after stroke were included. The results of these studies showed a (significantly) positive effect on different parameters of gait in favor of Action-Observation Training.

Conclusion: Action-Observation Training seems to be a promising approach for the reha¬bilitation of gait after stroke. However, the comparison of the included studies revealed several issues regarding its application which still have to be addressed in further studies.

OP59

Acute effect of functional electrical stimulation (FES) and therapeutic exercise on skeletal muscle tone in patients with traumatic spinal cord injury – pilot study

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Introduction: During unsupported sitting greatest change in muscle activation was noted in erector spinae (ES), latissimus dorsi, rectus abdominus (RA) and obliquus externus abdominis in spinal cord injured (SCI) patients compared to healthy controls. Also, trapezius (TR) and pectoralis major (PEC) contribute largely to maintain sitting balance [1]. Change in muscle tone after physical therapy has not been studied before in SCI patients.

Objectives: Aim of the study was to investigate acute changes of skeletal muscle tone characteristics in SCI patients after physical therapy session.

Patients and methods: Six cervical SCI persons aged 38.7±5.5 yr (mean±SD) participated in the study. Three patients performed therapeutic exercises (TE) combined with functional electrical stimulation (FES) of RA and ES to strengthen trunk muscles (FES+TE) and other three patients performed only TE. Age and gender matched control groups performed similar interventions for comparison with SCI patients. Muscle oscillation frequency (MOF, characterizes muscle tone) of TR and PEC in sitting position was measured before and after intervention by MyotonPRO device (Myoton AS, Estonia). Percentage of change and a ratio of TR:PEC for MOF were calculated.

Results: During unsupported sitting in SCI patients, after FES+TE MOF increased in TR (6,4% and 7,3% for left and right side,

respectively) and decreased in PEC (6,6% and 2,3% for left and right body side, respectively).TR:PEC ratio increased from 1,14 to 1,31 and from 1,59 to 1,73 for left and right side, respectively. In SCI patients, after TE MOF decreased in TR (2,4% for left side and 1,6% for right side) and increased in PEC 0,1% for left side and decreased 2,4% for right side. TR:PEC ratio decreased from 1,30 to 1,26 for left side and increased from 1,41 to 1,44 for right side.
Conclusion: In SCI patients MOF increased in TR after FES+TE but decreased after TE. MOF of PEC decreased after FES+TE and after TE in right side, but increased after TE in left side. Change was greater in FES+TE group.

[1] Wang Y-J. et al. J Spinal Cord Med 2016; 39(1): 15–23.

OP61

Eye-tracking – a new chance to increase communication in physiotherapy for people with tetraparesis

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Session for young therapists/motor rehabilitation

Question: Eye-tracking computers used for communication improve the quality of life in physically handicapped children and adults. Yet, there is a lack of scientific research on its relevance during physical therapy. Therefore this study investigated wether using an eye-tracking computer facilitates the communication with physically impaired individuals during a physiotherapeutic intervention.
Methods: This study was an open, qualitative, prospective and non-experimental trial. The study included two subjects with cerebral palsy at the age of five to 31 years. First, they were questioned about their everyday life experience with the tool and their medical history. Second, they participated in a physical therapy session of 60 minutes divided into two sub-sessions of 30 minutes each. The first sub-session was performed without, the second with the use of an eye-tracking computer. In both, similar therapeutic interactions were observed, based on the main problem and special needs of the patient as well as on the goal of the study. These observations evaluated the influence of the tool on the communication skills of the participants, their ability to express their needs as well as to make individual decisions.
Results: The involvement of an eye-tracking computer is an alternative way to communicate with physically impaired children during routine physical therapy sessions. Thus it may increase the motivation of these children to the therapy. For adults with physical impairments, the eye-tracking tool is essential for anamnesis conversation, which is a major aspect in a treatment process. However, it is in general inappropriate to simplify the communication during specific exercises in physical therapy due to physical conditions (e.g. it can only be used in stable positions).
Conclusions: Further research should investigate to which extent an eye-tracking computer assists patients in goal setting and therefore may improve outcome and subjective well-being in physical therapy.

Hwang, C-S Weng, H-H Wang, L-F Tsai, C-H and H-T Chan. An Eye-Tracking Assistive Device Improves the Quality of Life for ALS Patients and Reduces the Caregivers' Burden. Journal of Motor Behavior 2014; 46(4): 233–8. Lifetool. Tobii Dynafox I-Serie+ (2015).
Grenzenlose Kommunikation. http://tdgermany.wpengine.com/wp-content/uploads/2015/09/Tobii-Dynavox_I-SeriePlus_DE_Print.pdf (download 1.2.2017)

OP63

Is neuropsychological rehabilitation effective? – evaluation of home-based neuropsychological rehabilitation in post stroke aphasia using fMRI for low resource settings

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Introduction: Cognitive impairments after stroke cause disability and impact the quality of life (QoL) and independence. In the clinical context, impaired attention and executive functions interfere with the rehabilitation of aphasia. The effectiveness of Neuropsychological Rehabilitation (NR) post stroke is well documented and established, but there is a paucity of literacy and cost effective retraining interventions for developing nations which can be used as home-based retraining interventions. We have attempted to study whether home-based neuropsychological interventions can improve post-stroke cognitive performance in patients suffering from post-stroke aphasia.
Methodology: After ethical approval and CTRI registration, using an open-label, single-blind, block randomization, patients suffering from post-Stroke aphasia were randomised in Intervention Group (IG) and Standard of Care Group (SCG). IG received 8 weeks of Home-based Comprehensive NR along with aphasia therapy, whereas the SCG continued to receive the standard pharmacological treatment along with classical speech therapy. Neuropsychological assessments along with fMRI comprising of language and cognitive processing were done at baseline, 2 months and 5 months.
Results: Neuropsychological assessment of IG at 5 months post NR shows a marked improvement in the scores of the language as compared to the SCG (SCG- p=0.10; IG- p=0.000). On fMRI, the post assessments for intervention group subjects revealed significant BOLD activations as compared to the control group. IG made more and faster gains in working memory and naming tasks following the intervention. Intervention-induced changes in BOLD suggested that better naming was correlated with the recruitment of perilesional tissue and left supramarginal along with lingual gyrus.
Conclusions: The effects of NR tend to show long-term benefits by continuous improvement in neural substrates that underlie the cognitive processing in post-stroke aphasia reflecting significant improvement in the IG and SCG. Frequently used cognitive interventions have been found to be non-reproducible in developing nations like India, as literacy rates can affect task performance. This intervention can be used with patients with low education levels or from lower socio-economic status & can come to aid in developing countries where it becomes difficult for patients for routine travel to the hospital due to financial constraints.

OP65

Russian validation study of Coma Recovery Scale-Revised

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Introduction: There is a need for standardized objective approach in assessment of patients with disorders of consciousness (DOC) in Russia. Mostly Russian doctors use Glasgow coma scale (GCS) and Full outline of unresponsiveness scale (FOUR) for acute and chronic consciousness disorders, but they are not enough informative in DOC patients. Meanwhile in Europe and USA

Scale: subscale	r	p
CRS-R: sum score		
GCS: sum score	0,900	0,0001
FOUR: sum score	0,597	0,0001
CRS-R: visual function		
GCS: eye response	0,257	0,047
FOUR: eye response	0,702	0,0001
CRS-R: motor function		
GCS: motor response	0,886	0,0001
FOUR: motor response	0,878	0,0001
CRS-R: verbal function		
GCS: verbal response	0,699	0,0001
CRS-R: communication		
GCS: verbal response	0,691	0,0001

OP65 Tab. 1

Scale: diagnosis, n patients	Sum	Auditory function	Visual function	Motor function	Verbal function	Communication	Arousal	Brainstem reflexes	Respiratory score
CRS-R: VS, 27	5 [4;5;6]	1 [1;1]	0 [0;1]	1 [1;2]	1 [1;1]	0 [0;0]	2 [2;2]		
CRS-R: MCS, 33	13 [10;19]	3 [2;4]	5 [2;5]	5 [2;5]	1 [1;4?]	1 [0;1]	2 [2;3]		
p	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001		
FOUR: VS, 33	12 [8;13]		3 [3;3]	2[3;2]				4 [3;4]	4 [3;4]
FOUR: MCS, 27	14 [12;16]		4 [4;4]	4[3;4]				4 [4;4]	4 [3;4]
p	0,0001		0,0001	0,0001				0,017	0,836
GCS: VS, 38	8 [7;9]		4[4;4]	3 [2;4]		1 [1;1]			
GCS: MCS, 22	11 [11;13]		4[4;4]	6 [6;6]		1 [1;2]			
p	0,0001		0,859	0,0001		0,0001			

OP65 Tab. 2: Vegetative state (VS) and MCS groups divided according to Aspen Workgroup criteria by each scale respectively. Scores are shown as Me [LQ;UQ]; difference significance was found by Mann-Whitney U test

Coma Recovery Scale – Revised (CRS-R) is accepted as the most comprehensive and full scale for DOC assessment (Giacino et al., 2004). In the light of neurorehabilitation, a correct examination and assessment of the patient is a very important issue to detect time and volume of rehabilitation procedures.

Objectives: The aim was to perform a validation study of Russian version of CRS-R.

Patients and methods: There were included 60 DOC patients in different period after coma (4 weeks – 3 years after accident) and with different etiology (traumatic and non-traumatic). To test concurrent validity of the translated scale, GCS and FOUR were administered. Three experienced neurologists assessed inter-rater agreement. Diagnostic sensitivity of CRS-R was assessed as the detection rate of minimally conscious state (MCS). MCS diagnosis was established in accordance with Aspen Workgroup criteria (Giacino et al., 2002). For GCS and FOUR we made a diagnostic algorithm according to these criteria as well (Schnakers et al., 2008).

Results: Inter-rater reliability was good for total CRS-R scores (Cronbach α 0,87, p=0,001). Sub-scale analysis showed high inter-rater agreement, indicating that the scale yields reproducible findings across examiners. Total CRS-R scores correlated significantly (p<0,01) with total GCS (r=0,900) and FOUR (r=0,597) scores, indicating acceptable concurrent validity. The comparison of respective subscales showed significant correlation (p<0,05) between all items, except eye opening in GCS and visual function of CRS-R **(Tab. 1)**. Finally, the CRS-R demonstrated a significantly higher sensitivity in detection of MCS, as compared to GCS and FOUR **(Tab. 2)**.

Conclusion: Russian version of the CRS-R is a valid and sensitive scale which can be used in DOC patients for clinical assessment of rehabilitation and recovery progress and in differential diagnosis of DOC. It is also a very useful tool for making a good structural neurological examination of a difficult patient.

OP67

Trephined syndrome in patients with large decompressive craniectomy and effects of cranioplasty

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Introduction: decompressive craniectomy (DC) is frequently performed to treat acute intractable intracranial pressure. Trephined Syndrome (TS) describes a neurologic deterioration, which is attributed to a large craniectomy [1]. The symptomatology is varied but includes headache, aggravation of a hemiparesis or cognitive disorders, often has an orthostatic component and improves with cranioplasty [2, 3]. The incidence of TS has been reported between 7% and 26% [1, 4]. However, it might be underestimated if the course of cognitive functions before and after cranioplasty (CP) were insufficiently documented.

Methods: in a prospective observational study we evaluated 43 consecutive patients who underwent DC. Neurological and neuropsychological examination and brain imaging were performed at admission to neurorehabilitation, when TS was suspected, and 1-4 days before and 1–4 days after cranioplasty.

Results: nineteen (44%) patients had a clinical course compatible with TS. Fourteen patients (33%) had an improvement in cognitive testing (neglect, language and/or executive function). One patient, who had been in vegetative state for 3 months, started to communicate by writing after CP. Median delay from DC to developing TS was 78 days (range 24-187) and from DC to CP 118 days (range 27–310). Twenty-two patients (51%) had a postoperative complication (hematoma, infection, CSF fistula) of which 14 (33%) had to be re-operated, which may have masked a potential effect of the CP.

Conclusions: neurologists should consider the presence of TS in patients with DC who worsen or fail to progress. Almost half of the neurorehabilitation patients with DC might be at risk of developing TS. Cranioplasty had a therapeutic effect on motor and/or cognitive impairment in a large proportion of the studied patients. (ClinicalTrials.gov number, NCT03186157.)

[1] Honeybul. Complications of decompressive craniectomy for head injury. Journal of Clinical Neuroscience 2010; 17(4): 430–5.
[2] Bijlenga et al. Orthostatic mesodiencephalic dysfunction after decompressive craniectomy. J Neurol Neurosurg Psychiatr 2007; 78(4): 430–3.
[3] Joseph and Reilly. Syndrome of the trephined. J Neurosurgery 2009; 111(4): 650–2.
[4] Stiver et al. Reversible monoparesis following decompressive hemicraniectomy for traumatic brain injury. J Neurosurg 2008; 109(2): 245–54.

POSTERS

P001

Comparison between sitting and standing positions on anterior reaching in children with cerebral palsy

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Introduction: Children with Cerebral Palsy (CP) perform a smaller displacement of center of mass during the anterior reach in standing position compared to their peers of typical developing. Will children with CP have similar performance during the anterior and sitting reaching? The purpose was to compare the anterior reach until the limit of stability in standing and sitting position in CP and typically children.
Methods: Children aged from 6 to14 years old participated of this cross-sectional study, 11with spastic CP (levels I and II of the Gross Motor Function Classification System) (CPG) and 11 with typical motor development (CG). Kinematic analysis system was used to describe trajectories of a marker attached on ulnar styloid process. Child was instructed to perform a 90º of shoulder bending, elbow and wrist extension in neutral position; reach to the maximum range of motion and remaining in this position for 3 seconds; and return to the starting position. Three trials were collected. The same protocol was applied in sitting position. Total distance of reach (cm), time (s), mean velocity (m/s) and deceleration index (% - the ratio between time after the velocity peak and the total time of movement, multiplied per 100) were calculated. Repeated measure ANOVA with significance level of 5% was conducted.
Results: The CPG showed lower distances (p=0.001), time (p<0.01) and mean velocity (p=0.002) and higher deceleration index (p<0.01) than CG. Both groups performed higher distances (p<0.01), time (p=0.003), and mean velocity (p<0.01) in sitting than standing position **(Tab. 1)**.
Conslusion: Children with CP, even with mild impairment, show lower anterior displacement and movement control during the reach in standing and sitting position, suggesting balance deficit. Sitting was better than standing position during reaching until the limit of stability and it can be an alternative to improve the balance of typically and cerebral palsy children during reaching tasks.

P001 Tab. 1: Mean (SD) of variables in standing (St) and sitting (Si)

		CPG	CG
Distance (cm)	St	7.8 (3.3)	14.7 (6)
	Si	12.1 (4.5)	21.8 (7.6)
Time (s)	St	2.1 (0.4)	2.9 (0.5)
	Si	2.4 (0.4)	3.2 (0.4)
Mean velocity (cm/s)	St	3 (1)	5 (1)
	Si	5 (1)	7 (2)
Deceleration index (%)	St	95.6 (5.8)	86.3 (6.5)
	Si	94.9 (7.1)	84 (5.3)

P002

Day programme with constraint-induced movement therapy for lower limbs

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CIMT (Constraint Induced movement Therapy) as was described first by Taub (1994, 1999) and Millner (1999) is based on two basic principles. Forced used of the affected extremity by restraining the unaffected extremity and massed practice of the affected extremity through so called shaping activities. Massed practice seems to be more important and that is why it is used also in lower limbs without restraining healthy lower limb. Objectives: We have introduced special day program with CIMT for lower limbs for people after brain injuries on our department and we evaluate the effect of the program.
Method: 16 patients (10 men and 6 women) with hemiparesis due to brain injury age 18 and older were involved. They had good cognitive functions to understand and follow the tasks . Neuropsychological assessment was necessary before and after the program. They had paresis of lower limb and were able to walk without any technical aid. They had individual as well as group activities using CIMT principles for 6 hours a day for four weeks (from Monday to Friday). Individual activities were mostly repetitive movements of lower limb from so called LE-MAL (lower extremity Motor Activity Log).The evaluation of the effect was done using standardised functional tests (e.g. 10mWT (10 minutes walking test), TUG (time up and go test), 2mWT (Two minutes walking test), Berg Balance Scale and GSSA (Global Subjective Self-Assessment) as well as measuring time of repetitive activities and spasticity scales (MAS – modified Ashworth and Tardieu). After finishing the program patients continued in practicing at home. They were controlled after one month, three and six months after finishing the program. The results are very promissing. 14 patients fineshed the programme, almost all of them were much better after the programme, 85 % were better even after three and six months after finishing the program. Gait parameters were better as well as GSSA. We think CIMT is very useful method for hemiparetic patients not only to train upper limb but also lower limb.

P003

Effectiveness of a multidisciplinary rehabilitation in advanced stages of Parkinson's disease

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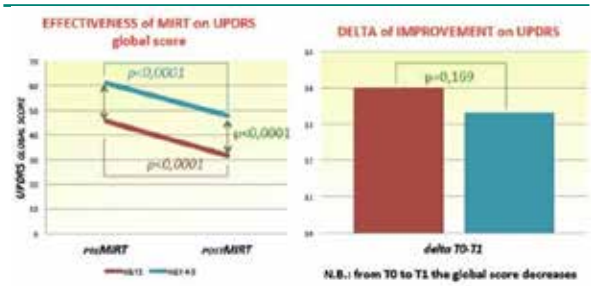
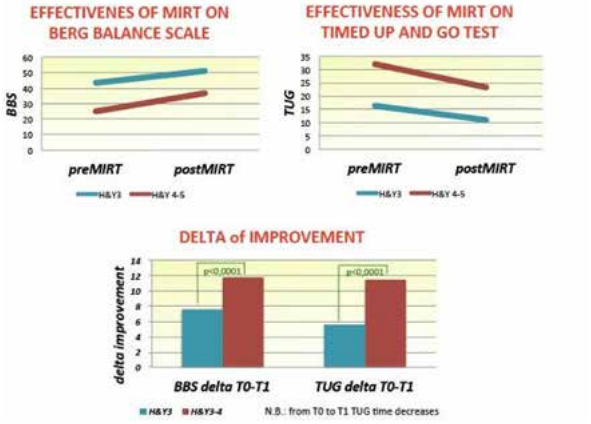
Parkinson's disease (PD) is characterized by several motor and non-motor symptoms that impact on patients' autonomy in daily activities. In advanced PD stages the mobility without assistance is very limited and severe motor deficits with risk of falls occur. Over the years, patients suffer from disturbances that are unresponsive to antiparkinsonian medications, while a number of drug-related side effects appear. Thus, the clinicians have to find complementary strategies in order to provide these "advanced" PD patients with a better management. Several evidences show that PD patients in early-medium stages of disease benefit from an inpatient, aerobic, motor-cognitive, intensive and multidisciplinary rehabilitation treatment. We aimed to investigate whether this approach is effective also for PD patients in advanced stages of disease. Retrospectively, we identified 640 PD patients hospitalized for a 4-week Multidisciplinary Intensive Rehabilitation Treatment (MIRT). According to Hoehn and Yahr scale (H&Y), patients were subdivided into two groups: H&Y 3 (497), H&Y 4-5 (143). All subjects were evaluated at the beginning (To) and at the end of MIRT (T1). The following outcome measures were considered: Unified Parkinson's Disease Rating Scale (UPDRS), Berg Balance Scale (BBS), Timed Up and Go Test (TUG), Six Minutes Walking Test (6MWT) and Parkinson's Disease Disability Scale (PDDS). The cognitive status of patients was also evaluated at To by using the Mini Mental State Examination (MMSE) and the Frontal



P003 Fig. 1



P003 Fig. 2

Assessment Battery (FAB). After the 4-week MIRT, all outcome measures significantly improved in both groups of patients ($p < 0.0001$, for all outcomes). Comparing the amount of improvement in the two groups, significant differences were observed only for the changes in BBS and TUG scores (both $p< 0.0001$, after adjustment), with a better improvement in the H&Y 4-5 group. Finally, modeling the improvement in BBS and TUG as a function of H&Y, age, sex, levodopa equivalent dosage, MMS and FAB, it was shown that only the H&Y scale was a significant independent predictor. We conclude that a tailored rehabilitation treatment, such as MIRT, is effective also for PD patients in advanced stages of disease.

P004

Importance of combination treatment of Torticollis spasmodicus with focus on the paraclinic therapeutic options

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Introduction: Cervical dystonia (CD) is the most prevalent type of dystonia and many patients face a lifetime of chronic disability despite repetitive Botulinum neurotoxin (BoNT) injections. First retrospective studies have shown a synergistic effect of physiotherapy and the injection of BoNT.
Objectives: To assess if results of a combination-therapy show significant improvement within impairment and activities, as well as the hQoL of torticollis patients.
Patients and methods: 22 patients (mean-age 53.3 years; mean-duration of disease 14.0 years, BoNT-injections or sole physiotherapeutic treatment was so far unsuccessfully); individualized rehabilitation program (period: 4–6 weeks stationary rehabilitation) 14 weeks post BoNT; consisting of 5x/week Bobath, PNF and Bleton, laser-assisted visual biofeedback training, set reaction-training; 3x/week behavioural training, relaxation according to Jacobsen and Snoozelen, massages and stretching of cervical muscles. Severity of CD assessed by Tsui-score, extended Barthel-Index, EQ5D and CDQ-24
Results: follow up 4–6-week: Tsui-score significantly reduced from mean 11.4 to mean 8 points ($p=0.002$); extended Barthel Index improved from mean 94.1 to 99.5; EQ5D significantly reduced; CDQ-24 improved from mean 69.8 to mean 53.5 ($p<0.001$, each)
Conclusion: From the obtained results, a high level of significance can be demonstrated statistically in the area of impairment and activities as well as the QoL after the combination of BoNT-injection and adapted therapy. It becomes clear that a good therapy success is possible only through the implementation of several different therapeutic procedures. This combination offers the patient an extended field of interventions to minimize their symptoms.

P005

Integrated robotic approach for upper limb functional rehabilitation

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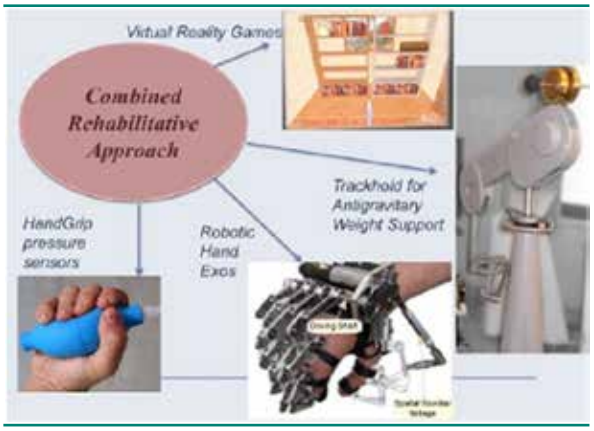
Upper limb motor impairment is a leading cause of long-term disability in stroke survivors. Recently, functional tasks that involve multi-joint coordination and three-dimensional movements demonstrated to have a greater impact than standard point-to-point. Our aim is to propose an innovative approach that integrates anti-gravity weight support and robotic-assisted grasping-releasing hand mobilization, in a functional task-oriented training in virtual reality. Ten chronic stroke patients with right mild-to-moderate hemiparesis were enrolled. At the beginning (to) and at the end (t1) of treatment all patients underwent to the following assessments of independence in ADL and upper limb functionality (Wolf Motor Function Test, Upper Limb Fugl-Meyer Assessment). Evaluation exercises were also administered "Trajectories" and bimanual "Grasping". We extracted kinematics parameters: "Isotropy" that means trajectory roundness, "Eccentricity" and "Radial Error" that represents the smoothness of the movement. From the "Grasping" we obtained "Bilateral Score" and the "Correct Rate" score. All these assessments were also administered at two months follow-up (t2). The treatment was performed in 3 weeks divided into 5 weekly sessions of 60 minutes each. The system is composed by a robotic device (TrackHold) to support the weight of the limb during tasks execution and active hand exoskeleton (HandExos)



P005 Fig. 1

to assist grasping tasks. During each session reaching-grasping and bimanual exercises were administered. At the end of treatment significant improvements were observed in UL-FMA- active and passive motility. A significant reduction in WMFT time was also recorded. A significant effect on UL-FMA and on the WMFT time reduction was also observed at t2. ADL scales showed a mild improvement. Kinematic evaluations showed a significant effect on "E" and "I" at t1 ad at t2. At t1 the Handgrip analysis reported a significant effect on right hand "CR".Positive correlation was found between the improvement in UL-FMA scores and the "RE" and a negative correlation between WMFT time and "BS". These data highlighted that gains in upper limb functionality and bimanual motor coordination could be translated into the ability to perform a smoother and more accurate movement in three-dimentional space, important for daily activities. In conclusion, this intensive robotic task-oriented treatment demonstrated to have short and long term effects, probably acting on central processes.

P006

Interest of selective motor nerve block under ultrasound guidance for target muscle selection in the treatment of spasticty

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Question: The target muscle selection is the crucial point in the treatment of spasticity with Botulinum toxin injections . Clinical examination doesn't always reflect functional situation. As a clinician , we need some easy to use , non time consuming techniques for assessement of our patients . In this presentation we want to demonstrate the interest of selective motor nerve blocks in the treatment strategy of spasticity.
Methods: We assessed 19 patients (12 man, 7 woman) with motor nerve blocks before starting the treatment by botulinum toxin injections in spasticity. 15 patients were hemiplegic (12 post stroke and 3 CP) and 4 paraplegic (3 SCI, 1 hereditary spastic paraplegia) . On 13 patients we observed varus or equino varus gait pattern and on 6 patients stiff knee gait pattern. In this first group we blocked Gastrocnemius medialis and lateralis and/or Soleus superio. motor nerve . In the second group (stiff knee) rectus femoris and/or Vastus intermedialis motor nerve has blocked.
Results: The analysis is ongoing to understand in how many cases the decision of treatment and / or target muscles has changed and in which situation the motor nerve block is more usefull

P007

Lower-extremity motor coordination is affected on the ipsilesional side in stroke patients

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Introduction: Motor coordination is one of the major contributors to disability after stroke; however, little is known about motor coordination of the lower limb ipsilateral to the brain lesion and its implications on the rehabilitation related measures.
Objective: To evaluate the motor coordination of ipsilesional lower limb (IL) in stroke patients, comparing with the contralesional limb (CL) and with lower limbs of health subjects.
Materials and methods: 38 patients (23 men and 15 women, with mean age of 56.5 years) with unilateral stroke and gait deficits (until one year of sequelae) were submitted to the Lower Extremity Motor Coordination Test (LEMOCOT), performed by the IL and CL. Data of IL were also compared with reference values for LEMOCOT of 38 healthy subjects (PINHEIRO et al., 2014), matched by age and gender. Independent T-tests were applied for these comparisons. Furthermore, ipsilateral data of LEMOCOT were correlated with scores of: Functional Ambulatory Category (FAC), National Institute of Health Stroke Scale (NIHSS) and Berg Balance Scale (BBS), using Spearman´s correlation tests.
Results: As expected, it was observed better scores of IL, when compared to CL (IL: 26.32, CL: 15.42; P <0.001). However, when comparing the IL to the dominant and non-dominant limbs of healthy subjects, were verified lower scores to the IL in both comparisons (IL: 26.32, dominant: 34.29, non-dominant: 32.71; P <0.001). Moreover, IL scores of LEMOCOT were significantly correlated with gait ability (FAC: P=0.034, r=0.35), neurological status (NIHSS: P=0.017, r=-0.39) and postural balance (BBS: P=0.019, r=0.38).
Conclusion: According to the results, motor coordination deficits are present even in the IL in stroke patients and can be an indicative of the degree of impairment on gait, balance and neurological status. Therefore, it is suggested that these deficits may be considered both for assessment and treatment during stroke rehabilitation.

P008

Motor rehabilitation of upper-limb paresis with use of accelerometer

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The movement ability of the upper limb is essential for an individual's self-sufficiency, the performance of common daily activities, and thus for an independent life in a family setting. New technological developments have led to the production of miniature accelerometer sensors. The using of accelerometer is possibility for objective functional assessment in motor rehabilitation. One of the aims of this work was to demonstrate, using objective function methods, the possibility of influencing the movement patterns of a paretic upper limb by means of intensive interprofessional rehabilitation even several years after the acquired brain injury. The second aim was to demonstrate that the monitoring of motor functions in patients after acquired brain injury leads to improved motivation, thereby improving motor functions. A study was conducted among 50 selected patients after brain damage with central hemiparesis who participated in the 4-week stay in a rehabilitation day care centre. Two groups of patients were studied, one group with an accelerometer (25 patients – Group A) and one group without an accelerometer (25 patients – Group B). The parameter studied with the accelerometer was daylong physical activity of the upper limbs, paretic limb and non-paretic limb. Using of sensor - accelerometer in the experimental group (group A) significantly improved upper arm movement activity, can objectively detected the positive changes in movement spastic pattern. The results confirmed that an accelerometer is a suitable instrument for detecting of the changes of upper limb movement activity. The most important positive parameters of the monitoring are the increased motivation of patients for physical therapy and the use of the principles of a feedback accelerometer.References

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P009

Motor strategies after treatment of consequences of fibular nerve lesion – contribution of gait analysis

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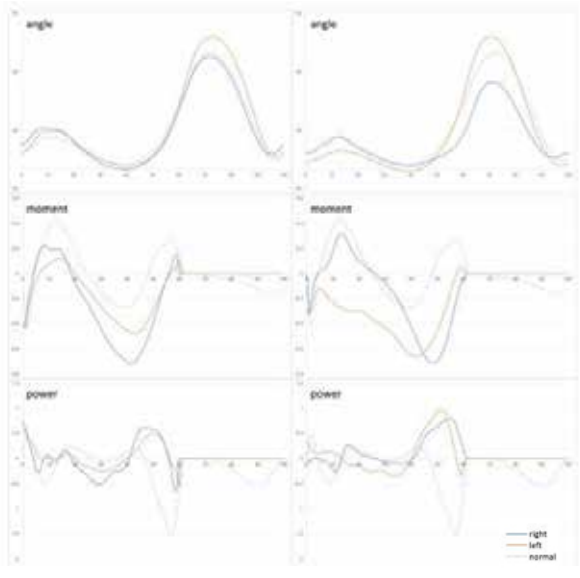
Introduction: Tendon transfer is a possible approach to nerve lesion with irrecoverable muscle deficit. This treatment can ameliorate motor performance.
Objective: We evaluated the walking of patients with fibular nerve injury, treated with conservative or surgical approach, in order to assess the difference in motor strategy.
Patients and methods: Two patients with fibular nerve injury were evaluated. The first patient was a 50-year-old man with deficit in left tibialis anterior muscle, occurred after a skiing accident causing left tibia and fibula fractures and fibular nerve lesion. He was just treated with rehabilitation. The second patient was a 23-year-old man with history of road accident trauma, occurred three years before, causing left fibular nerve neurotmesis. He was treated with tibialis posterior tendon transfer. Gait analysis was performed to assess spatio-temporal parameters, kinematics and kinetics in two patients presenting fibular nerve lesion. Surface electromyography estimated lower limbs muscles activation. We calculated the envelopes and relative area under the curves of electromyographic traces. Ratios between those areas of different muscles were calculated.
Results: The first patient presented ankle ankylosis, symmetric walking, high activation of gastrocnemius medialis muscle. The second one had reduced stance phase, quadriceps avoidance and low activation of tibialis anterior muscle. Both patients had reduced knee excursion of uninjured side and bilateral abnormal power generation in knee **(Fig. 1)**.
Conclusion: Gait analysis may provide important and precise data able to support the comprehension of motor strategies used by the patients. The information may be useful for follow-up, rehabilitation management and patient education.



P009 Fig. 1: Kinematic and kinetic parameters of knees in the first patient (left side of the Fig.) and in the second patient (right side)

P010

Prediction of community walking in patients with stroke

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Question: Stroke is the most frequent cause of handicap in the adult population. It mainly affects the motor and sensorial systems, and walking disability is one of the major consequences. Recovering walking ability is an important aspect for patients activities of daily living. Nowadays, it is still difficult to predict the functional prognosis of patients in early stage after stroke. The aim of this study was to evaluate the capacity of the Trunk Control Test (TCT) to predict community walking in stroke patients.
Methods: For this review, a literature search was performed on PubMed, CINAHL, The Cochrane Library, Embase, PEDro and Kinedoc databases from September to December 2016. We included studies using the TCT as predictive variable and the 10 meters Walk Test or the Functional Ambulation Classification for walking ability. Only studies that established a prediction at two different times were retained. In order to discuss the results, we determined risks of bias by assessing the quality of the studies.
Results: We included 6 studies. They showed that the TCT score in early stages of rehabilitation can predict independent walking in the first 6 months after stroke. However, studies werent specific to community walking. Models of prediction were proposed, but none were validated for clinical practice.
Conclusions: TCT is a predictor of independent walking. However, future research concentrating on establishing a reliable cut-off and validating prediction models is necessary. In addition, it would be interesting to conduct studies focusing on community walking so as to be more specific to patients functional needs.

P011

The effect of neurorehabilitation on gait in patients with multiple sclerosis

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Introduction: Gait disorders are common in patients with Multiple Sclerosis. Comprehensive rehabilitation intervention still remains the best option to improve impaired ambulation. Aim of the study was to observe whether a prolongation of inpatient neurorehabilitation can lead to a significant increase of gait abilities.
Methods: A retrospective study was conducted using data of 307 MS-Patients, treated in the period January 2015 until December 2016 at Neurological and Neurorehabilitation Center Valens, Switzerland. Investigated parameters were changes in walking distance and walking speed at the entry and discharge, using standard walking tests (2MWT, 6MWT, maximal Distance, 10MWT, 20MWT). The EBI was used to evaluate changes in autonomy of activities of daily living.
Results: The study provides evidence for significant improvement in patients walkability by increased walking speed and distance specially in patients with prolonged hospitalisation over 4 and 5 weeks.
Conclusion: MS-patients with gait disturbances benefit significantly of a prolonged inpatient rehabilitation program in a multidisciplinary rehabilitation team – in particular with respect to walking distance and speed.
Key words: Multiple Sclerosis, multidisciplinary neurorehabilitation, gait improvement.

P012

The effectiveness of electrostimulation on hemiplegic shoulder pain and motor function after stroke — a literature review

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Question: Hemiplegic shoulder pain is frequently observed in individuals with stroke (up to 75% of the population) and usually occurs two to three months after the event. Its etiologies can be diverse, which complicates treatment. One of the many possible treatment modalities is surface electrostimulation. A link between shoulder pain and motor function seems to exist even if its nature is not fully known yet. For example, strength and power of the shoulder and the arm appear to be decreased when pain occurs. The aim of this review is to investigate the efficacy of electrostimulation treatment on shoulder pain and motor function of the upper extremity in adult patients after a stroke.
Methods: Five databases were consulted between June 2016 and January 2017. Only the studies published after 1980 that met our inclusion criteria were kept. The eight remaining articles were analyzed and evaluated using the Joanna Briggs Institute (JBI) appraisal tools.
Results: Among the eight articles, six were randomized control trials (RCT), another was a follow-up study and the last was a quasi-experimental study. Four studies evaluated shoulder pain but none of them were able to identify a positive change using electrostimulation therapy. Regarding the motor function of the upper extremity, three studies carried out during the subacute stage demonstrated the efficacy of this treatment. In contrast, during the chronic stage, two studies failed to show significant improvement using electrostimulation therapy versus a control group.
Conclusion: Electrostimulation is an interesting adjuvant treatment for patients in the subacute stage after a stroke, where it helps stimulate motor function recovery of the upper extremity. The results concerning pain should be treated with caution, because of the great methodological heterogeneity of the trials. Additional studies are needed to confirm these results and to furthermore evaluate the effects of electrostimulation during the chronic post-stroke stage.

P013

Concurrent transcranial direct current stimulation (tDCS) with Cycling exercise enhances knee joint position sense and muscle force after chronic stroke

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Background: Stroke is one of the leading causes of disability worldwide. Functional impairment resulting in poor performance in daily living activities in stroke individuals. The development of therapeutic strategies that promote functional recovery is a major goal of stroke research. We have developed a new conceptual framework for balance training emphasizing Transcranial direct current stimulation (tDCS) , a new and promising method to examine the therapeutic potential of tDCS combined with balance training on motor performance in this population.
Materials and methods: In this single-blinded cross over sham controlled study, 5 session of anodal tDCS (2mA,20 min) combined with daily session of leg cycle ergometer was delivered to six post stroke hemiparetic individuals. Protocol comprised an assessment of the maximum voluntary contraction (MVC) and joint position sense for the paretic Tibialis Anterior before and after active or sham tDCS. Anodal electrode was located over

P013 **Fig. 1**

the leg motor cortex of the affected hemisphere and cathode electrode over controlateral supraorbital area.
Results: After combined tDCS and balance training, the active tDCS group showed statistically significant significant increase in ankle dorsiflexion strength and joint position sense from baseline, but not the sham group ($P < 0.05$).
Conclusions: This study suggests that augmenting cortical excitability with tDCS combined with rehabilitation enhanced generating force in paretic limb which may opens up novel perspective for the use of tDCS in neurehabilitation after stroke.

P014

Peripheral Facial Palsy and mimicry after rehabilitation

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Introduction: The achievement of the facial nerve is common. The lesions may be nuclear (Pontic) or sit on everything along its path. It is agonizing and etiological diagnosis often difficult unlike the positive diagnosis. There are few drug way especially for the idiopathic form or most of the support is rehabilitative. The objective of our study was to determine the contribution of the rehabilitation in the management of facial paralysis peripheral and its etiologies mapping.
Methodology: A through a retrospective study on 1 year, 5 months, all patients followed for peripheral facial paralysis in the Department of physical medicine at Fann National Teaching Hospital in Dakar, Senegal have been listed and the sociodemographic characteristics, the severity of the deficit according to the classification of Brackman and House, headquarters of the deficit and the etiology was identified. Patients, whose records have been enlisted, were summoned in February 2017 for an appreciation of the evolution of the facial paralysis and the felt functional gene.
Results: Fifty-four (54) records of patients were enrolled. The sex ratio (H/F) was 1.25 and the average age of 40,8. The motor deficit was grade II in 18.51%, III (37.2%), IV (23.25%), V (11.62%), VI (9.3%). Bell's palsy (68,51.%), otitis (16,66), the paratidectomia (9.3%), traumatic fracture of rock (4.6%) were the main causes. After rehabilitation, facial paralysis was grade I in 6% of cases, II (63.6%), III (15%), IV (9%), V (6%). Fifty-four cases of patients were enrolled. Sex (M/F) ratio was 1.25 and the average age of 40.8 years. Peripheral facial paralysis was grade II in 18,51%, (37, 03%), III, IV (24,07%), V (11.11%), VI (9.25%). Bells palsy at (68,51%), otitis (16.66%), the paratidectomia (7.40%), were the main causes. After rehabilitation, 62% of patients were satisfied with the results and expressed no disability. The most expressed functional gene was about food. The leak of the drinks and the food bowl out of the mouth has been reported in 37.20% of cases.

Discussion and Conclusion: The aetiologies of peripheral facial paralysis in sub - Saharan Africa are largely dominated by Bell Palsy and otitis. The aesthetic and psychological repercussions are certainly present in peripheral facial paralysis but it is also functional. The most common discomfort was in the diet. Conventional rehabilitation can considerably improve this discomfort in the diet

P015

Please schedule on Wednesday 25 or Thursday 26 October?An ergonomic upper-limb support (HOLSTER) to improve comfort and enhance gait in patients with hemiparesis – a first insight into an ongoing cross-over trial

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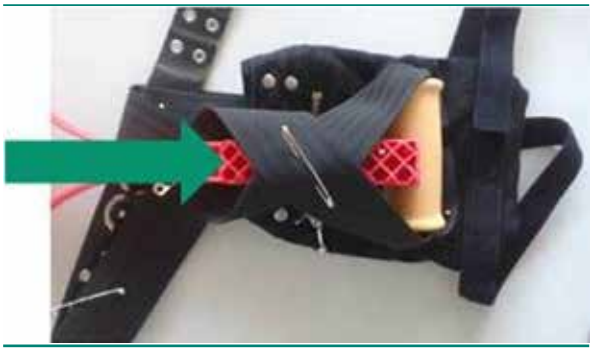
Introduction: Positioning the disabled upper-limb is important to minimize discomfort while walking and practicing activities. Sling and clothespin causing unwanted adduction and internal rotation of the shoulder joint, often increase pain, limit mobility, and alter gait pattern. We designed a low-cost and easy-to-use device to secure the paretic limb in a physiological position. We tailored a leather brace named HOLSTER (**HO**lding the **L**imb after **ST**roke through an **E**rgonomic **R**eceptacle) that maintains the arm along the trunk and positions the hand on the proximal thigh. **Objectives:** Assess whether the HOLSTER is better accepted by the patient and improves overall comfort while performing daily activities. We also seek to show whether gait patterns are different while walking with the HOLSTER compared to walking with an arm sling.
Patients and methods: We are recruiting hospitalized patients after a brain lesion in acute to sub-acute phase (maximum 12 month)). The inclusion criteria are: 1) shoulder paresis (force ≤2 MRC); 2) ability to maintain an upright position and/or to walk. The initial examination consists in standardized questionnaires and functional tests. The participants are then stratified (FAC score ≥ 4) and randomized into two groups. They are equipped either with an arm sling or a HOLSTER. Then, included patients follow two physiotherapy sessions per days for four days. On day five, a new battery of test is performed. Over the second week, the groups are exchanged (cross-over) and a final examination is carried out. The study's outcomes are: 2 minute walk test, measurement of shoulder subluxation, muscle tone (Ashworth scale), subjective perceptions (satisfaction, pain, comfort, and safety), gait patterns, and daily physical activity (measured through an accelerometer).

P015 Fig. 1



P015 Fig. 2

Results and discussion: The end of the study is planned for 2019. Here, we present the HOLSTER and preliminary results through two case reports, showing that the HOLSTER is easy to use, lowers pain, and improves comfort.

P016

Assessing upper limb function post stroke — validation of the Stroke Upper Limb Capacity Scale using the Fugl-Meyer Assessment

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Question: The Stroke Upper Limb Capacity Scale (SULCS) consists of ten items assessing the upper limb (UL) function of stroke patients. The first three items investigate the proximal arm basic capacities, the following four the UL capacities including basic wrist and finger capacities and the last three items the advanced control of wrist and finger movements. The SULCS was found to be feasible, internally consistent, hierarchical and unidimensional. Moreover, a good interrater realiability and a high construct validity with the assessments ARAT and RMA were shown. The Fugl-Meyer-Assessment (FMA) is the most widely used clinical assessment for UL motor impairment post stroke and reflects the pattern of recovery after stroke. It has excellent quality criteria and is established as the standard for proving the validity of UL measurements post stroke. The aim of this investigation is to assess the validity of the SULCS using the FMA. Methods: The SULCS and the FMA were assessed in 29 subacute and chronic stroke patients with moderate to severe hemiparesis. Assessments were conducted two to three times at intervals of three weeks resulting in a total of 80 data sets.
Results: Correlation analysis revealed a high correlation between the scores of the SULCS and the FMA (rSp=0.913, p=0.000). Changes in the scores were calculated as differences between the consecutive tests. These differences yielded a significant but weak correlation between the two assessments (rSp=0.289, p=0.038). An improvement of 5 points on the FMA was considered a minimal detectable change (MDC). Improvements (≥5 FMA and ≥1 SULCS points) and unchanged conditions were equally detected by both assessments in 58% of cases. 42% of cases resulted in inconsistent results, i.e. 13% showed an improvement on the FMA, but no change on the SULCS, and 29% an improvement on the SULCS, but no change on the FMA.
Conclusion: The scores of FMA and SULCS correlate highly, while changes of the scores show only weak agreement. This might be explained by the different conceptual constructions of the assessments (recovery of UL function vs. task specific activity). At some levels, a disproportional enhancement of motor function is required to reach a higher SULCS score. This has to be considered when using the SULCS in clinical practice.

P017

Cognitive Reserve Index – a variable impacting rehabilitation outcome in Parkinson's disease?

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Introduction: Cognitive reserve (CR) is an active process, expression of the individual capability of activating different brain networks to cope with a brain damage. Studies showed the association between high CR and lower age-related cognitive decline [1]. There are some evidences about the influence of CR on cognitive impairment in Parkinson's disease (PD) [2].
Objective: To detect if there is a possible relationship between CR and rehabilitation effectiveness in PD patients who underwent a conventional rehabilitative protocol.
Materials and methods: This is an observational longitudinal study that took place in the neurology outpatient Unit, University Hospital. Fifty-three patients affected by idiopathic PD, stage 2–3 at the Hoehn and Yahr scale, were enrolled in the study. Each patient underwent thirty-two group sessions of conventional rehabilitative treatment. Patients were evaluated before starting the treatment (To) and at the end of the rehabilitative program (T1). Outcome measures considered at baseline were: Mini Mental State Examination, Unified Parkinson's Disease Rating Scale Part III (clinician-scored monitored motor evaluation), Berg Balance Scale (BBS), Cognitive Reserve Index (CRI) questionnaire and Brief Intelligence Test. BBS was repeated at T1.
Results: Considering the clinically meaningful change, as the noticeable change in ability on 5-points, BBS improved in 26% of patients (BBS T1-To ≥5), in 2% worsened (BBS T1-To ≤5), in 72% remained stable (-4≤ BBS T1-To ≤4). BBS score significantly improved after the treatment in those with lower CR total score.
Conclusions: From a preliminary analysis, it emerges that PD patients with higher CRI are probably not enough stimulated and motivated by a conventional rehabilitation as much as the would and they could have a higher motor improvement if they performed a more stimulating non-conventional rehabilitation (e.g. robotic, virtual reality). CR appears a significant variable that physicians should consider in the choice of the appropriate rehabilitative treatment, tailored on patients' characteristics and needs.

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P018

Decoding movement intentions from EEG activity in subcortical and cortical stroke patients minimising the influence of artifacts

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Introduction: Traditional rehabilitation remains unsuccessful for severely paralyzed stroke patients with no residual movement. Although brain-machine interfaces (BMI) have appeared as the only means to induce motor recovery in this population, they are still at a very preliminary stage and many optimizations have to be carried out to improve their efficacy and to personalize them for each specific patient. Electroencephalography (EEG)-based BMIs constitute an accessible tool to decode movement intentions from completely paralyzed patients and associate those intentions to a contingent peripheral feedback, facilitating Hebbian plasticity. However, the low signal-to-noise ratio of the EEG and its easiness to get contaminated by artifacts hinders its direct application in out-of-the-lab environments.
Objective: This study aims at evaluating the influence of EEG artifacts on the decoding of movement intentions in chronic stroke patients with lesions involving the motor cortex or with intact motor cortex.
Patients and methods: Twenty-eight chronic stroke patients with complete hand paralysis were recruited: 14 of them with subcortical lesions only, and 14 with cortical and subcortical lesions. Their EEG activity was recorded while they attempted to move their paralyzed hand. A BMI for decoding movement intentions was built, relying on features extracted from the ipsilesional hemisphere. To study the influence of artifacts, the BMI was trained in two different conditions: one removing trials containing EEG artifacts (i.e., eye movements, motion and muscle artifacts) from the training dataset, and one leaving the training dataset without removing artifacts.
Results: Our results show that patients with lesions excluding the motor cortex achieve a higher overall BMI performance (around 10% higher). In both patient groups, the removal of trials with EEG artifacts from the training dataset leads to lower BMI performances (3–5% lower).
Conclusions: Although leading to lower performances, removing EEG artifacts might help to better characterize the neural activity related to movement intentions and to provide associative feedback truly dependent on the brain activity, and not on other compensatory activity. Future research should focus on the improvement of the methodologies to enhance the BMI performances, especially for patients with cortical stroke, whose low accuracy might lead to lower efficacy of BMI-based rehabilitation interventions.

P019

Effects of isokinetic training in patients with stroke

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Introduction: Stroke is a common cause of muscle weakness, gait disorder and disability. Isokinetic training is an efficient modality to recover muscle strength and, at the same time, to assess it objectively. It has been proven that muscle strength was significantly correlated with gait performance.
Objectives: The goal of the study was to evaluate the effects of isokinetic training on muscle strength at the knee level and on functional performance in hemiparetic stroke patients.
Materials and methods: 24 patients were randomly assigned into either study group or control group. Conventional rehabilitation program was applied to patients from both groups. Patients from study group had, additionally, an isokinetic training session per day, consisting of maximal concentric contractions of knee extensor and flexor muscles, performed at angular velocities of 1800/sec and 1200/sec. Both training programs were carried out 5 days a week for 2 weeks. Outcome measures were performed on the first and the last days of treatment and included isokinetic peak torque of knee extensor and flexor muscles, evaluated at angular velocities of 1800/sec and 1200/sec, using a Gymnex Iso 1 Dynamometer. Functional performance was assessed using Functional Independence Measure (FIM) scale and Time Up and Go (TUG) test.

Results: Compared to baseline, peak torque of the knee muscles increased in both groups, but significantly better in the study group (p<0.05). Also, functional performance (FIM, TUG) increased in both groups, but the improvement was significantly higher in the isokinetic training group (p<0.05).
Conclusion: Isokinetic strengthening training in stroke patients brought supplementary benefits in addition to conventional rehabilitation.

P020

Effects of treadmill training with adding load on measurements of functional mobility and postural balance in subjects with stroke – a randomised controlled trial

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Background: Constraint-Induced Movement Therapy (CIMT) is commonly used for upper limb motor recovery after stroke, with fewer studies about this therapy for lower limbs.
Objective: To examine the effects of load addition as a restraint for the non-paretic lower limb on functional mobility and postural balance in subjects with stroke.
Patients and methods: A 40-day follow up, single-blind randomized controlled trial. 38 communitydwelling subacute stroke subjects (mean time since stroke: 4.5 months). Participants were randomized into treadmill training with load on non-paretic ankle (experimental group) or treadmill training without load (control group), with both groups performing training every day of the week for two consecutive weeks. Main Outcome measures: Postural balance was evaluated by the Berg Balance Scale (BBS). Functional mobility was assessed by the Timed Up and Go test (TUG) and by kinematic parameters of turning movement, using the Qualisys System. These measures were obtained at baseline, mid-training, post-training and follow-up.
Results: Repeated-measures analysis of variance showed a significant effect for time, with improvements in postural balance (BBS: F=39.39, P<.001) and functional mobility, showed by TUG (F=18.33, P<.001) and by kinematic turning parameters (turn speed: F=35.13, P< .001; stride length: F=29.71, P<.001; stride time: F=13.42, P< .001; double support time: F=17.48, P<.001), without statistical difference between groups. All these improvements were maintained in follow-up.
Conclusions: The improvement which occurred in both groups suggests that two-weeks of treadmill gait training associated to home-based exercises can be effective to improve postural balance and functional mobility in subacute stroke patients. Considering these measurements, load addition has not shown to be a differential factor in intervention.

P021

High-level mobility training to foster effective and efficient functional recovery following an acute stroke – a case study

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Specificity, amount, and intensity are key variables for motor recovery. Providing sufficient task specific practice for many behaviors represents a challenge. Evidence suggests that less practice of a more complex task leads to improvements in a simpler task. Developing interventions that combines intensive training with complex tasks may offer an opportunity for effective interventions. Williams and Schache (W&S) developed a conceptual framework for retraining High Level Mobility (HLM) following traumatic brain injury structured around the hierarchy of skills using the HiMat and biomechanical characteristics of running. The purpose of this case study is to illustrate the effectiveness of this framework on an adult with an acute stroke. A 32 year-old man was referred to outpatient physical therapy. He presented with right hemiparesis requiring a brace to walk. He was unable to work. He was prescribed HLM training following W&S framework. The program consisted of interventions at the skill level following the hierarchical ordering of the mobility continuum as defined by the HiMat, and running biomechanics. The patient learned pre-running skills (walking over obstacles, stairs, lunges), running skills (bounding, running) and post running skills (hoping, skipping, agility drills). Training intensity was monitored using Rate of Perceived Exertion (RPE) scale. Initially, patient gait speed (GS) was 1.0 m/s, he walked 1220 ft during 6 minute walk test (6MWT), his HiMat score was 19/54. He was unable to run, hop, skip and stand on Right Leg (RL). He regained the ability to run after 5 visits. After 9 visits, his GS was 1.5 m/s, he walked 1700ft during 6MWT, his HiMat score was 29/54. He was able to stand for 5 sec on RL. During each session, he reported high training intensity (≥14 on RPE scale). He also returned to work and no longer used a brace. This program enabled the patient to acquire more complex skills such as running. It forced him to practice more complex tasks than walking which could have promoted reverse transfer explaining his walking improvements. It also offered opportunities for high intensity training, which fosters greater neuroplasticity. These results suggest that this program was effective in fostering functional recovery. Research will be required to further test this program.

P022

Postural stability and lokomat therapy in patients with stroke and severe gait disorder

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Question: Many stroke patients suffer from gait disorder and/or disturbances of balance. Locomat therapy (LT) is an established therapy for gait rehabilitation after stroke. However, only little data are available with respect to LT and postural stability during stance. At the beginning of the LT we measured the difference in deviations from the center of gravity (CG) in order to assess its possible effect on postural stability after stroke.
Methods: 11 stroke patients (4 male; 60±15 years; time from stroke onset 20–51 days) with a severe gait disorder (median FAC≤1) were examined by measuring the deviations from the CG at the beginning and at the end of two out of the first three lokomat sessions. 6 patients were able to stand freely (non-pushers), while 5 patients featured the pusher syndrome (pushers). The non-pushers had 55±22 min and the pushers 48±23 min of LT (p=0.62). The deviations from the CG (cm), the radius of sway (cm) and area of movement (cm2) were measured with the MediBalance Pro Board (MediTECH, Germany).
Results: Over all patients, there were no significant changes between the 1st and last measurement. However, the results differed between the 6 non-pushers and the 5 pushers. Non-pushers showed a decrease of the overall deviation from the CG by 27% (p=0.06), the mean radius of sway by 14% (p=0.28), the maximum radius of sway by 27% (p=0.03) and the area of movement by 52% (p=0.01). In both groups the horizontal deviation of CG and the horizontal maximum radius of sway decreased, in non-pushers by 19% (p=0.45) and 12% (p=0.46), in pushers by 28% (p=0.1) and 27% (p=0.03). All other values in pushers increased.

Conclusions: This pilot study indicates that stroke patients with a severe gait disorder may benefit from LT with respect to postural stability during stance. This, however, may rather be true for patients without a pusher syndrome. Future research should confirm these preliminary data and investigate whether the possible improvement of postural stability is due to a specific effect or rather due to an improved use of the paretic leg.

P023

Rapid strength and eccentric muscle training in neurorehabilitation

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Question: Injuries of the central nervous system affect human gait. Pathological gait patterns are associated with significant changes in basic gait parameters like walking speed, stride length and cadence. The importance of rapid strength and eccentric muscle training is well known in sports science, but not commonly integrated in neurological rehabilitation concepts. The "Gait training program+" (GTP+) was adapted from a concept published by Götz-Neumann and added to our standard neurorehabilitative therapy focusing on improving intramuscular coordination, rapid/explosive strength and eccentric muscle activity. This program aims at patients with a strong motivation to improve their gait.
Methods: 31 in-patients (20 male, age 59±13 years) with different neurological conditions such as stroke and multiple sclerosis featuring a Functional Ambulation Category ≥ 3 participated in the GTP+. At the beginning of the 1st session (60 min) a timed 10-meter walk test was performed and documented by video. Subsequently, a customized training was performed and the video documentation (VD) was repeated by the end of this session. Walking speed, double stride length and cadence were calculated and the main gait problems were explained to the patient by using the VD. Then the patient received an intense 30-min gait and a mainly eccentric muscle training both three times a week. The entire program lasted on average 3 weeks and was completed with a final VD.
Results: Already after the 1st session a significant improvement of self-paced walking speed and double stride length was observed (p=0.001). After the performance of the 3-week program all examined gait parameters improved significantly (p<0.001).
Conclusions: Our data suggest that neurological patients with persistent gait problems may benefit from a customized gait training such as GTP+, indicating the importance of rapid/explosive strength and eccentric muscle activity in neurorehabilitation.

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P024

Repeated split-belt treadmill walking improved gait ability in individuals with chronic stroke — a pilot study

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Introduction: Frequently reported characteristics in gait post-stroke include reduced gait speed (Ada, Dean, and Lindley, 2013; Lord et al, 2004), endurance (Dunn et al, 2015) and symmetry (Patterson et al, 2008) compared to unimpaired individuals.
Objective: This study investigated the effects and feasibility of repeated split-belt treadmill (SBT) walking on gait ability in individuals post-stroke.
Patients and methods: Twelve individuals with a first unilateral cerebral stroke (10 males; mean age 53 (SD 8.74); mean time post-stroke 25 months (SD 23.5); 9 left-sided stroke) and initial step length asymmetry (ratio=1.10-2.05) volunteered for the study. Participants were trained by physiotherapists from an outpatient rehabilitation center six times over 2-3 weeks using a SBT protocol.
Results: After the six sessions of training, all participants reduced their step length asymmetry from an average ratio of 1.39 (SD=0.28) to 1.16 (SD=0.16) (p=0.002) and increased walking speed (p=0.043). Improvements in symmetry and speed were retained over one month (p≤0.008). No effect was observed in participants' endurance, assessed with the 6-Minute Walk Test.
Conclusion: These findings suggest that the present SBT protocol has potential to be an efficient intervention to improve both SL symmetry and gait speed, in individuals post-stroke.

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P025

Training of balance and verticality control in subacute stroke patients – a pilot trial using the SpaceCurl

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Question: Several approaches have been described to train standing balance after stroke. However, most of these are not feasible for severely affected patients who are not able to stand unassisted. The Spacecurl is a cardanic suspension apparatus that allows balance training in a standing position while being sufficiently secured to prevent falling. Although advertised for this indication there is no evidence on its use in stroke patients. The aim of this pilot trial was to provide preliminary evidence on the feasibility and effectiveness of balance and verticality training with the Spacecurl in stroke patients.
Methods: Subacute stroke patients with severe to moderate balance impairments (Berg Balance Scale [BBS] score 4–45) were included. We used a 2-week multiple baseline design to control for intervention effects. The intervention period lasted 3 weeks with 5 sessions (30 min each) of Spacecurl therapy per week. It was followed by a 2-week follow-up phase. During the baseline and follow-up phases patients received standard physiotherapy treatment as inpatients of a rehabilitation center. Bipedal posturography, the BBS, and the subjective postural vertical (SPV) were assessed after every week.
Results: We included 19 patients, 13 of them finished the intervention phase per protocol. Three patients were discharged before or during the intervention phase, one patient declined to continue due to pain in the knees, and two due to deterioration of the general condition. At baseline, four patients were not able to stand unassisted for 30 sec; two of them were able to perform

the task after the intervention period. During the 30 min training sessions, patients spent 20 to 25 min standing in the device. Standing balance measured with the BBS and posturography significantly improved over the study period, but improvements were not significantly different between the study phases. Assessment with the BBS was feasible in all patients; posturography was only possible in patients who were able to stand unassisted. The SPV in the frontal and sagittal plane was on average within the ranges of normality and did not change over the study period.
Conclusions: Balance training with the Spacecurl is safe in stroke patients. Also severely affected patients, not able to stand unassisted, can do the training in an upright standing position for up to 25 min. The effectiveness of this training varies between subjects and needs further investigation.

P026

Varus foot deformity after stroke and the role of tibialis posterior

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Introduction and objectives: Chronic stroke often results in spastic muscles of the leg with deficiency of walking and in many cases with the development of a varus or equinovarus foot. Often the tibialis posterior muscle is thought to be responsible for the foot condition which is therefore treated with botulinum toxin injection or other similar treatments. However, little is known about the isolated function and structure of the tibialis posterior, and thus its contribution to the foot condition and to the gait.
Methods: This study investigates the structure and function of the tibialis posterior muscle. Using cadaveric material various parameters is investigated, including the points of origin and its relationship with surrounding muscles and fascial layers, innervation patterns, histological distribution of neuromuscular junctions, as well as the functional and histological properties of the tendon. In addition, dynamic poly EMG is recorded on post stroke patients with varus or equinovarus deformities, as well as the surface EMG of the tibialis posterior, tibialis anterior, the soleus, gastrocnemius and peroneus longus muscles. Activation time of these muscles is analyzed at comfortable gait.
Results: Will be presented in September.
Conclusion: This study supports the importance of the tibialis posterior muscle with its special structure and function in chronic post-stroke foot deformities and deficiency of gait.

P027

Refractory case of paroxysmal autonomic instability with dystonia syndrome following cardiac arrest managed using botulinum toxin type A injection

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Paroxysmal autonomic instability with dystonia (PAID) is a syndrome commonly occurring following traumatic brain injury, with symptoms of intermittent agitation, hyperthermia, tachycardia, hypertension, diaphoresis and tachypnea. It is rare following prolonged cardiac arrest and can be a challenge to promptly recognise and manage it specially if it presents early in the course of intensive care stay. We present the case of a 43 year old male who had an out of hospital cardiac arrest with a down time of 25 minutes. ROSC was achieved after CPR and DC cardioversion by ambulance crew. The patient suffered severe hypoxic brain injury and was transferred to ward for neurorehabilitation following intensive care stay. On the ward, patient had episodes of agitation, sweating, tachycardia, tachypnea and dystonic posturing. After series of workup to determine the presence of infection as cause of febrile episodes, a diagnosis of PAID syndrome was made. After trying various first and second line agents, clonidine, clonazepam, pregabalin, dantrolene, amantadine and Botulinum Toxin A injection resulted in control of symptoms. Accordingly, BNT-A injection is proposed as a treatment option in cases where other muscle relaxants fail to control dystonia.

P028

Gripping stroke patients with shoulder pain

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Introduction: The shoulder pain in the hemiplegic limb function alters, extends the length of hospital stay and decreases adherence to rehabilitation [1, 2].
Objectives: To evaluate the precision grip in patients who have a complicated vascular hemiplegic shoulder pain.
Methodology: All stroke hemiplegic patients progressing under 2 years, presented shoulder pain, followed for rehabilitation at the National Orthopaedic Center in Dakar (Senegal) were included. Precision grip was evaluted by the Nine Hole Teg Test which consist of putting 25 rods to the corresponding holes in the fastest way and remove them immediately. The duration of the test was recorded. The characteristics of pain etiologies were also identified.
Results: 50 patients including 28 men, average age 57.34 % were included. The pain was neuropathic (16 %). The score of the VisualAnalogue Scale was 5.46. Shoulder stiffness was identified in 54 %. 20 % of patientshad a normal precision grip, abnormal (16 %). Only 14 % of patients were able to perform the Nine Hole Peg Test with an average of 4mn 25s.
Discussion: The shoulder pain in stroke patients alters the patient's experience and limb function [1, 2] in particular manual dexterity.

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P030

Systemic lupus erythematosus first manifestation as a stroke – Is it common? – an alert case

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Systemic lupus erythematosus (SLE) is a multisystem autoimmune connective tissue disorder with a variety of clinical presentations, neurologic manifestations are among possible features. Less than 40–50 % of events are due to underlying central nervous system (CNS) lupus activity. The most common manifestations are the organic encephalopathies (35–75 % of case series) but other manifestations such as stroke may occur. Stroke is clinically evident in 5–10 % of most series and may involve small, medium, or large vessels. Central nervous system events in SLE have a more favourable outcome than events secondary to non-SLE causes, although they do have a negative impact on the quality of life of the patient and vary in severity and frequency. Cerebral lupus is finest managed with the cooperation of neurologists, physiatrists, clinical immunologists,

renal physicians, rheumatologists, and eventually the primary care physicians.This work aims to highlight the case of a patient admitted to the emergency room with stroke attributable to central nervous system lupus activity, being this his first manifestation of the disease. It was used the clinical process of the patient as well as scientific articles published in PubMed using "CNS lupus", "systemic vasculitis" and "stroke in SLE". We report a case of a male patient, 36 years old, with no previous known diseases, hospitalized after onset of gait ataxia, right hemiparesis and dysarthria, diagnosed with stroke from CNS lupus origin. He was observed in inpatient Hospital care by Physical and Rehabilitation Medicine after a collaboration request from Internal Medicine and started a multidisciplinary rehabilitation program with very positive recovery. The global outcome of CNS lupus, quality of life, and prognosis can be enhanced with close follow-up and coordination between different specialties physicians and this diagnosis should be present in every physician's mind when evaluating a patient with acute neurological findings.

P031

Assessment and treatment of patients with prolonged disorders of consciousness

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Objectives: Survivors of brain injury may, in some cases, survive for many years in a Prolonged Disorder of Consciousness (defined as being in a vegetative state (VS) or a minimally conscious state (MCS) for 12 months or more) raising challenges in relation to their ongoing care and rehabilitation. A series of three studies examining assessment and treatment were carried out with patients in Prolonged Disorder of Consciousness (PDOC). The first was a longitudinal study of recovery from persistent VS in a single case study. The second question examined whether a pharmacological intervention (Modafinil) impacted on the level of consciousness and the third examined infections in patients with a PDOC and whether scores on the Wessex Head Injury Matrix (WHIM) decreased prior to an infection being diagnosed.
Methods: Retrospective data for all patients who were regularly assessed with the WHIM and the JFK Coma Recovery Scale- Revised were examined. Scores from the JFK were used to determine if patients were in VS or a MCS and scores from the WHIM were used to determine change in status.
Results: Results showed that (i) continuing improvement and/or delayed recovery is possible after a prolonged period of impaired consciousness; (ii) Modafinil appears to be beneficial for enhancing cognition in PDOC patients. Traumatic brain injured patients (n=11) benefited more than non-traumatic brain injured patients (n=6) and (iii) WHIM scores decreased in all MCS patients (n=14) but not for the VS patients (n=7).
Conclusion: Results suggest that continuing improvement is possible in survivors of severely brain injured patients. MCS patients showed more favourable outcomes relative to patients diagnosed with VS and that difference was more pronounced for traumatic versus non-traumatic brain injured patients. A drop in WHIM scores indicates a possible infection.

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P032

Biomechanical study of the finger of the hand as a prognostic factor for the recovery of the paretic upper extremity in patients with acute stroke

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Introduction: Stroke is one of the most serious and common public health problems. Impairment of the upper extremity (UE) following stroke affects 50–80% of patients. The most reliable prognostic factors associated with UE recovery are localised motor impairments, especially in the musculature of the hand and abduction of the shoulder in the first days after a stroke. Evaluation of the biomechanics of the hand allows an accurate identification of the motion arcs of the digital joints.
Objective: Assess the prognostic value of the range of motion of the finger joints using an instrumental glove (CyberGlove II®) one week after stroke for UE functional recovery at 6 months.
Methods: A prospective, longitudinal, observational study with follow-ups at 3–4 days, 1 week, 3 and 6 months of patients with UE motor impairment. Variables collected included: demographic data, level of stroke severity (NIHSS), deep sensitivity, sphincter incontinence, Fugl Meyer Assessment of UE (FM- UE), muscle balance with the Medical Research Council (MRC), muscle tone (Modified Ashworth Scale) and pre- and post-stroke functional ability (Barthel Index and Modified Rankin Scale). Active range of motion of the metacarpophalangeal and interphalangeal joints of the index, middle finger, annulary, and little finger was assessed with CyberGlove II® without and against gravity. The dependent variable UE function was evaluated with the Action Research Arm Test (ARAT) categorized as good function (ARAT≥10) and poor function (ARAT<10).
Results: 31 patients were included, 18 of which completed the 6-month follow-up. Mean age was 68.2 years (SD=9.1) and 72.2% were men. A total of 77.8% of strokes were ischemic, and 50% of these were lacunar. Mean NIHSS score was 9.2 (SD=5.5). At 1-week follow-up, statistically significant differences were observed in the range of motion of proximal and distal interphalangeal joints of the index and annulary against gravity between the two ARAT groups and in maximum flexion for the same joints of the index, middle finger and annulary in both positions.
Conclusions: The biomechanical assessment of the range of motion of the proximal and distal interphalangeal joints of the index, middle finger and annulary of the hand one week post stroke has prognostic value for UE function recovery 6 months after stroke.

P033

Early start of (neuro)rehabilitation is in favour of the patient with complex care

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Introduction: For patients from Intensive Care Units, not enough recovered for a regular Rehabilitation Centre , there is a new concept of care in the Netherlands: Optimum Care (OC) in Rehabilitation Centre Heliomare. Because of dependency of complex care like mechanical ventilation , patients stay unnecessary long on the intensive care unit with all the negative effects of immobilization.
Objectives: The earlier the start of intensive rehabilitation, the better the outcome and reduction of length of stay. For patients

with severe stroke, Spinal cord injury, Neuro Muscular Disease, Traumatic Brain Injury or Intensive Care Unit Acquired Weakness with complex care we started a new department Optimum Care. The Optimum Care combines intensive care in combination with intensive rehabilitation care. It is a stepped care model. In about six weeks patients are stable enough for a regular department in the Rehabilitation Centre.

Patients and methods: One year before the start of the OC patients marked as potentially candidates for the OC (control group N=8) were followed and compared with the population starting at the Optimum Care (OC group (N=73). We followed the time path from the first day in the hospital, the transfer to the rehabilitation center till the day of depart from the rehabilitation center.

Results: Comparing with the control group the OC patients had a mean reduction of the hospital stay of 27 days (75 days vs 48 days) . The mean stay at the OC was 33 days. The total stay in the rehabilitation center of the control group was a mean of 166 days versus 130 days of the control group. From the first hospital day till discharge from the rehabilitation center the OC group shows a total mean reduction of 63 days.

Conclusion: Combining intensive care in with intensive rehabilitation care at an Optimum Care department in a Rehabilitation Centre gives a reduction of clinical stay (hospital and rehabilitation center) with a mean of 63 days. That's not only in favor for the patient but it's also a financial attractive alternative. Further outcome measurements will follow.

P034

Family caregivers of adult patients with severe disorders of consciousness (unresponsive wakefulness syndrome and minimally conscious state) during early neurorehabilitation

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Introduction: In science, health politics and public media, there is a rise of attention regarding informal caregiving by family members or other persons close to the patient. Family caregivers can be considered as service providers and at the same time as a health risk group, having to cope with considerable stressors and burden of caregiving. Not only from an individual perspective but also from a health economics view, caregiving by family caregivers is of high relevance. In both roles – as service provider and as member of a health risk group – there is an assumed need of preventive and competence enhancing caregiver education starting in an early stage of neurorehabilitation. Regarding family members of patients with severe Disorders of Consciousness, there is a lack of evidence-based concepts for caregiver education.

Objectives: The aim of this conceptual presentation is to give an overview of the current state of research about family caregivers of patients with severe Disorders of Consciousness, to analyze the need of this target group for caregiver education, and to discuss an interdisciplinary process model for caregiver education during early neurorehabilitation.

Patients and methods: The analysis focuses on family members or other informal caregivers of patients with Unresponsive Wakefulness Syndrome or Minimally Conscious State. This congress presentation is based on a conceptual thesis in the field of health services research and Applied Therapy science, using the methodology of Evidence-based Health Care.

Results: Literature analysis shows that the current state of research is limited. Available data is however sufficient to prove the need of the target group for caregiver education and to develop a process model for interventions for caregivers, aiming at competency enhancement and disease prevention.

Conclusion: Evidence shows that there is a need of caregiver education for family caregivers of patients with severe Disorders of Consciousness starting in early neurorehabilitation. In many cases, this need is not yet sufficiently taken into consideration and acted on by rehabilitation institutions and the interdisciplinary rehab team.

P035

Helping stroke survivors recover walking abilities through augmented reality gait training during early rehabilitation – first insight into the Gait Adaptation for Stroke Patients with Augmented Reality (GASPAR) trial

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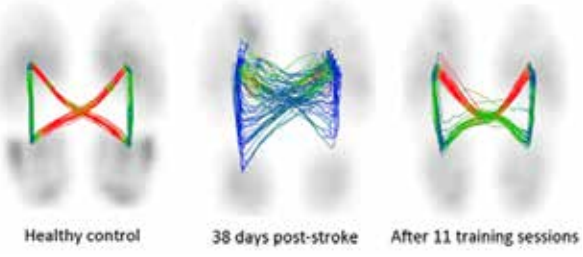
Introduction: Many stroke survivors suffer from lower-limb disabilities and restricted walking abilities. In early rehabilitation, repeated walking exercises stimulate brain plasticity and motor relearning. However, an unsteady gait may persist, which can impede the adaptation to changing environments and can lead to greater fall risk. Gait training with augmented reality providing visual feedback has been recommended to improve gait coordination and walking abilities.

Objectives: The objective of the study is to test whether a gait rehabilitation program using augmented reality is superior to a conventional treadmill training program of equivalent intensity.

Patients and method: The GASPAR trial (Gait Adaptation for Stroke Patients with Augmented Reality) is a single-center, parallel-arms, non-blind, superiority randomized controlled trial. The participants are recruited among patients hospitalized for early rehabilitation (<50 days after stroke). The recruitment began in July 2016. The intervention uses two instrumented treadmills equipped with projectors that display shapes on the walking surface [Rehawalk (Zebris Medical) and C-mill (Motek-Force Link)]. Specific exercises for gait symmetry, coordination enhancement, and gait agility are provided. The program includes 20 thirty-minute sessions spanning four weeks. The control group follows a standard treadmill intervention of comparable intensity. The trial includes pre-, post-intervention, and 8-month follow-ups, and a longitudinal analysis of gait parameters measured through the instrumented treadmills during intervention. The principal outcomes are walking speed (2 min. walk test) and spatiotemporal gait parameters. Secondary outcomes include balance control (Berg balance test), fear of falling (falls efficacy scale), fall rate, and health status (SF-36).

Results: Here, we show preliminary results illustrating the gait recovery in selected cases. For instance, **Figure 1** shows the center of pressure trajectory (butterfly graph) recorded during treadmill walking in a healthy control and in a hemiparetic par-



P035 **Fig. 1**

ticipant after an ischemic stroke (left middle artery), before and after the intervention.
Conclusion: An interim analysis of 30 patients is planned in 2018. Final results are expected in 2020. We hope that our results will provide new knowledge about gait recovery and will contribute to the design of better rehabilitation programs to accompany this process.

P036

Management of sialorrhea with botulinum toxin — service evaluation

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Introduction: Sialorrhoea can be seen in patients with neurological insult ranging from Parkinson's disease to traumatic brain injury. Complications from sialorrhoea include aspiration pneumonia, speech impairment, poor tracheostomy weaning, and social stigmatisation, thus warranting effective management approaches. Current treatment includes postural management, oral medications and surgical strategies. Botulinum toxin A has also been demonstrated as a successful treatment and is often used as a second line therapy.
Objective: To determine whether BoNT-A injections are effective and safe in management of sialorrhoea from a cohort of inpatient and outpatients in a neuroscience centre.
Patients and methods: This retrospective service evaluation included 14 patients, all of whom suffered from sialorrhoea due to neurological insult. Data from 7 outpatients and 7 inpatients in a rehabilitation unit was collected.
Results: In the inpatients, the goals (including aid in tracheostomy weaning, reduced suction requirements and cosmetic improvement) were met in 71%, with the remainder reporting no benefit. Efficacy in the inpatients reduced with increasing time from neurological injury to BoNT-A injection. 57% of outpatients were lost to follow up, 29% reported no benefit and 14% reported that the goals were met. No adverse events following BoNT-A injection were reported. Prior to treatment with BoNT-A, all patients had a trial of oral medication: 4 patients reported side effects, including confusion and drowsiness; the remaining 10 patients reported no clinical improvement. Per clinician preference, half of the injections were performed under ultrasound guidance; all submandibular glands were injected with guidance. Dose of toxin administered varied with brand, for Botox® the dose was on average 100 units for parotid and submandibular glands, for Xeomin® the dose ranges from 50-200 units and Dysport® was used once at 200 units.
Conclusions: The majority of inpatients benefitted from BoNT-A injections, demonstrating its clear efficacy in sialorrhea management. Unfortunately, many outpatients were lost to follow up - perhaps due to the progressive nature of the underlying condition. Oral medications led to more side effects than BoNT-A. Overall, BoNT-A is both beneficial and safe for the management of sialorrhea for inpatients undergoing neurological rehabilitation, and its clinical use could be considered earlier and perhaps before alternative medications.

P037

Meaningfulness and acceptability from health professionals and caregivers providing nature-assisted therapies (NAT) to severe brain damaged people

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Brain disorders after traumatic or non-traumatic injuries bring to light to severe physical and cognitive impairments (OMS 2011). Despite the progresses of the resuscitation techniques and of neurosurgery, the number of brain damaged people having sequels either in acute care units nor in long term settings is increasing. This population needs acute neurorehabilitation. Because of the increase of the problematic of disability in primary health care and in the community, multidisciplinary specific rehabilitation programs devoted to severely brain damaged people need to be elaborate and conducted. Recent studies have proved that the patient's outcome increases if neurorehabilitation starts as early as possible i.e. from Intensive Care Units. At the same time, the increase of health costs has obliged public health policy administrations to adopt adequate plans of care with quantifiable objectives based on therapeutic indicators justifying the techniques used, as well as the intensity and the length of treatments and therapies devoted to those brain damaged people who are severely impaired, physically and cognitively. Professionals are often facing non or pauci-communicant patients, presenting Disorders Of Consciousness so that they must adopt a perspective which includes also a partnership and interactions with families and health professionals (enlarged to daily caregivers). All those actors of care are facing a major challenge: to build rehabilitation programs on non-cognitive bases to correspond the best to the lasting capacities of those patients which are predominantly sensitive and emotional. Nature Assisted Therapies (NAT) respond to this aim as they are based on sensitive and emotional therapies when cognitive functions are impaired. NAT can also provide physical and cognitive therapies following patient's progresses and increased capacities. NAT are defined as "an intervention with the aim to treat, hasten recovery, and/or rehabilitate patients with a disease or a condition of ill health, with the fundamental principle that the therapy involves plants, natural materials, and/or outdoor environment" (Annersted & Währborg, 2011). Meaningfulness and acceptability from health professionals and caregivers providing NAT to severe brain damaged people seem to be under describe in literature. We have decided to conduct a JBI systematic review to explore it. Our project is to offer a synthesis of the actual qualitative data on the matter.

P038

Normal pressure hydrocephalus during intensive rehabilitation following severe acquired brain injury

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Introduction: Normal Pressure Hydrocephalus (NPH) is a possible complication of traumatic and non-traumatic brain injury (GCS< 8). The NPH is accumulation of cerebrospinal fluid within the brain supported by neuroradiology condition, in which the patients developed decline of neurologic evolution or deterioration of cognitive function. It can arise during intensive rehabilitation and can modify patient's outcome.
Objective-purpose: Evaluate the effect of NPH on patient's outcome, on recovery time and the incidence of this tardive complication in patients hospitalized in intensive rehabilitation (code

75), in Montecatone Rehabilitation Institute, Operating Unit of acquired brain injury.
Material and method: The sample included all patient hospitalized from 01.01.2008 to 31.12.2016, most of them with Disorders of Consciousness - DOC (LCF<3). Everyone was subjected to evaluation of consciousness at the entrance (T1) and at the discharge (T2) through LCF-Levels of Cognitive Functioning- and DRS-Disability Rating Scale. A multidisciplinary team, evaluating the radiologic and clinical signal, defined the necessity of surgical intervention ventriculo peritoneal shunt (VP).
Results: The sample included 525 patient affected by brain injury. Of these population, 85 patients developed NPH during hospitalization in intensive rehabilitation, of which 42 male and 43 female and middle age was 50.2. Of the population with NPH the etiology was traumatic for 29 subjects (30%) and non-traumatic for 56 (70%). The incidence (subjects whit NPH/sample) is 16%; everyone of these patients it was submitted to VP. At T1 DOCs were 55%, at the discharge 24% because of VP. At T1 26% has DRS 9- extreme vegetative state-, at T2 0%, 36% with DRS 8- vegetative state- at T1 and 13% at T2, 25% DRS 7 (extremely severe disability) at T1 and 32% at T2. Average recovery time of patients without NPH was 122 days and with NPH was 234 days. Of the sample, 38 patients returned at home (52%) with caregiver trained. We reported 2 deaths during the recovery.
Conclusion: The incidence of NPH in our study is 16%. It seems associated to DOCs and if it's early discovered and operated it doesn't lead to worst outcome. The outcome shows improvement of DRS In T2. We suppose that in case of DOC is primary search an eventual NPH. It could be useful establish a regional register about incidence of NPH in these patients of Emilia Romagna region to evaluate the influence about recovery time and outcome.

P039

Rehabilitation outcome evaluation in the stroke unit rehabilitation department

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In the Stroke unit rehabilitation department of the General University Hospital in Prague has been in year 2016 hospitalized 166 patients. Among those patients 108 suffered from stroke - 82 from ischemic stroke and 26 from hemorrhagic stroke. Mean age of those patients was 69,7 years (18–94 years old), mean time after stroke onset by admission to rehab unit was 20 days (6-120). Mean time of the hospitalization was 33 days. Patients are examined by admission and by discharge from the unit by therapist of the multidisciplinary team. Physiotherapist provides general kinesiology examination, Modified Rivermead mobility test (m-RIM), Berg Balance Scale (BBS), Timed Up end Go Test, 10 meter Gait Test and Five-step clinical assessment in spastic paresis by Gracies. Occupational therapist is using Functional Independent Measure (FIM), Barthel index (BI), Apraxia Screen of Tulia and screening of hemispatial neglect syndrome. OT provides Franchay Arm Test and Fugl Mayer Assesment of Upper Extremity by hemiparetic patients. Speech therapist is using The Mississippi Aphasia Screening, Dysartria Profile and Gugging Swallowing Screen for evaluation. Montreal Cognitive Assessment and Beck's Depression Inventory – II is done by psychologist. Patients are assessed by nutritional therapist and by visual therapist as well. Therapeutic plan is than fitted to the specific needs of each patient. We observe with help of complex evaluation the progress in each affected area during the hospitalization and by discharge. During the hospitalization of stroke patients in 2016 we registered mean progress in FIM 15,56 points (from 82 to 97,6 bodů), 16,8 points in BI (from 58,6 to 75,5), 3,3 points in m-RIM from 5,7 nto 9) and 11,27 points in BBS (from 21,65 to 31,92). Evaluation of the rehabilitation effect we use to monitor patient progress and also evolution by patients with different specific problems. We observe effect of different rehabilitation techniques. Our goal is to cooperate in evaluation of the stroke patients with other stroke units and rehabilitation centers to coordinate the care and research in Czech republic.

P040

Relationship between balance and quality of life in patients with brain surgery

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Introduction: Brain surgery can lead to balance difficulties. Some patients have long term problems with imbalance that affect their quality of life.
Objectives: Aim of this study was determine the relationship between balance and quality of life in patients with acute brain surgery.
Methods: Seventeen patients with acute brain surgery (mean age=49.47±15.33) were assessed with "Timed Up and Go Test" and The Functional Assessment of Cancer Therapy-Brain (FACT-Br) at post-surgery term. Data were presented median and interquartile range and Spearman's rank correlation coefficient was used for the analysis.
Results: There was a moderately negative correlation between balance and quality of life of the patients (p=0.02, r=-0.54).
Conclusions: Balance was significantly correlated with quality of life in patients with brain surgery. To increase quality of life, balance should be importantly evaluated and improved in early post-operative phase.

P041

Relationship between functional mobility, trunk impairment and dependence in daily living activitiy in patients who underwent surgery for brain tumor

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Introduction: Brain tumors cause sensorimotor functions. Most of the cases lost their functional mobility, motor movements of trunk and independence in activities of daily living. Although it is known that functional mobility was correlated with trunk control and independence in activities of daily living in stroke patients, there is no study about these relationships in patients who underwent surgery for brain tumor (PWUSBT).
Objectives: To investigate the relationships between functional mobility, trunk impairment and independence in activities of daily living in PWUSBT.
Materials amd methods: Twelve (7 male, 5 female) PWUSBT were enrolled the study at inpatient term after the surgery. Functional mobility, trunk impairment and independence in activities of daily living were evaluated by "2 Minute Walk Test", "Trunk Impairment Scale" and "Barthel Index", respectively.
Results: Functional mobility was positively correlated with total and static trunk control (p=0.028, r=0.629 for total trunk control, p=0.029, r=0.627 for static trunk control). There was a significant relationship between functional mobility and independence in activities of daily living (p=0.034, r=0.641).
Conclusion: Functional mobility was correlated with trunk impairment and independence in activities of daily living. To

gain trunk movements is important for functional mobility and independence in activities of daily living in early phase after surgery in PWUSBT. Trunk motor control exercises should be applied in inpatient physiotherapy in order to gain functional mobility as soon as possible after the surgery.

P043

Benefits of Functional Proprioceptive Stimulation in Acute Neurorehabilitation.

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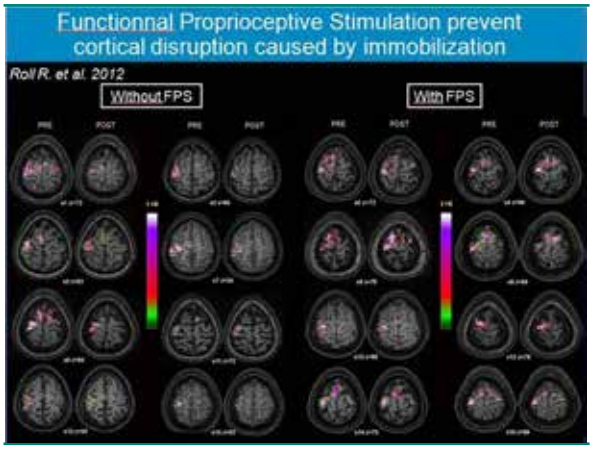
Question: Any neurological condition or poly-traumatism that led to long term immobility disrupts the cortical networks involved in sensorimotor activities and provoke many secondary effects: motor problems, atrophy, joint & brain ankylosis, muscular retraction, spasticity, orthostatic hypotension... Does Functionnal Proprioceptive Stimulation (FPS) applied since the very early phase of neurorehabilitation are able to limit or prevent the deleterious effects of immobilization and stimulate the neuroplasticity to enhance the final outcome of patients?
Methods: These researches used methods ranging from cellular levels (unitary muscle spindle activity recording by microneurography) to the most integrated level (fMRI, psychophysics).
Results: Recordings of afferent feedback of one movement evoke the sensation of doing the same movement when returned via FPS. Through these natural sensory stimulations, patients perceived movements they are not doing voluntarily. Moreover, by continuing to activate the sensori-motor networks with multi-joint realistic patterns, we demonstrate, using functional magnetic resonance imaging (fMRI), that the reorganization usually caused by disuse has been prevented: FPS prevent cortical disruption caused by immobilization. Finally, we demonstrate that FPS can provoke involuntary muscular responses helping patients to reinitiate complex movements copying the ones perceived during the stimulation.
Conclusions: FPS stimulate the nervous system with similar informations to those normally going along natural movements. By continuing to stimulate sensori-motor interactions, the need for re-training is reduced suggesting that FPS induce neuroplastic processes. Its accuracy as a mean of inducing complex movements for patients who are not able to move on their own make it a very valuable technique for early neurorehabilitation. Patients can be treated by FPS since day 1 after the trauma by progressive and intense work based on massive repetition of adapted motor tasks and sensory immersion improving long-term outcomes.



P043 **Fig. 1**

FPS allow locomotor training, prevent sensorimotor deprogramming due to long term immobility and stimulate the neuroplasticity. Clinicians need now to embrace this new approach and include FPS in the early phase of neurorehabilitation; by doing so they could drastically improve the motor recovery of millions of patients suffering from neurological conditions or poly-trauma.

P044

Two severe cases of acute disseminated encephalomyelitis in early neurorehabilitation with exceptionally good outcome following craniectomy

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Acute disseminated encephalomyelitis (ADEM) is a rare, but fulminant autoimmune disease affecting the central nervous system. A related disease is the acute haemorrhagic encephalomyelitis (AHEM) or Weston-Hurst syndrome, which may be considered as the haemorrhagic course of ADEM. The diseases are life-threatening, monophasic and affect, in most cases, young adults and children. The presented poster introduces the course and outcome of neurorehabilitative treatment of a 39-year-old patient with ADEM and a 43-year-old patient with histopathologically confirmed AHEM. In both cases, a high dose corticosteroid pulse treatment, plasmapheresis, immunoglobulin therapy and operative decompressive therapy by craniectomy had been applied. After a comparable length of stay at intensive care unit (42 and 49 days), both patients spent a comparable time in early neurorehabilitation (31 and 34 days). The main neurological deficits were severe hemiparesis and dysphagia in both cases and additionally aphasia in the AHEM-case. Functional outcome, validated by Barthel scores (BI), improved significantly during rehabilitation (from 15 to 50 in the ADEM, and from 10 to 45 in the AHEM patient, respectively) and both patients qualified for further rehabilitation in distinct facilities. With respect to particular neurorehabilitative issues, decannulation was achieved after a few days in the ADEM-case and had already been performed at the beginning of neurorehabilitation in the AHEM-case. Oral nutrition with all food and liquids could be established soon in both cases. The motorical outcome differed in favour of a stronger improvement of muscle strength in the AHEM-case. Nevertheless, the functional outcome concerning activities of daily life at the end of early neurorehabilitation was clearly better in the ADEM-case. Apart from factors, like young age and patients' motivation, we are convinced that decompressive craniectomy contributed to the remarkably favourable outcome in the presented cases. There are several case reports of the potentially life-saving role of craniectomy in the acute treatment of ADEM, but only a few reports of the following rehabilitative course and outcome. Thus, we speculate that craniectomy should be considered early in the acute treatment of ADEM patients with severe uni- or bilateral brain edema to decrease mortality rates. The presented cases also show the impressive functional improvement of two patients with ADEM treated with early neurorehabilitation.

P045

The concentration of brain derived neurotrophic factor (BDNF) after early post-stroke rehabilitation and its association with functional and mental status.

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Background and purpose: The association between concentration of brain derived neurotrophic factor (BDNF) and the level of disability, cognitive impairment, depression could have an impact on post stroke rehabilitation outcomes. The aim of this study was to determine the effect of a 4 weeks post-stroke rehabilitation on the concentration of BDNF and chosen clinical parameters in patients with subacute stroke. Moreover, we evaluated correlation between BDNF concentration and baseline patients characteristics as well as functional and mental assessments of post stroke rehabilitation outcomes.
Methods: The study was performed on the group of 24 patients with sub-acute first life stroke and 12 healthy controls. Both groups underwent the same rehabilitation program (120 min. /per day). Clinical assessments were scored according to the Mini-Mental State Examination (MMSE), Geriatrics Depression Scale (GDS), National Institute of Health Stroke Scale (NIHSS) and Barthel index. Blood samples were obtained in the before and after completing 4 weeks of post-stroke rehabilitation.
Results: BDNF was about 3-fold higher in plasma of post-stroke patients than in healthy volunteers. There was the statistically significant correlation ($p<0.001$) between baseline BDNF concentration and Barthel index, age, MMSE, NIHSS and no correlation with GDS. We also observed decrease of the BDNF concentration in post stroke study group (over 30%) after 30 days of rehabilitation ($p<0.03$) compared to insignificant changes in healthy controls. Moreover, after completing early post-stroke rehabilitation program an increase in all evaluated scales were observed. However, the most pronounced changes ($p<0.00003$) in Barthel index and MMSE ($p<0.0007$) were reported. We found also negative correlation between alteration after post-stroke rehabilitation in BDNF concentration and Barthel index, NIHSS and GDS.
Conclusion: It was concluded that BDNF concentration is decline with the age and the low concentration of BDNF is the negative prognostic factor of post-stroke disability, cognitive impairment as well as effectiveness of rehabilitation. Early post stroke rehabilitation has a very positive impact on functional and mental status. However, approximately 30% decrease of BDNF concentration was observed after completing 4 weeks early rehabilitation.

P046

Abnormal electrophysiological correlates in patients with left medial temporal lesion

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Immediately repeated stimuli are less well recognized after a delay than stimuli repeated after intervening items, an effect known as the Spacing effect. However, we found that stimuli repeated immediately within a continuous recognition task evoke a frontal potential at 200–300 ms, which emanates from the (left) medial temporal lobe (MTL) (James et al. Hippocampus 2009; 19: 371–8; Nahum et al. Hippocampus 2011; 21: 689–693) and has a protective effect on the memory trace (Thézé et al. Hippocampus 2016; 26: 445–54). Patients with Wernicke-Korsakoff syndrome lack this frontal potential (Nahum et al. Brain Topogr 2015; 28: 760–70). Here, we tested 11 patients with focal left medial temporal lesions and amnesia, compared to healthy controls, to verify whether this frontal potential would also be absent in this patient group. Brain activity was measured with high-density EEG as subjects made a continuous recognition task containing both immediately repeated stimuli and stimuli repeated after 9 intervening items. Both patients and controls had a spacing effect: after 30 minutes, they recognized new presentations and pictures repeated after intervening items better than immediate repetitions. Patients' performance was significantly poorer than controls during encoding and delayed recognition tasks. Importantly, only controls, but not the patients, expressed the frontal positive potential between 200 and 300 ms in response to immediate item repetition. The observations lend further support to the utility of immediate picture repetition for testing the integrity of MTL functioning. Also, they support the idea that this early frontal potential (emanating from the MTL) has a memory-protective effect.

P047

Analysis of subjective vertical perception in patients with unilateral spatial neglect

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Introduction: The important cognitive aspects related to vertical perception are subjective visual vertical (SVV) and postural vertical (SPV). Patients with unilateral spatial neglect (USN) is known to be disturbed SVV. However, the property of SPV in patients with USN is unclear. The purpose of present study was to clarify the characteristic of subjective vertical perception in patients with USN.
Materials and methods: Twenty-three patients with stroke enrolled in this study. USN was assessed using behavioral inattention test (BIT). Ten patients were considered as USN (N+; age, 61.9 (mean); BIT, 97.0), and thirteen were non-USN (N-; age, 66.7; BIT,142.1). This study was approved by the ethics committee, and all participants provided written informed consent. SVV was measured by orienting luminous rod using computer software. SPV was measured by a Vertical Board (VB). The subjects seated on the VB, with eyes closed (SPV) or eyes open (SPV-EO). The tilt of the rod or seat was stopped when the subject perceived perfect verticality, and the deviation from true vertical was recorded. Eight trials were performed. The orientation was calculated the value of average (Tilt direction) and standard deviation (Variability). The data defined as the negative value was paretic side. The differences of vertical parameter in two groups were compared by unpaired t-test.
Results: In SVV, tilt direction(N-; -0.6°, N+; -3.0°) was significantly deviated to paretic side in N+, and variability (N-; 1.5, N+; 4.6) was higher in N+ than N-. In SPV-EO, tilt direction (N-; -0.3°, N+; -0.3°) was no significant difference between groups, but variability of SPV-EO (N-: 2.7, N+: 6.0) was higher in N+ than N-. In tilt direction (N-; -1.1°, N+; -0.5°) and Variability (N-: 4.1, N+: 4.4) of SPV, there were no significant difference between N+ and N-.
Conclusion: These results suggest that SPV is not disturbed by USN, but visual information in patients with USN is possible to interfere vertical perception. It may be effective to exercise under the condition of cutting off the visual information in patients with USN.

P048

Behavioural adaptation and metacognitive assessment in Parkinson's disease

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Effect of antiparkinsonian medication and the degenerative aspect of Parkinson's disease (PD) on cognition remain key issues regarding PD's treatment and better understanding of medication's side effect. Here, we focus on the assessment of behavioral adaptation according to changes in stimulus reward contingencies by incorporating patient's metacognitive self-assessment. Specifically, 10 patients with PD and 10 healthy controls were tested with a reversal learning task that incorporated items to assess their decision confidence level. Patients participated with and without antiparkinsonian medication. The results obtained were in agreement with previous reports in that PD patients showed a reversal shifting impairment with respect to controls regardless of medication condition. The metacognitive assessment revealed a significant association between accuracy and decision confidence level for patients without medication and control group, but not for patients with medication. Simulations by using a Rescorla-Wagner learning model suggest deterministic and exploratory decision making for healthy controls and PD patients respectively.

P050

Effectiveness of a holistic day treatment rehabilitation programme for patients with acquired brain injury in the chronic phase in Greece

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Introduction: Acquired brain injury (ABI) is a major cause of death and disability in adults. Most ABI survivors exhibit a variety of chronic neurobehavioral sequelae, as well as impaired self-awareness, hindering independent functioning and social re-integration. A great amount of evidence-based studies have suggested that ABI survivors are best treated by holistic day treatment programs, offering integrated, multidisciplinary rehabilitation. However, there is limited research regarding the effectiveness of holistic rehabilitation in ABI patients in the chronic phase.
Objectives: The primary aim of the current study was to evaluate the effectiveness, in cognitive functioning, self-awareness and independence in daily activities, of a day treatment program treating Greek outpatients with ABI in the chronic phase, provided by the Brain Injury Day Treatment Rehabilitation Program of ELEPAP Athens.
Participants and methods: A prospective study with 30 ABI patients in the chronic phase (mean=6,5 years since injury, SD=5,8) who underwent a holistic day treatment program (5 hours/day, 4 days/week) for 12 months and 10 control patients (mean=8,8 years since injury, SD=7,8) who did not receive rehabilitation. The effectiveness of this intervention was evaluated with performance on neuropsychological (NP) testing, altered self-awareness on Awareness Questionnaire (AQ) and changes regarding independence in activities of daily living on a modified version of Behavioral Competence Inventory (BCI).
Results: NP functioning significantly improved for the rehabilitation group. In addition, after rehabilitation, patients showed better awareness of their difficulties (reduced difference between self and proxy report), especially in the cognitive and behavioral domain (AQ), and improvement in daily activities according to the proxy (BCI). In the control group, no significant change was observed at NP testing, awareness or daily activities.
Conclusions: The findings support that holistic day treatment rehabilitation programs can improve cognitive functioning, increase self-awareness and consequently enhance functionality in daily living in ABI patients even in the chronic phase.

P051

Effects of prefrontal transcranial direct current stimulation on language production in post-stroke aphasia

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Question: A successful interplay between prefrontal and domain-specific language areas has been shown to be crucial for language processing. Non-invasive brain stimulation is increasingly being used as a promising therapeutic tool for neurological diseases. The aim of the present study was to investigate the effects of excitatory transcranial direct current stimulation (anodal tDCS) of the dorsolateral prefrontal cortex on language production in chronic post-stroke aphasic patients. Using a randomized, sham-controlled and double-blind within-subject design, we expected an improvement of language production after left prefrontal anodal tDCS as compared to sham tDCS.
Methods: Subjects- 14 right-handed, French speaking participants (mean age 57.7± 8.79) with chronic aphasia due to ischemic or haemorrhagic stroke (> 6 months post-stroke). tDCS- tDCS was applied for 20 minutes with a current density of 0.04mA/cm2, with the anodal electrode placed over the left dorsolateral prefrontal cortex and the cathodal electrode placed over the right supraorbital area. Each patient underwent one anodal tDCS and one sham tDCS session, with a one-week interval between the sessions. Outcome measures - A picture naming task, a repetition task, a verbal fluency task and a nonverbal executive functions task were performed both during (online) and immediately after stimulation (offline)
Preliminary results: A preliminary analysis shows that in the verbal (phonemic) fluency task, participants produced more words after anodal tDCS (M = 6.5, SD=3.53) than after sham tDCS (M=5.5, SD=3.50), t(13)=2.65, p=.020, Cohen's dav=0.28. However, results indicate no online effects as well as no effects in the picture naming, repetition and in the nonverbal executive functions tasks (all p>.05).
Conclusions: These preliminary results suggest that increasing prefrontal excitability might have beneficial after-effects on language production in aphasic patients. Importantly, our data show that this effect might be found only in tasks which depend on a strong interplay between language and executive functions, such as phonemic fluency.

P052

Evaluating functional outcomes of conventional rehabilitation combined with rTMS in recovering hemispatial neglect using Kessler Foundation Neglect Assessment Process (KF-NAP™)

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Background: Hemispatial neglect, defined as the inability to perceive and process stimuli on one side of the body or environment, is a debilitating condition, associated with longer hospitalization and worse rehabilitation outcomes usually related to right hemispheric cerebral lesions. Recent research shows that repetitive transcranial magnetic stimulation (rTMS) could improve the symptoms of neglect in stroke patients. In our study, we adopted this approach to improve visuo-spatial deficit in patients with brain injury after stroke that showed important symptoms of visuo-spatial neglect. We found that continuous theta burst stimulation (cTBS) applied over the left posterior parietal cortex (PPC) induced a functional changes of fronto-parietal network as assessed by means of TMS. Furthermore, we observed a clinical improvement of cognitive disorder associated with a better functioning in the Activities of Daily Living (ADL). A validated assessment tool, sensitive to identify neglect and its functional consequences, Kessler Foundation Neglect Assessment Process (KF-NAP™), certified these outcomes. The primary aim of the present study is to investigate whether the repeated application of continuous theta burst stimulation trains could ameliorate spatial neglect on a quantitative measure of the activities of daily living spontaneous behavior.
Methods: In 6 patients with left hemispatial neglect due to stroke, we applied the KF-NAP scale to evaluate the functional outcome of a combined rehabilitative program with rTMS and multidisciplinary rehabilitation. Patients underwent rTMS sessions of 600 trains of continuous theta burst stimulation applied over 3 weeks, 5 sessions per weeks, on the contralesional, left posterior parietal cortex. Immediately before and after cTBS stimulation participants performed a visuospatial task.
Discussion: Preliminary results show that low- frequency and inhibitory cTBS application to the non-affected left parietal area can improve KF-NAP™ outcome. The KF-NAP scale proves to be a good index to detect significant functional improvements. The outlook for our next study will be to design a randomized, single-blind, sham-controlled design, to demonstrate the potential role of cTBS in hemispatial neglect rehabilitation.

P053

Home-based neurofeedback training – evaluation of a cognitive tele-rehabilitation system

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Question: Brain disorders often lead to cognitive impairment. Traditional cognitive rehabilitation methods are usually limited to the institutional environment and pose serious compliance problems. Home-based cognitive training programs are rare and hardly supervised by therapists. Therefore, we developed and evaluated a cognitive tele-rehabilitation system based on neurofeedback (NF) to bridge the gap between institutionalized and home-based cognitive training. In NF applications, patients learn to voluntarily modulate brain activation patterns underlying cognitive functions. In most cases, the electrical brain activity as assessed with the electroencephalogram (EEG) is used as feedback signal. Successful NF training generally leads to cognitive and behavioral improvements.
Methods: Our portable tele-rehabilitation system consists of a small EEG amplifier, a semi-dry EEG headset and a laptop enabling home-based NF training, which is supervised remotely by a therapist. In the present investigation, stroke patients as well as patients with multiple sclerosis that showed cognitive deficits performed repeated NF training sessions at home on their own using this tele-rehabilitation system. Cognitive functions were assessed before and after the NF training.
Results: Stroke patients as well as patients with multiple sclerosis were able to use the home-based NF training without any difficulties. Within repeated NF training sessions they learned to voluntarily modulate their own brain activity in the desired direction. Successful NF training also led to significant cognitive improvements.
Conclusion: The cognitive tele-rehabilitation system turned out to be feasible, easy-to-use, and was highly accepted by our participating patients. These results demonstrate the great potential value of such a cognitive tele-rehabilitation system based on NF for future cognitive rehabilitation.

P054

Investigation of mental states for motor stroke rehabilitation with virtual reality

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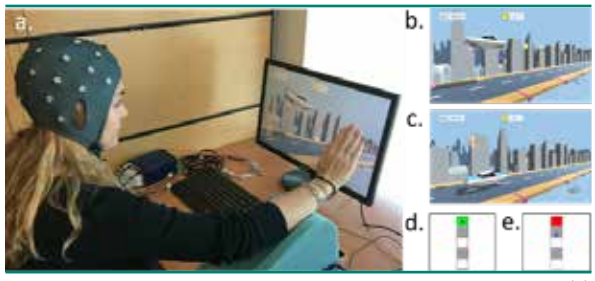
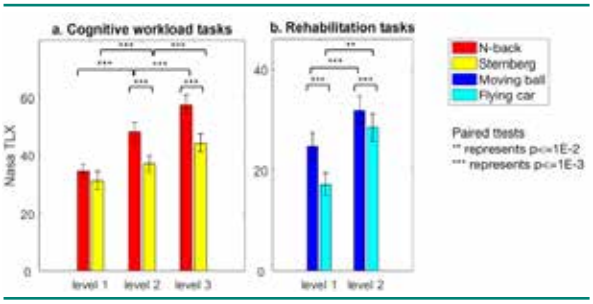
Introduction: Virtual reality and interactive video gaming provide a well-controlled and motivating environment for stroke rehabilitation. Games can be adapted to the patient's needs. To do so, therapists use behavioral measures (mostly subjective), but have no insight into the patient's inner states. Decoding mental processes of patients undergoing rehabilitation could allow an improved adaptation of the gaming environment and increase their engagement into the therapy.
Objectives: The objective of this work is to identify EEG measures of patient's task engagement and cognitive workload to adjust online the rehabilitation paradigms. We conduct a feasibility study on decoding these processes in healthy participants while performing rehabilitation exercises.
Methods: Objective measures reflecting different levels of engagement and workload were first computed from EEG recorded during well-established psychology tasks: (i) a vigilance task to elicit varying engagements, (ii) N-back and Sternberg memory tasks to elicit various workload levels. Secondly, these EEG measures were used to decode the mental state of participants playing two interactive rehabilitation games. The contexts and difficulty levels of these games were designed to elicit various degrees of engagement and workload **(Fig. 1)**. Participants self-assessed their workload using Nasa-TLX rating scales.



P054 **Fig. 1:** Rehabilitation games based on wrist motion. (a) Experimental setup. MindMotionGoTM flying car (b,c) and simple moving ball (d,e) with reaching (b,d) and avoidance (c,e) movements



P054 **Fig. 2:** Nasa TLX self-ratings (mean ± SE) for the different tasks/games and levels: (a) N-back and Sternberg tasks, (b) moving ball and flying car games

Results: Nasa-TLX revealed that significantly different degrees of the mental processes were elicited by the diverse games and levels **(Fig. 2)**. An EEG engagement index (Ei=β/(α+θ) [1]) computed for channels F3, F4, O1 and O2 with EEG power bands θ=4–7, α=8-12 and β=13–30 Hz was significantly higher during the vigilance task than rest time (p< 1e-3), and varied between the rehabilitation game contexts.
Conclusion: The described measure provides the chance to monitor engagement in rehabilitation tasks. This study shows promising possibilities for detection of optimal rehabilitation settings using EEG recordings.

[1] P. J. Mikulka, et al. Effects of a biocybernetic system on vigilance performance. Hum Factors 2002; 44(4): 654–64.

P055

Task-oriented circuit training in multiple sclerosis patients – the predictive value of white matter damage

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Question: Task-oriented circuit training (TOCT) is a feasible method, able to improve both physical and mental functioning in Multiple Sclerosis (MS). Current literature describes neurophysiological measures as reliable investigations for predicting functional improvement. However, up-to-date studies fail in identifying reliable prognostic factors of patient's recovery capacity. This is a longitudinal pilot-study evaluating the impact of disease-related brain damage on predicting patients' motor recovery capacity. The main purpose is to find prognostic factor of functional improvement, evaluating the relationship between accumulated white matter lesions and motor performance.
Methods: Eleven MS patients (EDSS score range 3.5–5.5) received a 2-week TOCT. Clinical outcome measures assessed before (To) and after (T1) training were: TUG, 6MWT, 10mWT, DGI, PCI. For each subject, quantification of brain damage was assessed using Magnetic Resonance Imaging (MRI). Specifically, we measured white matter lesion load (%) as a function of the total parenchymal volume using T2w FLAIR sequences and myelination maps (T1w/T2w). In addition, global brain atrophy was estimated using the overall parenchymal volume versus total intracranial volume ratio. White matter and global brain damage were then correlated with the functional outcome scale.
Results: Longitudinal analysis showed a significant improvement in DGI (p=0.03) at T1. In addition, patients' age was strongly correlated with performance changes in TUG (R=0.639, p<0.05), DGI (R=-0.633, p<0.05) and PCI scales (R=-0.607, p<0.05). Older patients showed a higher motor improvement in TUG and DGI. Importantly, the correlation analysis revealed a significant negative relation between the percentage of lesion volume and the performance modification in TUG scale (R=-0.5599, pvalue=0.04). Conversely, global brain atrophy was not associated with functional recovery as assessed by pre versus post TUG scores (R=0.4072, pvalue=0.12).
Conclusions: Our data showed that the amount of white matter damage, but not global brain atrophy, drives the motor recovery capacity of MS patients. In conclusion, our preliminary results point out that lesion load and age represent two important factors to be considered for assessing the effectiveness of rehabilitative training. A deeper knowledge of prognostic factors for motor improvement might help to design customized protocols and to maximize the effect of rehabilitative treatment.

P056

The art therapy methods in psychocorrective work with the ATO (anti-terrorist operation) participants (in Eastern Ukraine)

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In the Regional Hospital of invalids from War (Kharkov, Ukraine) experieced psychologists and psychotherapeutists actively work with the ATO (in East Ukraine) participants. Psychocorrective training constructed with applying art-therapy methods enables the ATO participants to distance themselves from traumatic feelings fixed mostly in non-verbal images through their objectization and representing them in visual and plastic images,give a way out to internal conflicts and strong emotions,interpret forced out emotional experience,favour realizing their own feelings.It is a possibility not only to express themselves in a creative way but also to get to know themselves better, express their internal world through creativity:colour,movement,form,plastics,etc. Combining verbal and non-verbal expression favours processing and understanding traumatic experience.Art-therapy does not demand from the participants special abilities or art-skills, so it is not restricted in use. It is worth saying that in the process of creative self-expressing the explosive exit of strong emotions is possible which calls for the special training of a psychologist. The methods of art-therapy are drawing, sculpturing, paper, wood and stone modelling, music. Different techniques may be used in art-therapy. One of the techniques in visual arts is drawing a circle. On finishing it the participants name their work,describe their own feelings and associations connected with the picture and the creative process.Thus,making a mandala ,a circle, a person pictures his own internal world,expresses his actual internal state and looks for the answers to existential questions 'Who am I? Where am I?' This favours the liberation of internal stress, thinking over and the reestimationof the situation. This brings the strongest psychotherapeutic effect. The technique of drawing pictures on a random topic is also possible.

P057

The differentiation of ependymal cells in the postnatal neurogenic niche of the spinal cord

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Introduction: Spinal cord injury and myelination disorders result in motor impairment, dysaesthesia, chronic pain and autonomic dysregulation. Such disease sequelae have a severe effect upon life quality and are a consequence of neuronal death, axonal damage and demyelination. Restoration of neurological func-

tion may be achieved by harnessing postnatal neurogenesis within the spinal cord. Previous studies have demonstrated that the ependymal cell population surrounding the spinal cord central canal can proliferate under cholinergic modulation. Endogenous retinoic acid (RA) has been identified within the neurogenic zones of the adult murine brain. Furthermore, exogenous RA increases the differentiation and proliferation of neuroblasts extracted from the subventricular zone of postnatal mice. Indeed, recent studies have demonstrated that RA can enhance the proliferation of ependymal progeny within the spinal cord.

Objective: The aim of this study is to determine whether RA, in combination with cholinergic modulation, can enhance the differentiation of proliferating ependymal cells within the spinal cord.

Method: C57/Bl6 mice received in vivo intraperitoneal injections of RA and the alpha7 nicotinic acetylcholine receptor modulator PNU120596 (PNU). The number of proliferating cells within the spinal cord was determined using intraperitoneal delivery of the cell proliferation marker 5-ethynyl-2'-deoxyuridine (EdU), and the phenotype of these cells was confirmed by immunohistochemistry.

Results: The results showed a significant reduction in EdU labelled cells for the RA group in comparison to PNU treatment alone. Fewer proliferating cells were found to co-localise with markers of differentiation, particularly within the central canal, which was the main area of focus.

Conclusion: The results therefore suggest that RA, in combination with PNU, is not a successful driver of murine ependymal progeny proliferation and differentiation.

P058

The role of functional MRI in the diagnosis and prognosis of patients with severe chronic disorders of consciousness

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Background and aims: Accurate diagnosis of patients with severe chronic disorders of consciousness (scDOC) following brain damage is essential for clinical and rehabilitative care as well as decision-making and a rate of 43% of misdiagnosis is evident. Neurobehavioral tests relying on the patients' intellectual and motor ability to communicate are the most widely used diagnostic tools, since their advantage over clinical assessment has been validated. However, with the emergence of modern neuroimaging methods, especially fMRI, objective physiological markers for assessing the state of consciousness are available but the benefits still have to be determined.

Methods: 21 patients clinically and neurobehavioral diagnosed as "Apallic-Syndrome (AS)" and 6 patients as "Minimally Conscious State (MCS)" after brain damage of different etiologies were examined with different fMRI paradigms testing fundamental functional networks of the brain (proprioceptive, pain, motor, emotion, self-awareness, language, resting state). The findings were compared with the clinical and neurobehavioral diagnosis and it was analyzed whether additional information from fMRI confirmed or questioned the clinical and neurobehavioral diagnosis.

Results: 16 of the 21 AS- and 5 of the 6 MCS-patients show specific brain activation in a special diagnostic battery of fMRI-paradigms suggesting that the AS-patients are in MCS or even better.

Conclusion: Misdiagnosis in scDOC-patients is still a big problem even with well-established diagnostic assessment scales. As long as internationally accepted guidelines for assessing patients with scDOC do not exist, we propose a special diagnostic battery of fMRI-paradigms to minimize diagnostic errors in these patients and to find systematically perceptive channels to approach the patients in neurorehabilitation programs.

P059

Cortical afferent inhibition reflects cognitive impairment in obstructive sleep apnea syndrome – a transcranial magnetic stimulation (TMS) study

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Objectives: Patients with obstructive sleep apnea syndrome (OSAS) show neurocognitive impairment, but the exact mechanisms that cause cognitive dysfunctions remain unknown. The cholinergic system is known to play a key role in all attentional processes and cognitive functions. A transcranial magnetic stimulation (TMS) protocol may give direct information about the function of some cholinergic circuits in the human brain; this technique relies on short latency afferent inhibition (SAI) of the motor cortex. The objective of this exploratory study was to test the hypothesis that impaired cognitive performances in OSAS patients are associated with a dysfunction of the cholinergic system, as assessed by SAI.

Methods: We applied SAI technique in a group of 13 patients with OSAS and compared the data with those from a group of 13 age-matched healthy subjects. All the patients underwent a sleep study, an extensive neuropsychological evaluation, and TMS examination.

Results: Mean SAI was significantly reduced in our OSAS patients when compared with controls. The neuropsychological evaluation showed impairments in most cognitive areas in the OSAS patients. SAI values were strongly correlated with the neuropsychological test scores.

Conclusions: These findings suggest that the cognitive deficits in OSAS may be, at least in part, secondary to alterations in cholinergic neurotransmission, presumably caused by nocturnal hypoxemia. TMS studies may shed light on the pathophysiological mechanisms of the cognitive disturbances in OSAS patients.

P060

Comparison effects of transcranial magnetic stimulation and physical activity training on alzheimer's disease

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Alzheimer's Disease (AD) is a neurodegenerative disease associated with a gradual regression in cognitive function. Transcranial Magnetic Stimulation (TMS) and physical activity (PA) training are alternative treatments that can be used in addition to pharmacological treatment. In our study, it was aimed to investigate the effect of the two treatment modalities in addition to pharmacological treatment in AD. Twenty-seven patients aged 60 years and over with AD were included in the study and

separated to 3 groups. In TMS group (n=10) 20 Hz repeated TMS (rTMS) treatment was applied to the bilateral Dorsolateral Prefrontal Cortex for consecutive 5 days a week for 2 weeks. In PA group (n=9) received moderate intensity of aerobic exercise for 50 min session, 5 consecutive days a week for 2 weeks. In control group (n=8) only pharmacological treatment was applied. Individuals were evaluated for neuropsychiatric and behavioral status, cognition, depression, balance, pain, functional mobility, physical fitness, physical activity level, daily life activity, quality of life, dementia level and functional changes before and after treatment. Statistically significant difference was found on attention, executive function, behavioral status, level of physical activity and quality of life in the TMS group **(Fig. 1, Fig. 1)**; on balance and functional mobility in the PA group **(Table 2, Fig. 1)**; on memory and behavioral status in the control group **(Table 3, Fig. 1)** (p<0,05). We found that physical activity affected memory performance in functional changes in the brain and rTMS treatment was effective on Default Mode Network (DMN) **(Photo 1, 2, 3, 4; Fig. 2)** Executive Control Network (ECN) **(Photo 4, 5; Fig. 2)**, and Dorsal Attention Network (DAN) **(Photo 6; Fig. 2)**. In conclusion, our study has shown that high frequency rTMS treatment and physical activity training including moderate intensity aerobic exercise are effective alternative treatment in addition to pharmacological treatment methods in AD. In AD, detailed studies are needed to understand better the destruction of cognitive

rTMS Group		pre-rTMS AV ± SD	post-rTMS AV ± SD	p value
Attention	Mental Control I	34,5 ± 1,58	26,4 ± 1,15	**0,037**
Executive Functions	Clock Drawing	1,28 ± 0,95	3,00 ± 1,52	**0,007**
Memory	Visual Memory	1,75 ± 1,48	1,37 ± 0,74	0,402
Behavioural Status	NPE	41,0 ± 2,16	21,9 ± 1,36	**0,007**
	FBI	18,2 ± 1,18	7,80 ± 3,76	0,018
Balance	BBT	45,4 ± 0,95	46,9 ± 0,79	0,181
Functional Mobility	TUG	27,1 ± 1,19	24,8 ± 5,09	0,303
Physcial Activity Level	IPAQ - Walking	1052 ± 1,12	277 ± 4,84	**0,025**
Quality of Life	QOL-AD	31,9 ± 8,25	34,9 ± 8,03	**0,033**

Table 1. rTMS Group Results

PA Group		pre-PA AV ± SD	post-PA AV ± SD	p value
Attention	Mental Control I	25,1 ± 9,83	23,8 ± 5,98	0,704
Executive Functions	Clock Drawing	0,83 ± 1,16	1,33 ± 1,75	0,296
Memory	Visual Memory	3,55 ± 3,57	2,44 ± 2,29	0,149
Behavioural Status	NPE	16,5 ± 2,29	15,0 ± 1,97	0,312
	FBI	19,3 ± 8,41	13,8 ± 1,20	0,108
Balance	BBT	42,7 ± 0,76	50,3 ± 0,47	**0,002**
Functional Mobility	TUG	20,2 ± 2,58	18,6 ± 2,00	**0,015**
Physcial Activity Level	IPAQ - Walking	614 ± 1,35	927 ± 5,87	0,592
Quality of Life	QOL-AD	33,7 ± 3,38	35,0 ± 3,53	0,454

Table 2. PA Group Results

Control Group		pre-control AV ± SD	post-control AV ± SD	p value
Attention	Mental Control I	18,5 ± 1,23	20,7 ± 0,10	0,439
Executive Functions	Clock Drawing	1,16 ± 1,47	1,33 ± 2,06	0,785
Memory	Visual Memory	2,50 ± 2,07	2,62 ± 2,55	**0,016**
Behavioural Status	NPE	3,25 ± 4,94	10,7 ± 1,20	**0,012**
	FBI	19,7 ± 1,33	19,6 ± 6,94	0,973
Balance	BBT	42,6 ± 0,10	33,6 ± 0,29	0,178
Functional Mobility	TUG	26,3 ± 1,41	41,0 ± 4,37	0,373
Physcial Activity Level	IPAQ - Walking	185 ± 2,77	637 ± 1,28	0,386
Quality of Life	QOL-AD	32,2 ± 6,38	33,3 ± 7,89	0,406

Table 3. Control Group Results

P060 **Fig. 1**

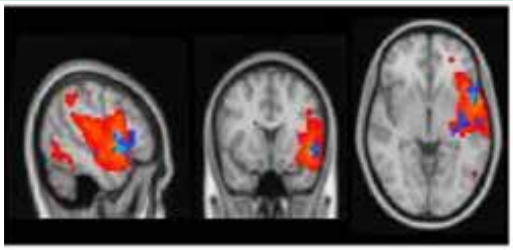

Photo 1. Inferior frontal gyrus / Insular cortex (DMN)

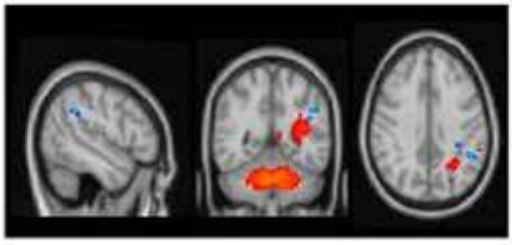

Photo 2. Left supramarginal gyrus (DMN)

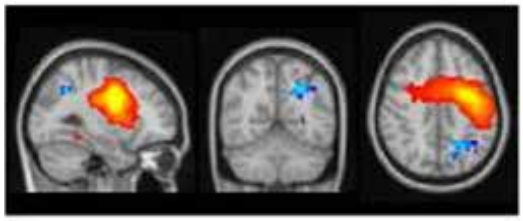

Photo 3. Superior parietal lobul (DMN)

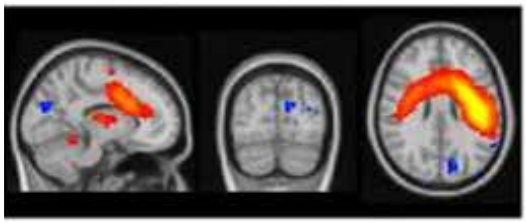

Photo 4. Precuneus (DMN) / Putamen / Talamus (ECN)

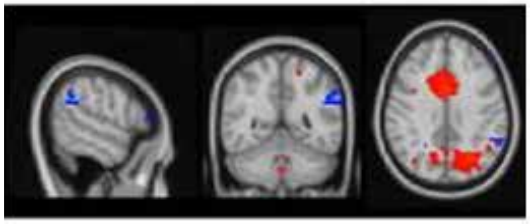

Photo 5. Angular gyrus (ECN)

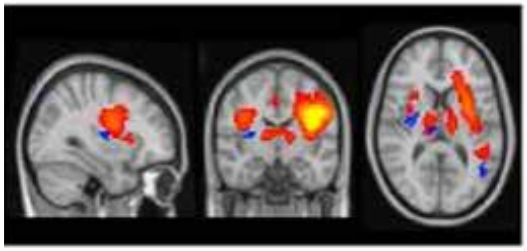

Photo 6. Left superior division (DAN)

P060 **Fig. 2**

functions and functional changes in the brain. Our findings show that therapeutic methods that appear to be alternative in AD are in fact influenced by different areas of the cognitive and behavioral profile. In conclusion, these findings suggest that the "multimodal" therapeutic approach, including high frequency rTMS therapy and FA education, in addition to pharmacological treatment, may produce the most effective treatment against the disease.

P061

Disease-specific rehabilitation in women with epilepsy

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Question: to study specific aspects of neurorehabilitation in women with epilepsy
Methods: 155 women at the age of 16–45 were included in the prospective observation research of reproductive endocrine complications (REC) due to antiepileptic drugs (AEDs) into 3 groups: 1gr. - AEDs monotherapy, 2 gr. - polytherapy, 3 gr. - without AEDs. Social, reproductive activity were studied in groups. STATISTICA for Windows system was used.
Results: Average age of the surveyed women made 25 years with prevalence patients in optimal reproductive age 62%. 1gr. - 70 (45%), 2gr. - 65 (42%), 3 gr. - 20 patients (13%). Statistically reliable differences in clinic weren't taped in groups. 47% women were marriage. 31% patients had children without differences in groups. Minority children were born before mother's disease. Fertility Rate (FR) was 0, 3. FR for simple replacements of generations should be 2, 15. Optimal FR - 4, 0. The overall incidence of REC were 53%, 75% of them due to side effects of AEDs. Comorbid REC was observed for 21 women (13%). In 61 (40%) cases REC due to treatment of AEDs were identified. REC were associated with the taking AEDs for 21 women (30%) at the 1 gr., 40 (57%) patients were healthy. In the 2 gr. REC associated with exposure to AEDs was diagnosed for 38 patients (59%). Comorbid REC was noted in 13% without differences in groups. Application of AED polytherapy enlarged REC frequency (p<0,001).
Conclusions: Disease specific rehabilitation in women with epilepsy inclided social, mental, reproductive aspects. Fertility rate among women with epilepsy was lower optimal due to medical and social reasons. Reproductive endocrine complications are a frequent side effect of antiepileptic drugs for women's epilepsy above at polytherapy. It is necessary monitoring reproductive health condition during treatment with antiepileptic drugs.
The reported study was funded by the Russian Foundation for Humanities research (RFHR) according to the research project № 15-06-10816.

P062

Efficient and intensive settings in neurorehabilitation

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Neurorehabilitation is experiencing a significant change due to technological progress. While the Third Industrial Revolution used electronics and information technology to automate processes, the Forth Industrial Revolution is blurring the lines between the physical, digital, and biological sphere. Trends in the area of sensor-supported environments, cloud computing, and artificial intelligence will revolutionize the way how Neurorehabilitation will be performed in the near future. Changing occupational profiles, adjusted clinical pathways, precise medical controlling and new financial models will be critical to ensure functioning health care systems. However, limited resources will force organizations to the develop and integrate efficient and intensive settings to fulfil the society's needs. We provide insights into the clinical integration of novel technologies and therapy models to increase efficiency and intensity in daily neurorehabilitation routines. Our organization is working on the development and integration of highly efficient clinical pathways for inpatient and outpatient settings. We highlight several pioneering projects in the field of clinical classification, rehabilitation technology, and telemedicine. Furthermore, we propose a change in the role model; interdisciplinary rehabilitation-coordinators/coaches are needed, who professionally manage a patient's entire rehabilitation process and close the gap between medical, social, and cultural needs.

P063

Epidmiological profile of individuals with Parkinson's disease attended at reference centres in the city of Brazilian Northeast – a cross-sectional study

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Introduction: Parkinson's disease (PD) is the most common form of Parkinsonism, one of the most prevalent chronic neurological syndromes among the elderly. Of all those diagnosed with this syndrome, 85% are individuals with PD. A multicenter study was conducted by the Parkinson Network-Brazil in seven state capitals, in order to determine the epidemiological profile of individuals with PD in terms of physical-functional and emotional-cognitive domains.
Objectives: The aim of the present study was to analyze the results obtained in the city of Natal, Brazil, whose human development index (HDI) is one of the lowest among the participating capitals.
Patients and methods: Cross-sectional descriptive with s sample of 78 individuals with PD. Sociodemographic information related physico-functional and cognitive aspects was collected. All the participants were participants were assessed in the ON time of antiparkinson medication. Statistical analysis was conducted using the Statistical Package for Social Sciences, 21.0 program.
Results: Of the total sample, 64.1% were male, with a higher prevalence in the age group between 70 and 79 years (35.9%). The time since PD onset varied between 1 and 28 years (7.6 ±4.7) and the prevalence of Hoehn & Yahr was distributed as follows: stage 1 (14.1%), 2 (28.2%), 3 (28.2%), 4 (24.4%) and 5 (5.1%). Regarding the number of comorbidities, 66.7% reported having ≥ 4 comorbidities and among the most common being visual dysfunction (87.2%). The Human Activity Profile found that more than half the sample analyzed (57.7%) were physically debilitated. Presence of dementia (64.1%) and depressive symptomatology (52.6%).
Conclusions: Knowledge of sociodemographic and clinical characteristics of individuals with PD may make it possible for physiotherapists and health teams to better understand the prognosis of the disease and plan therapies that are better suited to meet the real demands of this population.

P064

Frequent surfing on social health networks is associated with increased knowledge and involvement in personal health

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Background: Individuals with chronic medical conditions often seek information in Web-based social health networks. Their main reasons for this activity include acquiring information and support, communication, networking and browsing.
Objective: The objective of this study was to assess how participation in a social health network among individuals with a chronic condition contributed to their activation.
Patients and methods: This was a prospective, cross-sectional survey with a retrospective component. We collected data from a Hebrew-language Web-based social health network, among participants with diabetes mellitus, pain, hypertension, and depression/anxiety. Experienced users at least 6 months of enrollment in the network and newly enrolled users received similar versions of the same Patient Activation Measure (PAM) questionnaire as well as a socio-demographic assessment.
Results: Among 686 participants, 154 of the 337 experienced and 123 of the 349 newly enrolled completed the questionnaire. We found positive correlations (P<.05) between frequency and duration of site visits and patient activation, social relationships, and chronic disease knowledge. Men's surfing time was longer than women's ($\chi^2$3=10.104, P<.05). Experienced users with diabetes surfed more than those with other illnesses and had significantly higher PAM scores (mean, M=69.3, standard deviation, SD=19.1, PAM level 4; Z=−4.197, P<.001) than new users (M=62.8, SD=18.7, PAM level 3). Disease knowledge directly predicted PAM for all users (β=.26 and .21, respectively). Frequency and duration of social health network use were correlated with increased knowledge about a chronic disease. Experienced surfers had higher PAM than newly enrolled, suggesting that continued site use may contribute to increased activation.
Conclusion: Web-based social health networks offer an opportunity to expand patient knowledge and increase involvement in personal health, thereby increasing patient activation. Further studies are needed to examine these changes on other aspects of chronic medical conditions such as quality of life and costs.

P065

Hospital-acquired infections in severe acquired brain injury during inpatients neurorehabilitation

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Background: In the last decades the improvement in acute care for severe neurological patients and the early rehabilitative approach to this population determined a progressively diffusion of MDRs species also within the neurorehabilitation setting.
Aims: To investigate the epidemiology and burden of hospital-acquired infections in a cohort of patients affected by severe acquired brain injury (sABI) during in-hospital rehabilitation.
Material and methods: Patients affected by sABI in intensive neurorehabilitation. All the patients performed: Glasgow Coma Scale (GCS); Level of Cognitive Functioning (LCF); and Disability Rating Scale (DRS), at admission (To) and at discharge (T1). Patients were divided into two groups: Infected Group (I-Group) or non-infected (NI-Group) and data were compared (significance at p=0.05).
Results: Data from 104 (42 F, 62 M) sABI patients were collected. Patients came from Intensive Care Unit (33.6%), Neurosurgery (29.8%), Stroke Unit (26.9%) or other wards (9.7%). Urinary tract infections were reported in 80.3%. The most frequent pathogens were: K. Pneumoniae (18.6%) and E. Faecalis (11.6%); 27.9% showed multiple pathogens. On average patients received 13.2 ±5.1 days of antibiotic therapy. At admission (To) the mean scores at the clinical scales were GCS: 10.5±3.6; LCF: 3.5±1.7; DRS: 7.3±1.7 for the whole group; GCS: 9.3±3.3; LCF: 2.8±1.5; DRS: 8.2±1.2 for the I-Group and GCS: 11.4±3.5; LCF: 4.0±1.7; DRS: 6.7±1.8 for the NI-Group. At discharge (T1) the functional evaluation resulted in GCS: 11.7±3.6; LCF: 4.5±2.2; DRS: 6.1±2.3 for the whole group; GCS: 10.3±3.7; LCF: 3.6±2.1; DRS: 7.3±1.8 for I-Group, and GCS: 12.7±3.3; LCF: 5.1±2.1; DRS: 5.3±2.3 for NI-Group. Both at To and T1 the scores at the clinical measures were significantly higher for patients in the NI-Group. The mean length of stay was 105.3±72.4 days for the whole group; patients in the I-Group showed a longer stay with respect to NI-Group (131.1±74.8 vs 87.1±65.4 days, p=0.002). The loss of rehabilitation days/sessions was 0.6±1.5 for the I-Group and 0.5±1.1 for the NI-Group, without statistically significant difference.
Conclusions: In I-Group the levels of outcome measures for GCS and LCF were lower than in NI-Group, while the DRS was higher. Although, in I-Group the length of stay resulted higher than in NI-Group, the number of loss of rehabilitation sessions/days was not significant, maybe due to the efficiency of organization

P066

Medicolegal assessments – the Just(us) way

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Background: The impact of medicolegal assessments can be profound, forming the basis for things such as compensation for loss of income. However, despite the high stakes nature of the assessment, there is limited consensus regarding how the medical aspects of this process should be accomplished. In the Netherlands, considerable variation between individual expert reports makes it difficult to compare results and judge the consistency and quality of a report. This project examined the impact of a standardised procedure to produce a high quality assessment and a thorough and structured report that provides information across different types of injury.
Method: A standardised report was developed based on various published guidelines and codes of conduct. Each finished report was reviewed by an experienced Insurance Medicine Physician to ensure questions have been answered specifically, unambiguously, and were understandable to laymen. Once implemented, questionnaires were sent to 159 consecutive clients in March 2014 to ascertain feedback. Respondents rated various features of the process on a 10 point scale (where 0="very poor" and 10="excellent").
Results: The response rate was 47% (75/159). Overall, the new report was rated an average of 7.3 out of 10. Report timeliness scored lower at 6.6. Clients considered that reports made valid arguments for the conclusions reached and were easy to read and understand. Despite this, inconsistencies in the quality of the reports were noted by the survey team. Communication about the status of the report and the service of the front office clearly showed room for improvement.
Conclusion: A number of modifications were enacted following the survey: we invested effort and time in recruiting new experts in different fields of medicine, educating and training our experts and frontoffice. We also invested in communicating to our clients about our services, updated corporate identity and our website and made contact with our MO more accessible. Another survey is planned in the fall of 2017 to assess compli-

ance and see if the improved system is meeting the needs of both the clients and claimants. It is hoped this data will be available in time for the conference.

P067

Neurorehabilitation of ischemic stroke due to subarachnoid neurocysticercosis

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Objective: Perceived disability after stroke may persist long-term even among young individuals with mild stroke and may be related to age-related expectations of health and recovery. In patients presenting ischemic stroke secondary to subarachnoid neurocysticercosis (ISSNCC) this statement does not differ from the general stroke population. Thus, in order to appreciate the magnitude of perceived disability in a younger ISSNCC population studies are needed to explore perceived health-related differences between young individuals with ISSNCC and a matched general population and then to identify the length of complete neurorehabilitation. Further, to provide long-term measures by health care, relevant to the same young individuals with stroke, their perceived long-term functioning and disability associated with health need to be explored.
Methods: The generic questionnaire NMAH-5D was used to compare ratings of global health, disability and physical recovery between young individuals living in the community around Mthatha (South Africa) up to 6 years after ISSNCC (n=150) and an age and geographically matched general stroke population (n=2661). The t-test was used to assess differences between the young individuals with stroke and the matched general population with regard to self-rated global health Four multiple linear regression analyses were performed using the following health-states from the MYS questionnaire as independent variables.
Results: Among the young individuals 79% had suffered a mild stroke and got 100% recovery from physical disabilities, 45% rated a low global health compared to 15% of the matched general population and a higher proportion rated problems in mobility, self-care, usual activities, anxiety/depression and, recovery.
Conclusion: The neurorehabilitation of ISSNCC, on self-rated global health among young individuals living in the community, appear to be substantial, multi factorial and long-standing which call for interdisciplinary research collaborations and team measures by health care long-term.

P068

Problematic ankle pain in spastic diplegia in an adult with cerebral palsy – a case study

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Introduction: The effect of Botulinum Toxin-A (BTX-A) on treating lower limb spasticity in people with cerebral palsy (CP) is well recognised, particularly for equinovarus deformities around the ankle. In Australia, BTX-A receives government funding for children under 18. Adults are only subsidised if they were injected as children. This sets up discrepancies in access to clinically appropriate spasticity management for a subset of adults with lower limb spasticity.
Objectives: To present the clinical problem solving of an adult patient with acute onset ankle pain and to examine the costs associated for this individual.
Patient and method: A 33 year old male presented with acute left ankle pain limiting mobility. Plain x-rays were unremarkable and an ultrasound found tibialis posterior tenosynovitis. A later MRI identified a left distal tibial stress fracture and osseal oedema in talus and calcaneus. He was managed NWB in a CAMboot for 6 weeks. A follow up MRI showed tibial healing, however, during his graduated return to FWB he developed increased pain and was found to have a new calcaneal stress fracture. While bone density scanning showed borderline osteopenia, his fractures were diagnosed as being secondary to spasticity.
Results: A small literature base supports the occurrence of ankle/foot stress fractures from spasticity in both adults and children with CP. In this patient's case, mobility and capacity to work were restricted over an almost seven month period. Direct costs (health, plus time off work) were estimated at around $23,100. Due to funding restrictions, he had not received BTX-A injections for equinovarus for 20 months pre fracture.
Conclusion: This study presents a patient with recurrent ankle/foot stress fractures on the basis of under treated spastic diplegia. The inability to treat adults with CP who were not injected as children appears based on rationing practices that are not supported by the literature or the costs of not treating.

P069

Rehabilitation facilities after neurological admission — appropriate capacity for a good management

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Introduction: Recently, high attention has been paid to the prolonged length of stay (pLOS). Several studies suggest that pLOS may cause serious implications for health, patient management, costs. The delay in inpatient rehabilitation facility placement could be one of the causes of pLOS. This delay is probably related to capacity of the facilities. At present, the adequate number of rehabilitation facility units to meet the need of a neurological department is still not defined.
Objectives: We assessed the number of facility units, based on data obtained from our neurological Department.
Materials and methods: We retrospectively studied patients admitted to the Department of Neurology (Policlinico Gemelli) and transferred to rehabilitation facilities after clinical stabilization, during a 6-month period. The pLOS was calculated for each patient as the number of days between the last test or consultation and the date of transfer to rehabilitation. For our local Healthcare System, 44 days in rehabilitation facilities are guaranteed. Considering this amount, the number of total rehabilitative hospitalization of the patients from our Department was calculated: patients moved to rehabilitation X 44 days. For the 6-month period, this result was divided for 180 days (6 months) to calculate the number of necessary beds in rehabilitative facilities.
Results: During the period, 746 patients were admitted to our Department and 94 patients (40 females, 23–93 years), with central and peripheral nervous system diseases, were transferred to rehabilitation facilities. In these 94 patients, mean pLOS was 3.2 days (0–50 days). We calculated 4136 days of total rehabilitative hospitalization, for the patients moved to rehabilitation (94 patients X 44 days), and 23 necessary beds (4136 days / 180 days) in rehabilitative facilities.
Conclusion: Our approach shows the relationship between the number of patients in a neurological Department and the capac-

ity of associated rehabilitative facilities, able to support patient management after acute phase. Many factors and limitations were not considered in this study. Further multicentric studies should be performed to plan an adequate rehabilitation program for the Health Systems.

P070

Relationship between sex and motor symptoms in Parkinson's disease – a cross-sectional study

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Introduction: Parkinson's disease (PD) is a chronic neurodegenerative disorder, which affects the male sex. There is a divergence found in the literature regarding the presentation of PD between the sexes, regarding motor behavior, it raises the need to analyze the relationship between sex and motor symptoms in PD.
Objectives: Analyzing the influence of sex on motor symptoms in subjects with PD.
Material and methods: This is an observational cross-sectional study. Sociodemographic variables were collected: age, sex, years of study, physical activity and physiotherapy; and motor symptoms: Disability Stage (Hoehn and Yahr Disability Scale - HY), Balance (MiniBESTest), Mobility and Risk of Falls (Timed Up and Go test and Sit-and-lift Test 5 times - ST-DP5X). The protocol of evaluation was applied in two days, in the same shift, in period ON of the antiparkinsonian medication. For the data analysis, the Statistical Package for the Social Sciences version 21.0 was used. For the analysis of the difference between sexes and socio-demographic variables, categorical, the Chi-square test was used. From these analyzes, multivariate analyzes were performed with multiple linear regression, in order to identify the potential risk factors, involved with the gender variable. The exit criterion for all variables introduced in the model was p <0.20. The level of significance was 5%.
Results: More than half of the sample was composed of men (64.1%), with a mean age of 66.00±10.0. Regarding the sociodemographic variables, there was a significant difference between the sexes only regarding the practice of physical activity (P=0.03) and physiotherapy (P=0.008), with men performing both activities more often than women. Multiple linear regression analyzes did not find significant differences between the sexes considering the other motor symptoms (P±0.445).
Conclusion: Sex did not interfere in the motor behavior of individuals with PD, when adjusted for age, HY, practice of physical activity and physiotherapy. The variables capable of modifying the PD presentation were age, HY and physical activity practice. This result may guide clinical practice, giving subsidies for treatment planning and therapeutic goals to be achieved.

P071

Responsive Engagement of the elderly promoting Activity and Customised Healthcare (REACH) – A user-centred requirement analysis for a European project

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Introduction: The EU funded REACH project aims at developing a modular sensing-monitoring-intervention system that can be placed unobtrusively in various care settings (e. g., acute care, rehabilitation, care home, home care) and living environments of elderly citizens (65+ seniors). The aim of the REACH system is to predict health risks or adverse events and mitigate the risk of deterioration by the early application of interventions. For a successful developmental progress it is essential to perform a requirement analysis at the beginning of the project. It includes a description of the primary user including the environment the primary user lives in, and the associated stakeholders. The requirements, however, differ between European countries.
Methods: We conducted a stakeholder analysis aiming at understanding similarities and differences among the REACH use cases in four different European countries (D, DK, CH, NL). The aim is to identify primary, secondary, and key stakeholders. Primary stakeholders are directly influenced by the REACH system. Secondary stakeholders are indirectly affected, whereas key stakeholders do not belong to the former two groups but have significant influence. Workshops were held to collect and discuss benefits and obstacles primary users and stakeholders may have with using a sensing-monitoring-intervention system.
Results: The four use cases in the four countries have similarities as well as differences. One major difference between the analysed countries lies in the societal characteristics, for example in the role of health insurance coverage. Another key factor is the organization of the social, health, and welfare system. According to the treatment stage in the continuum of care, influence and roles of stakeholders differ. For the primary users drawbacks of using such a complex system are the fear of data disclosure and the stress associated with the use of technology for elderly. These risks are similar for relatives and friends and, to some extent, for the formal care givers as well. The benefits for the primary users, their families and friends are the greater autonomy that the system may provide, greater independence and self-determination.
Conclusion: Differences in the setting, as well as socio-political factors, and the treatment stage influence the level of importance of stakeholders. The workshops helped to clarify key aspects for the development of the REACH system.

P072

Role of physical activity in metabolic syndrome

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Introduction: The aim of this study is to determine the physical activity levels of the individuals with metabolic syndrome (MetS) and compare with healthy individuals.
Method: In this study six houndred and sixty diagnosed MetS individuals (310 F, 350 M) and six houndred and sixty control group (310 F, 350 M) with age range 30–55 was included. For pain evaluation, Visual Analog Score (VAS), for quality of life Nothingham Health Profile, for physical activity level International Physical Activity Questionnaire long scale (IPAQ) was used. Community integration questionnaire (CIQ) was applied to state the integration of the individuals to the community.
Results: The physical activity level of the people in the MetS group was found significantly lower than the physical activity level of healthy individuals.
Conclusion: This study showed that an active lifestyle is a very important criteria to prevent MetS.

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P073

The effectiveness of active training to reduce pain in cervicogenic headaches

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Session for young therapists Headaches in general are among the top ten causes of incapacity for work. 15 to 20 percent of all chronic and recurrent headaches worldwide have cervical origin in the segments C1-C3 and the pain is not caused by any trauma. Cervicogenic headaches are described as "referred pain" that is perceived in the head. There is literature that describes the use of mobilization or manipulative techniques for the treatment of cervicogenic headache, but this is not allowed on some people due to certain diseases or hypermobility. So the aim of this work is to address active training in terms of pain reduction. The following research question arises: "Do active exercise programs have a pain-reducing effect on patients with cervicogenic headache?" For this research work, the databases PubMed, PEDro and Cinahl as well as the social network ResearchGate were browsed with the keywords below for finding suitable literature. Through this procedure, six matching research question studies were selected, then compared with each other and finally discussed. All used studies observed pain reduction on active training. Some studies related to headaches only, but others have also observed a positive impact on the reduction of neck pain or local pain during active movement. By a proper posture or by an increased holding function of the muscles, pain caused by overload can be reduced. Active exercises not only contribute to the reduction of pain, but also improve the proprioception, the postural alignment and the quality of life of patients with cervicogenic headache. The research question can be answered as follows: active exercises have a pain-reducing effect, especially with regard to intensity of pain. In order to examine the effectiveness of active training over a longer period in several studies, further research would be necessary.

Keywords: cervicogenic headache, neck related headache, exercise therapy, training.

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P074

The effects of suspension exercises programme on static and dynamic balance in healthy individuals

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Introduction: We investigate and compare the effects of suspension exercises on static balance and dynamic balance in healthy individuals.
Method: Healthy subjects divided into two groups; the study group and the control group with fourthy individuals for each and ages between 20 to 45. Study group had two sessions of suspension exercises per week for eight weeks and control group had no exercises during this period. All the participants were given static and dynamic balance tests using single leg stance test, Y-balance test before and after the eight week period.
Results: In the study group a statistically significant difference was found between pre and post tests in static and dynamic balance.
Conclusions: Suspension exercises are very effective in improving static and dynamic balance in healthy individuals.

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P075

Self-awareness of fall among community- dwelling older adults: a cross-sectional survey

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Background: Falling is a significant cause of injury and disability in elderly. Approximately 30 percent of people aged 60 years and older experience fall once in lifetime, and almost 50 percent of those fallers experience recurrent falls in the following year. Age-related change in cognition may cause decrease in individual's self-awareness of fall. Many studies demonstrated that loss of this self-awareness was associated with falling. Therefore, the objective of this study was to compare elder's awareness of falls between fallers and non-fallers.
Methods: Seventy-eight community-dwelling older adults with and without a history of falls were recruited in the study. Twenty-seven participants had a history of falls within a year, while 51 participants had no history of falls. Cross-sectional surveys were conducted using a questionnaire modified from Braun et al. (1998) and Mackintosh et al. (2007). The questions mainly included the items about 1) self-estimate of usual walking ability, 2) the importance of falls as a health concern, and 3) factors they consider most likely to cause a fall. The rating of awareness scale from 0 to 10, 0 represents "not at all important" and 10 represents "most important". A Mann-Whitney U test was used to determine comparability in age and cognitive function, as well as compare score between groups.
Results: Age and cognitive function did not show significant difference ($p>0.05$) indicating both groups were comparable. Result revealed significant difference ($p=0.037$) in self-awareness regarding the importance of falls as a health concern between fallers and non-fallers. We found that fallers had lower self-awareness on the importance of fall (median=8; interquartile range=5–10), comparing with non-fallers (median=10; interquartile range=7–10). No significant differences ($p>0.05$) were found between groups for self-estimate of usual walking ability and factors they consider most likely to cause a fall.
Conclusion: Our results suggest that clinicians should emphasize on how importance of fall to enhance self-awareness in community-dwelling older adults, particularly those who have a history of falls. This could be in turn preventing recurrent falls in those elderly.

P076

Changes in oscillatory brain activity during one month of BMI training in chronic stroke patients

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Introduction: Motor recovery in chronic stroke patients is known to be restricted to very small improvements. Previous studies have shown, however, that the mechanism of use-dependent

plasticity combined with brain oscillatory activity contingent haptic feedback training can yield positive results in the recovery of upper-limb motor function for these patients. Yet, most studies have evaluated EEG correlates of recovery only in discrete time points, usually before and after the intervention. Understanding such complex connectivity and brain activity changes due to sensorimotor integration (closing the efferent and afferent loop via BMI) and motor recovery over time requires continuous evaluation during the whole training period to be investigated.

Objective: In this study we aim at tracking changes in brain-to-brain connectivity and cortical activation during movement attempt of the paretic arm in chronic stroke patients along four weeks of proprioceptive BMI training.

Patients and Methods: 30 chronic stroke patients underwent four weeks (mean 17 sessions) of proprioceptive Brain-Machine Interface (BMI) training followed by subsequent goal-oriented physiotherapy. Proprioceptive feedback was contingent to ipsilesional desynchronization of the sensorimotor rhythm (SMR). We have used partial directed coherence from EEG signals to derive intra- and interhemispheric connectivity measures for each training session. Additionally, we calculated EEG Event Related Desynchronization (ERD) laterality values in the α and β bands with respect to the resting period. Changes in these features during the training were analyzed using Linear Mixed Effect Models (LMEM). The relationship with the changes in upper-limb motor impairment was subsequently assessed.

Results: We observe significant changes in connectivity and ERD along the training sessions.

Conclusion: The obtained results highlight the importance of neurophysiologically relevant features, that may be used to predict recovery in this population and hence optimize future rehabilitation interventions.

P077

Evaluation of changes in ventilation parameters and bioelectrical activity of accessory respiratory muscles depending on breathing stimulation in chronic stroke patients

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Question: Consequences of brain stroke may involve abnormalities in muscular tonus, postural and movement control, that lead to insufficient functioning of the entire organism, including dysfunction of synergy in muscles involved in breathing mechanism. These changes, especially on the affected side of the body, may cause weakness of the respiratory muscles, as well as decrease movements of the rib cage influencing the function of respiration. Despite many different interventions for respiratory system, most of the exercises is directed to patients in the acute phase of stroke. In later stages, the rehabilitation is oriented on regaining motor functions and the aspect of breathing therapy may be treated marginally. Therefore the research question has been put forward: whether breathing intervention (a. breathing stimulation according to PNF method or b. patient positioning) will influence the respiratory system in chronic stroke survivors?

Methods: 60 patients included in the study were randomized into two comparison groups: group A (PNF group, n=30), group B (patient positioning, n=30). In the study, authors evaluated the influence of single intervention of PNF breathing stimulation and patient positioning on bioelectrical activity of respiratory muscles (external oblique muscles, sternocleidomastoid muscles, pectoralis major and serratus anterior), spirometry and pulse oximetry (SpO2, HR). sEMG, spirometry and pulse oximetry were performed before and after the intervention. The study was a part of research project number ST.E060.16.059.

Results: PNF breathing stimulation in comparison with patient positioning contributed to a greater decline in the sEMG activity of respiratory muscles (p<0,05). In the inter-group comparison a greater decrease of sEMG activity was observed on the affected side of the body. In group A there was significant increase of FEV1/FVC% (p=,0007). Changes of SpO2 in both groups were not statistically significant. Both patient positioning and PNF stimulation caused the HR decrease.

Conclusion: A single breathing stimulation according to PNF method can lead to normalization of bioelectrical activity of respiratory muscles, especially on the affected side of the body. The importance of respiratory interventions among chronic stroke patients should be verified.

P078

Factors affecting the physical activity level in patients with idiopathic Parkinson's disease – a preliminary report

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Introduction: Postural instability is the most disabling feature of İdiopathic Parkinson's disease (PD). It might contribute to reduced physical ability. However, physical activity with PD has not been extensively investigated, particularly from a postural instability.

Objectives: The objective of this study was to investigate the factors affecting physical activity level in İdiopathic PD.

Materials and methods: Seventeen volunteers with İdiopathic PD were assessed using sections III of the Unified Parkinson's Disease Rating Scale (UPDRS). Their motor functions were classified according to the Hoehn and Yahr (H&Y) scale. Demographical data, duration of disease were recorded. Physical activity measured with the BodyMedia Sense Wear accelerometer used for 7 consecutive days. Primary outcome measure was the average daily energy expenditure in joules. Postural stability measurements were obtained using the Balance Master System (NeuroCom System Version 8.1 Balance Master). Postural stability was assessed by the modified Clinical Test of Sensory Interaction on Balance (mCTSIB), Limits of Stability (LOS), Sit to Stand, Walk Across and Tandem Walk with Balance Master System. Functional mobility (Timed Up&Go Test, TUG), walking speed (10 meter walk test, 10MWT) and functional exercise capacity (6 minute walk test, 6 MWT) were also assessed.

Results: There were 8 female and 9 male PD patients with a median age of 66.00 (61.00–70.50) years. H&Y scores were between 1 and 5,with a median of 2.00 (1.25–2.75). A median of UPDRS section III scores and duration of disease were respectively 27.00 (15.00–30.50),4.30 (3.45–5.85). Median average daily energy expenditure was 9691 joules. Directional control of LOS correlated with average daily energy expenditure (r=0.676, p<.01). TUG (r=-0.502,p<.05), 10MWT (r=-0.625, p<.01) and 6MWT (r=0,701,p<.01) were correlated with physical activity variable.

Conclusion: Our study showed that dynamic balance can play an important role in maintaining physical activity. Our study on this subject is still ongoing.

Keywords: Idiopathic Parkinson's Disease, Physical Activity, Postural stability

P079

Functional outcome of patients who suffered from stroke who enrolled in the Early Supported Discharge programme in Singapore

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Background: The Early Supported Discharge (ESD) of National University Hospital, Singapore was set up since 2007. It provided patients with mild to moderate stroke to have early discharge followed by home based rehabilitation through a multi-disciplinary team. Functional outcomes, including Functional Independence Measure (FIM), Frenchay Activities Index (FAI), ambulatory status were measured before and on completion of the ESD program. Telephone interview will be performed at one year after ESD to access the instrumental activities of faily living (ADL) by FAI.
Method: Analysis of the functional outcome of patients enrolled into the program.
Results: A total of 460 patients' data during the period 2007 to 2016 were available for analysis. The mean age was 63.1 and 59.2% patients were male. The FIM, FAI at the end of the ESD program were 113.6 (standard deviation 17.0) and 11.7 (standard deviation 8.3) respectively. 88.5% (406 out of 460 patients) were community ambulant. 73% (335 patients) were able to walk unaided. 407 patients were able to complete the FAI at one year. The mean FAI at 1 year improved to 17.1 (standard deviation 10.4), which was still significantly lower than the FAI before stroke (22.7, standard deviation 9.0).
Conclusion: Patients who suffered from mild to moderate stroke enrolled into ESD program had satisfactory outcome in terms of basic activities of daily living. However, at one year post-stroke they were still impaired in terms of instrumental ADL.

P080

Identification of factors associated with physical activity levels in adult muscle diseases

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Introduction: The level of physical activity in adult patients with muscle disease is an important parameter affecting patients' activities of daily living and quality of life.
Objectives: This study was designed to evaluate physical activity levels and factors that may be associated with physical activity levels in adult patients with muscle disease.
Material and methods: 40 adult patients with muscle disease whose mean age was 32.67±6.57 and 40 healthy individuals with mean age 30.40±4.55 were included to the study. After recording the demographics of individuals, pain intensity (Visual Analog Scale), pain localization (Body Diagram), fatigue severity (Fatigue Severity Scale), activity limitations (Activlim), quality of life (SF-36 Quality of Life Survey), muscle strength (hand-held dynamometer) and functional mobility (the Timed Up and Go test and 6 Minute Walk Test) were evaluated. Physical activity levels were evaluated subjectively with International Physical Activity Questionnaire, and objectively with Sensewear Armband Pro 3 activity monitor.
Results: In adult patients with muscle disease group; step counts of 5 days; moderate, severe, very severe periods of physical activity; walking, severe and total physical activity (MET-min/week) scores were found significantly lower than the healthy group ($p<0.05$). Total energy expenditure of 5 days of adult patients with muscle diseases and healthy individuals were similar ($p>0.05$). Total energy expenditure; was found associated with body mass index, muscle strength and functional mobility in both groups ($p<0.05$). Total step counts; were found associated with the body mass index, lower extremity muscle strength and functional mobility in adult patients with muscle disease group and were found associated with only functional mobility in the healthy group ($p<0.05$).
Conclusion: As a result; adult patients with muscle disease have lower physical activity levels than healthy individuals and have engaged in similar activity performance by spending approximately doubled energy. Because of that situation, increased energy expenditure may be the major cause of reduction in physical activity of adult patients with muscle disease. Physical activity is associated with body mass index, muscle strength and functional mobility, that was shown time spent in activities at different intensities is associated with activity and limitations of participation.

P081

Improving gait and balance in patients with Parkinson's disease using transcranial direct current stimulation and spinal direct current stimulation – a triple cross-over study

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Introduction: Progression of Parkinson's disease (PD) is characterised by motor deficits which respond less to dopaminergic therapy. Direct current stimulation (DCS), is a non-invasive brain stimulation technique able to modulate the activity of brain areas through the application of small electrodes on the scalp or at spinal level. Previous studies suggested that transcranial DCS (t-DCS) is effective in improving motor symptoms in PD patients. Unlike, literature on the effect of spinal DCS (s-DCS) in PD is scant.
Objectives: The aim of our study is to evaluate the efficacy of a Direct Current Stimulation applied at the cortical or at the spinal level in the treatment of gait disorders and, in particular, of freezing of gait in patients with PD.
Materials and methods: the study was performed on 14 subjects with PD, according to a randomized, double-blind, cross-over design. All participants underwent to anodal t-DCS over primary motor cortex, anodal cathodal s-DCS and cathodal s-DCS applied to the 10th dorsal segment in a randomized order. Each treatment foresaw 5 daily sessions lasting 20 minutes each. Each stimulation cycle was followed by a 30 days observation period. Assessment included clinical specific scales evaluating gait and balance impairment in PD: Unified Parkinson's Disease Rating Scale (UPDRS- part III), Tinetti Assessment Scale, Freezing of Gait Questionnaire (FOG) and Timed Up and Go (TUG) test.
Results: An improvement in all outcome measures was observed in t-DCS group after the end of treatment with a stable effect at 1-month follow-up. After spinal stimulation, cathodal s-DCS showed a significant improvement in UPDRS-III and FOG scores, while anodal s-DCS was more effective in Tinetti and FOG scores. At 1-month follow-up cathodal s-DCS showed a stable effect in FOG score, while anodal s-DCS had no significant effect on all these parameters. Comparing groups, t-DCS was more effective than both sDCS techniques in UPDRS-III and TUG scores either at T1 or T2. However, anodal s-DCS was more effective than the other methods on balance impairment (Tinetti score).
Conclusion: The application of anodal t-DCS may be a relevant tool to improve motor abilities in PD, especially in advanced

stages, and may represent an add-on option in the pharmacological and rehabilitative treatment of these patients.

P082

Relevance of the origin of chronic pain when using virtual reality in rehabilitation

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Introduction: A virtual arm can be felt as your own in virtual reality (Slater et al, 2008). The modification of visual aspects of the "owned" virtual arm has been shown to modify pain threshold in healthy subjects. For example, redness of the skin decreases the heat pain threshold (Martini et al, 2013), while looking at the virtual arm increases pain threshold contingent on co-location (Nierula et al, 2017). However, the effect that these manipulations have on patients with chronic pain are not well known.
Objectives: To explore how varying transparency and size of an "owned" arm in immersive virtual reality affects pain ratings in patients with arm chronic pain.
Patients and methods: We carried out a study with 19 patients with chronic pain, 10 of which had peripheral nerve injury (PNI), here a control group, and 9 of which had complex regional pain syndrome (CRPS type I) without nerve injury, here the experimental group.
Results: We found that CRPS type I patients showed higher levels of ownership and agency than PNI patients. Looking at the virtual arm of normal size reduced pain ratings in CRPS type I but not in PNI patients. The transparency of the virtual arm induced some reduced pain ratings in CRPS type I but not in PNI patients.
Conclusion: The origin of chronic pain determines the response towards interventions on the virtual body and this should be taken into account when using virtual reality as a tool for rehabilitation.

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P083

Segmental zoster paresis – a rare complication in an immunocompromised patient

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Introduction: Herpes zoster is a well known condition; however segmental zoster paresis is a rare complication that can lead to misdiagnosis.
Case report: We report a case of a 60 year-old man, with history of kidney transplantation and under tacrolimus and prednisolone therapy that was referred for PRM consultation by his general physician, for sciatica of lumbar etiology. He reported a painful vesicular rash in lateral border of the right lower leg and foot 3 months ago, followed by the development of motor weakness one week later. On examination, he presented alodynia in L5 and S1 right dermatomes and MRC grading 3/5 in the dorsiflexion of the right inferior limb. The rest of the examination was unremarkable. The CT and MRI of the spine showed no medullar or radicular involvement. The EMG showed small amount of fibrillations and positive sharp waves in the right tibialis anterior, tibialis posterior and extensor digitorum brevis. The recruitment of motor units was reduced in these muscles. The patient did not undergo anti-retroviral therapy due to nephrotoxicity risk. He underwent an individualized rehabilitation program, which included physical modalities for pain relief, strengthening exercises and sensory-motor reeducation. After 12 months of the disease onset, he completely recovered from motor weakness and alodynia.
Conclusions: Epidemiologic research suggests segmental motor involvement in 0.5% to 5% of patients with herpes zoster, but the true incidence is unknown. This case highlights the importance to recognize the motor neuropathy as a complication of herpes zoster.

P084

The effect of the Fascial Distortion Model on micrographia in parkinsonism – a single system study

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Question: Patients with idiopathic Parkinson's disease typically suffer from a wide range of motor and non-motor problems. Besides the cardinal symptoms of akinesia, tremor and rigidity, micrographia, another common symptom in Parkinson's disease, is characterized by small handwriting with further progressive reduction in size. There is no proven theory that could explain the pathophysiology of micrographia exactly. The therapies described so far are time-consuming and involve a high risk of relapse. Until now, there exists no specific manual treatment for improving micrographia in neurorehabilitation.
Methods: The method according to the fascial distortion model addresses local changes in the area of the forearm fascia. It is suited to reduce functional impairments associated with this symptom complex by applying targeted manual techniques. In the Fascial Distortion Model approach, treatment is directed into the specific anatomical distortions of the capsule, ligaments and surrounding fascia, physically reversing them. One patient (male) participated in the study. A writing sample was used for the quantification of the writing skills. Subsequently four treatments of the forearm fascia were performed (once a week in four weeks). A follow-up measurement of four weeks was taken.
Results: Evident improvements of writing speed, letter height and surface area were achieved. Surprisingly, rigidity and diadochokinesia were improved as well. The long-term measurement showed no deterioration of the effects.
Conclusion: The fascial distortion model is a potential effective and low-priced method for influencing writing skills in patients with idiopathic Parkinson's Disease. In order to change also neurological parameters, the treatment acts as a bottom-up therapy and changes even neurological pathways and the perspective of understanding the disease. The fascial distortion model probably fills in a current gap in neurorehabilitation. Therefore, more research on the fascial distortion model is necessary in order to make reliable conclusions on its efficiency in long-term rehabilitation. Larger randomized studies are needed to confirm these results.
Keywords: Parkinson's Disease, Fascial Distortion Model, Micrographia and Handwriting

P085

The investigation of the relationship between position sense and postural control in ataxic patients

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Introduction: The postural control disability, which occurs in ataxic patiens, has many subcomponents. The assessment of position sense, involved in sensory strategies of postural control and determination of the relationship between position sense and postural control has an important role in rehabilitation programs of ataxic patients.
Objectives: The objectives of this study were to compare the position sense of healthy individuals and ataxic patients, to investigate the relationship between postural control and position sense in ataxic patients and to compare the effects of position sense of upper extremity, lower extremity and trunk on postural control in ataxic patients.
Patient and method: 20 ataxic patients (13F/7M) and 20 healthy individuals (8F/12M) were included. The International Cooperative Ataxia Rating Scale (ICARS) was used to assess the severity of ataxia. In order to assess postural control, Sensory Organization Test (SOT) in Computerized Dynamic Posturography, Berg Balance Scale (BBS) and Timed Up and Go Test (TUG) were used. The position sense was measured by using Baseline Digital İnclinometer in upper extremity (UE),lower extremity (LE) and trunk in eyes closed and the method of repositioning error was used.
Results: The means age of the patients and healty individuals were 34.75±8.83 and 31.25±6.33, respectively. It was observed that the position sense of ataxic patients was worse than healthy individuals in UE, LE and trunk ($p<0.05$). Also in ataxic patients, the mean of BBS scores, TUG scores, ICARS scores and composite scores of SOT were worse. There were statistically correlations between trunk position sense and composite equilibrium score of DOT ($r=-0.725$) and BBS score ($r=-0.493$). In addition, there was statistically significant correlation between UE position sense and the Kinetic Functions parameter of ICARS. Also, there was statistically correlation between LE position sense and TUG score ($r=0.520$, $p<0.05$) in ataxic patients.
Conclusion: According to these results, while the impairment of UE position sense affects the severity of ataxia, the impairment of LE position sense affects dynamic balance. Furthermore, the impairment of trunk position sense affects the sensory interaction required to maintain balance. Addition of sensory therapy approaches to rehabilitation programs, in order to develop postural control components, which motor functions used to be the focus of treatment, will increase the success of rehabilitation in ataxia.

P086

The main milestones of motor recovery after stroke

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Background: The progressive increase of aging population in Western Countries will cause the growth of stroke prevalence. Considering the decrease of mortality after stroke at the present time, and that stroke leaves 35% of patients chronically affected by severe disability, an increase in economic, social and medical burden could be expected in the near future.
Aims: Objective measures of motor recovery after stroke are needed, with the aim to improve the rehabilitative treatment after stroke, and to obtain more precise predictive information after stroke. For this purpose, we adopted in a wide sample of post-stroke selected patients a multi-dimensional approach for measuring the rehabilitative outcome, by using both global and specific scores for the post-stroke deficit. Moreover, we also developed, for the first time, a novel measurement of rehabilitative outcome, focused on the reaching of the main milestones of the neuromotor recovery.
Methods: A 30-month long monocentric observational prospective study was performed in 144 post-stroke inpatients. Patients older than 18 years at the first cerebrovascular event, occurred within 30 days before the admission, and without other neurological diseases were consecutively recruited. All patients underwent an individualized rehabilitative treatment, consisting of a 60-minute long daily one-to-one physiotherapy, three 30-minute long sessions per week of occupational therapy, and, when needed, speech therapy. Clinical data were collected for statistical comparison with three different measures of outcome: a measure of global functioning (Functional Independence Measure, FIM), a specific measure of the neurological post-stroke deficit (Fugl-Meyer scale), and a novel one which reported the time of reaching of the main milestones of motor recovery.
Results: Our study provided a multi-dimensional measure of the efficacy of the rehabilitative treatment in a sample of post-stroke patients. Preliminary analyses showed that the average gain in FIM score resulted 26.7 points, whereas the mean Fugl-Meyer increase was 22.3 points. FIM and Fugl-Meyer scores gains were statistically associated with three independent variables: lenght of stay (direct correlation), initial FIM score and initial Fugl-Meyer score (inverse correlation). As regarding the milestones data, at least 75% of the patients reached a satisfactory level of recovery, and the mean times of milestones acquisition were shorter than 30 days.

P088

Impact of functional electrical stimulations in the early neurosurgical rehabilitation of patients with cerebral tumors – a comparative study

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Introduction: Most of patients with brain tumors require a complex neurorehabilitation program after surgical intervention. Our purpose was to evaluate the impact of pre-formed physical modality functional electro-stimulation in the post-operative management of hemiparesis.
Objective: Our goal was to effectuate a comparative evaluation of two neurorehabilitation complexes in patients with brain tumors after neurosurgical intervention, and to check the significance of functional electrical stimulations on the level of hemiparesis.
Material and methods: During last years a total of 46 hemiparetic patients after neurosurgical intervention for cerebral glioma and glioblastoma were observed and investigated. The investigation was conducted with consideration for the protection of patients, as outlined in the Declaration of Helsinki, and was approved by the appropriate institutional review boards and ethic commissions. All patients gave written informed consent before undergoing any examination or study procedure. Patients were randomized into two treatment groups of 23 each one. All patients received a complex neurorehabilitation programme including physical therapy, ergotherapy and patients' education. In group 1 we applied only these physical modalities. Patients of groups 2 received too functional electrical stimulations for shoulder abductors, for hand and foot extensors. For

statistical evaluation we used t-test (ANOVA) and Wilcoxon rank test (non-parametrical correlation analysis), performed using SPSS package. The treatment difference was considered to be statistically significant if the P value was < 0.05.
Results: The comparative ANALYSIS of RESULTS shows a significant improvement of the symptoms of the patients, concerning: active and passive range of motion (ROM) of the hemiparetic shoulder, hand and foot; reduction of muscle weakness, increase of the grasp, stabilization of the balance and the gait, amelioration of independence in activities of daily living and of quality of life. We received best results in the second group.
Discussion and conclusion: The functional electrical stimulations stimulate the cortical neuroplasticity; and this way support the muscle function and assist the functional restoration of hemiparetic patients. We could recommend the complex program for treatment of patients after neurosurgical intervention.

P089

Next-generation interactive devices in neurorehabilitation of social skills in children with acquired brain injury

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Background: Neurological disorders affect children's social development and social skills. Creating modern multiuser rehabilitation methods is important in pediatric social skills remediation.
Aim: Developing social skills neurorehabilitation for children with acquired brain injury (ABI) using multitouch tabletop technology. Methods: 15 children with ABI - epilepsy, sTBI, tics, stroke - (7 in training, 8 in waiting-list) and 9 healthy controls aged 8-13 participated. Social and cooperational skills were evaluated with NEPSY-II, Theory of Mind (ToM) stories, and Friendship Observation Scale (FOS). Children were trained with 2 applications: "NoProblem!" (vased on Cognitive Behavioral Therapy) on Multi-user Diamond Touch tabletop (DTT) for social perception; "Snowflake" on Suite Multi-Teach platform for collaboration skills. 10 paired sessions were conducted in two parts: social and cooperation skills training guided by 2 therapists. For social skills, children were presented with social scenarios (pictures and videos) for finding solutions and participating in role-play. Also, video processing of real-life experiences developed metacognitive skills. For cooperation, tasks requiring compromises, mutual decision-making etc were presented.
Results: We found pre-training problems in patients compared to healthy peers: below average performance in emotion recognition and ToM. Low frequency of entry and ending skills for conversations and cooperational behaviours were observed with FOS. Patients scored ratings 2-3: only 25-50 % of skills observed during assessments. Patients used less non-verbal communication, inadequate social responses and had problems with understanding social scenarios. They interrupted conversations frequently and had lower perception of communication norms. After training, training group performed better in Theory of Mind skills and had increase in cooperational behaviours and empathy skills compared to baseline.
Conclusions: Children with ABI have deficits in social communication and collaboration skills. After paired neurorehabilitation, we found noticable increase in Theory of Mind, communication skills and cooperational behaviours. Improving social skills is crucial for children for feeling competent in everyday interactions and better quality of life. Children are easily motivated and their social skills improve by using next-generation devices (MTT) in playful atmosphere (estimated by standardized assessment and parents' reports).

P090

Creating a social cognition neurorehabilitation model for modern multitouch technology to treat communication and cooperation problems in children with acquired brain injury

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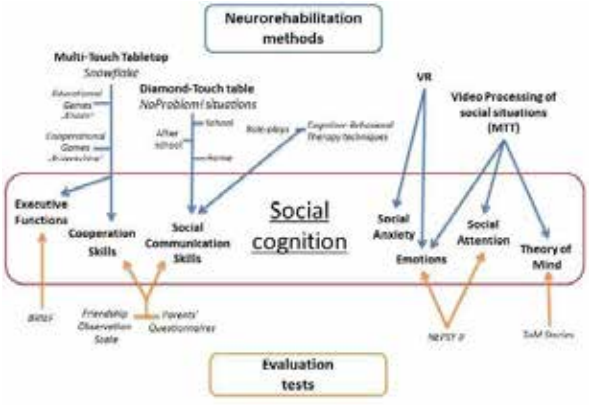
Background: Social competence as a capacity to integrate behavioural, cognitive and affective skills to social contexts is often impaired in children with acquired brain injury (ABI). Multitouch-multiuser technology (MMT) is effective for pediatric social skills remediation. Aim Creating a theoretical model of the main components of social cognition with intervention and evaluation tools for social neurorehabilitation for children with ABI.
Methods: 15 children with ABI - epilepsy, sTBI, tics, stroke - aged 8-13 (7 in training group, 8 in waiting-list, 9 healthy controls) attended individual and paired assessments and rehabilitation for social skills.
Results: We created a theoretical rehabilitation model as a basis for practical MTT intervention, consisting tools for social communication skills, cooperation skills, Theory of Mind (ToM), emotion recognition, social attention, social anxiety, executive functions. Individual evaluation tools are used before and after intervention and in follow-up 1 year later: Social Perception domain from NEPSY-II for emotion perception and social attention, ToM stories for ToM skills and parents questionnaires (executive functioning behavior "BRIEF-P", "Social Cognition Questionnaire", "Social Skills Rating System"). For paired evaluation Friendship Observation Scale is used for communication skills and cooperational behaviours in direct interaction. Intervention is conducted with interactive computer-based applications, video processing and virtual reality methods. "NoProblem!" (principles of Cognitive Behavioral Therapy) on Multi-user Diamond Touch tabletop (DTT) trains social communication skills: situations at school, after school, at home environments (including role-plays). Also, social scenarios through video processing are presented. Discussions about real-life experiences develop metacognitive skills. For cooperation skills, "Snow-



P090 Fig. 1: Theoretical model of main components of social cognition with intervention and evaluation tools

flake" on Suite Multi-Teach platform is used: educational games (eg "Einstein") and cooperational games (eg "Bridge-Building"). Virtual Reality (VR) aps. are used for social anxiety and emotion perception training.
Conclusions: Children with ABI have impairments in social cognition, leading to social communication and cooperation skills deficits. We created a theoretical model of main components of social cognition with intervention and evaluation tools. Based on the model, practical neurorehabilitation design for social skills is created for children using next-generation devices (MTT, VR).

P091

Robotic assessment to quantify upper limb position sense in patients with stroke: preliminary results

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Introduction: Proprioceptive deficits affect around 50% of stroke survivors. Most commonly used proprioception assessments have poor psychometric properties and are not adapted for persons with multiple impairments. To address these limitations, we developed an assessment protocol that enables the quantification of elbow position sense without using the opposite arm, involving active movement of the evaluated limb or relying on working memory. The objectives of this study were to quantify elbow position sense of stroke survivors and to compare it with a control group.
Participants and methods: Elbow position sense of the affected arm was quantified in subacute stroke patients and compared to age-matched healthy persons (dominant arm). Participants were excluded if they had severe cognitive deficits. Elbow position sense was evaluated using a KINARM exoskeleton and a virtual reality display. The exoskeleton passively moved the participant's arm from an initial to a target position (no visual cues of arm position). A virtual arm representation was then projected on a screen placed over the participant's arm. The participant had to indicate verbally its relative position (more flexed or more extended) compared to the virtual representation. A 75% detection threshold was statistically extracted from a sigmoid curve fit representing the relationship between the angular difference and the percentage of successful trials. Independent T-tests were used to compare results of both groups.
Results: Seven persons (65±11 yrs old; 4 males; 62±18 days post-lesion) with a stroke and 19 age-matched controls (63±6 yrs old; 8 males) were recruited. Based on a clinical assessment (Nottingham Sensory Assessment [NSA]), none of the stroke participants had proprioceptive deficits in the affected arm. A significant difference in the mean elbow position sense detection thresholds between the stroke group (14.3±5.2 degrees [range: 6.0-23.0]) and the control group (7.2±3.5 degrees [range: 2.7-15.7]) was noted (p=0.001).
Conclusion: This robotic assessment enables the quantification of elbow position sense in patients with stroke. Difference in detection thresholds observed between both groups demonstrated that stroke survivors might have impaired proprioception. Considering that no proprioceptive deficits in stroke patients were identified with the NSA, these results suggest that our protocol could provide a better sensitivity. More participants are required to confirm these results.

P092

Arthrogryposis multiplex congenita – What are the limitations of activities of daily living (ADL) in adulthood?

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Objective: Arthrogryposis multiplex congenita (AMC) is a disease characterized by the presence of at least two joint contractures at birth. This study is the first to describe disability patterns of a cohort of adults with AMC.
Methods: Between 2010 and 2016, 43 patients (age 33.2±13.4 years; 27 females) underwent a 4 day evaluation in the frame of the French Reference Centre for adult with AMC: 28 with amyoplasia, 15 with other types.
Results: Most patients had modified independence with mean FIM score=113±13.9/126. Patients with amyoplasia had lower FIM sores than patients with other types of AMC (110.4±16.3 vs 118.1±4.8, p=0.026) meaning that they were less independent in daily life. Nearly all patients had high scores at the Cognitive FIM (34.8±0.6/35). The Motor FIM was altered (78.3±13.4/91), overall in patients with amyoplasia (75.6±15.8 vs 83.2±4.6, p=0.024), especially the tasks dealing with personal care and mobility (stairs climbing) were the most affected. Fifty % of AMC patients needed technical aid in ADL. Deficits in muscular testing and articular ranges of motion were pronounced, both in upper and lower limbs. Regarding the upper limbs, majority of AMC could achieve all the upper limbs' tests, with greater activity limitations for patients with amyoplasia. Regarding the lower limbs, patients with amyoplasia presented greater muscular deficits than patients with other types of AMC, especially for ankle muscles (p<0.001), also with major limitations (stiffness) more frequently at the joints of lower limbs, but the capability of independent walking was preserved by majority of AMC. Thirty-nine (91%) patients complained of pain in daily life. In addition to the psychological dimension of pain, principle psychological problems were: anxiety (43%), fatigue (34%), difficulty in sexual life (24%), altered self-esteem (17%), and feeling of solitude (15%).
Conclusion: Despite many obvious deficits, most patients with AMC are relatively independent in daily live, with technical aids and compensations. This study revealed that pain and psychological suffering were frequent. Patients with amyoplasia presented greater activity limitations than other types of AMC. Rehabilitation options were proposed accordingly, and patients' satisfaction for this expert evaluation was high.

P093

Communication function in cerebral palsy – modified Communicative Effectiveness Index (CETI) assessment

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Communication consists in exchanging feelings, opinions and any other kind of information by means of speech, writing and/or sign codes. If they are altered, personal, social, educational, professional and occupational issues may arise, leading to disability factors. Speech, language and communication disorders can be associated to any kind of cerebral palsy. However, reliable prevalence rates have not yet been calculated. The aim of our survey was to assess the communication effectiveness in children with cerebral palsy (CP).

Material and method: A descriptive, cross-sectional study in a retrospective 14 years of follow-up cohort CP patients. We performed CETI scale (adapted to our environment) by telephonic questionnaire. Disability was classified into 5 levels. We collected demographic data, motor function, and speech and language treatments. A descriptive analysis of the data was conducted using the Kruskal-Wallis non-parametric test and Chi-square test for quantitative variables. Statistical analysis was carried out using the SPSS software.
Results: We obtained 204 medical records from which we randomly selected 80 for this intervention. Final sample included 40. Gender prevalence was similar and age was within a range between 4 and 20 years old, with an average of 13,6 years. CETI results showed an average 117.38 (in a range between 34 and 160). Statistically significant differences were observed in CETI results according to the nature of cerebral palsy (p=0,042), observing the worst results in tetraplegic patients. Associated communication disability was observed in 52,5% of the sample. In 32,5% of the cases, speech and language treatment was being given at school and in 17,5%, treatment was given in private entities.
Conclusion: Communication disorders reported in childhood cerebral palsy determine the aggravation of their general disability. These disorders are usually underestimated in the usual clinical practice. We propose a modified CETI scale as a simple and reliable tool to determine their presence.

P094

Evaluation of the effectiveness of robotic kinesiotherapy in complex rehabilitation in children with cerebral palsy

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Introduction: In recent years, the priority direction of motor rehabilitation of children with cerebral palsy (CP) has been the introduction of high-tech, computerized rehabilitation complexes. One of the latest achievements in this direction is the complex of robotic kinesiotherapy Lokomat. However, data on effectiveness of robotic kinesiotherapy in the complex rehabilitation of children with CP are heterogeneous and contradictory.
Objective: To evaluate the influence of the method of robotic kinesiotherapy on the improvement of motor functions in children with spastic diplegia.
Materials & methods: The study included data of 58 children who received rehabilitation treatment at the National Center for Children's Rehabilitation in Astana with a diagnosis CP, spastic diplegia. Children were divided into two groups: the main group (n=35) received rehabilitative treatment with robotic kinesiotherapy with Lokomat, the control group (n=25) - with usual kinesiotherapy. According to the GMFCS, patients were divided into 3 subgroups (II-IV levels). The following tests were used to evaluate the effectiveness: GMFM-88, Modified Ashworth Scale. The significance of the results of the rehabilitation was measured using the Wilcoxon test. The significance of the differences between the two groups was assessed using a nonparametric Mann-Whitney test.
Results: Evaluation of the volume of motor functions with GMFM-88 before and after the end of rehabilitation showed an improvement in the indices in both groups. The most significant improvement was noted in children with II level of GMFCS (the main group - p=0.0001, the control group - p=0.007). However, the assessment of differences between the main and control groups did not reveal significant differences (p=0.097). In the III and IV levels, there was also improvement in motor abilities, but a statistically significant difference between the study groups was found only in children with III development level (p=0.047), indicating a significant improvement in the indices in the main group.
Conclusion: According to our data, children with II and IV levels of development by GMFCS using Lokomat did not show much better improvement in motor functions compared to the group of children engaged in ordinary kinesiotherapy. The obtained data dictate the need for further study of effectiveness of robotic kinesiotherapy, taking into account the clinical forms and factors affecting the course of disease.

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Feasibility and sensibility trial of a non-invasive device to analyse the swallowing process and its disorders

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Introduction: Early swallowing disorders rehabilitation for neurological patients with disorders of consciousness (DOC) have received limited attention in term of objective and non-invasive assessment. Gold standard medical tools (FEES, videofluoroscopy, questionnaries) are only partially adapted to these patients.
Objectives: To explore the feasibility of using the Nox-T3, ventilatory polygraph (Resmed©), for clinical investigation of swallowing process and dysphagia.
Materials and method: We test the Nox-T3, commun sleep exploration device, for a normal subject pilot trial, by mean of :

- 2 couples of surface EMG : one on submental muscles and mylohyoid muscles, to explore first phase of swallowing and one on subhyoid muscles, for its second phase.
- Nasal or canula flow sensor to detect swallowing central apnea
- Saturometer to detect possible inhalation desaturation
- Abdominal and thoracic belts to explore the coordination between breathing movements and swallowing reflex
- Microphone to record cough, speech, swallowing sounds.

Preliminary observations : The Nox-T3 is able to extract synchronized plots and can inform about different variables : swallowing frequency, multiple swallowing acts, average time of oral and pharyngeal phases, central apnea, coordination between breathing and swallowing process, desaturations. Its sensitivity appears to be sufficient to investigate the swallowing process:

- To detect swallowing patterns
- To identify very short apnea, less than 2 seconds To visualize apnea place in breathing phases
- To investigate muscular swallowing actions
- To explore the coordination between all these signals

Conclusion: The Nox-T3 is useful to investigate the swallowing process. It is non-invasive and can be used with non-communicative patients. This pilot trial is the beginning of a research elaboration with DOC patients, with or without tracheotomy, in our Acute Neurorehabilitation Unit. It will explore objective effects of early swallowing disorders rehabilitation by speech therapy including Nox-T3 and clinical measures.

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Growth profile of children with developmental disabilities

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Introduction: Developmental delay refers to children who are mentally or physically inhibited for their ages. Previous studies showed concurrent growth problem including failure to thrive, short stature or overweight were higher among children with developmental disabilities.

Objectives: In this study, we analyzed the growth profile of children with delayed development and compared their head circumferences, heights, weights to normal children.

Methods and Materials : 1757 children who had visited the Developmental Delay Clinic at the National Health Insurance Service Ilsan Hospital from March, 2001 to December, 2014 were included in this study. Head circumference, height, and weight were measured and we compare them to the normal data from the National Statistical Office.

Result: Among the 1757 children, 1234 (70.23%) were male and the mean age was 51.79 month. All children were classified into different diagnostic groups: global developmental delay (GDD) (including intellectual disability), autistic spectrum disorder (ASD), developmental language disorder (DLD), cerebral palsy(CP) (including isolated motor delay) and other disorders. 760 children (43.26%) diagnosed with GDD, 396 children (22.54%) diagnosed with DLD, 375 children (21.34%) diagnosed with ASD and 56 children (3.19%) diagnosed with CP. According to the 2013 report of National Statistical Office about Health Screening of Infants and Toddlers, 3.69% of children had abnormal head circumferences, but we found 11.1% of that in children with developmental disabilities, higher than in normal children. Microcephaly was found most frequently in ASD (8.4%), followed by CP (7.4%), GDD (6.8%), and DLD (6.4%) (p=0.133). Macrocephaly was found most frequently in ASD (5.3%), followed by GDD (3.0%), DLD (2.8%) and CP (0%) (p=0.133). Abnormal head circumference such as microcephaly and macrocephaly was statistically most common in ASD group (13.8%), followed by GDD group (9.9%), DLD group (9.2%), and CP group (7.4%) (p=0.046).

Conclusion: Compared with normal children, children with developmental disabilities showed more impairment in growth profile such as head circumference, height and weight. Abnormality in head circumference was found most frequently in children with ASD.

P097

Intelligence profile in children with cerebral palsy

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Introduction: Cerebral palsy (CP) is defined as a primary disorder of movement and posture, however, many of children with CP also have an intellectual problems in diverse spectrum.

Objectives: The aim of this study is to investigate the intelligence profile in children with cerebral palsy classified by the type of clinical features, severity of disability and MRI findings.

Materials & methods: The participants in this study included were children with CP who has been followed-up in our clinic and assessed cognitive function using by standardized tests such as Korean-Wechsler Preschool and Primary Scale of Intelligence (K-WPPSI) or Korean-Wechsler Intelligence Scale for Children (K-WISC). The children were classified into subgroups by gender, abormal movement pattern, GMFCS, and MRI fingings. And the intelligence profiles of the subjects of each subgroups were analyzed.

Results: Fifty-one children with CP were enrolled in this study, 29 male, 22 female, respectively. The mean age of Wechsler test assessment was 82.2 month. Twenty-one children (41.2%) was diagnosed of intellectual disability (ID).Children accompanying with ID were 12 (48.0%) in SD, 5 (41.7%) in SH, 4 (50.0%) in SQ. While CP ataxic and CP dyskinetic group had none. No significant difference of VIQ, PIQ, PIQ/VIQ was noted among each subtype. We categorized GMFCS I~III as mild and GMFCS IV~V as severe group,in order to compare the cognitive characteristics in both groups. Mean VIQ of each group was 77.39±21.46, 67.80±21.47 and mean PIQ was 61.90±22.23, 47.50±14.36, respectively. As a result, patients with mild GMFCS level showed significantly higher VIQ and PIQ ($p<0.05$). According to MRI findings, children were sorted into two groups: the PVL group and the cortical/subcortical involvement group. Each group's VIQ was 87.14±21.14, 68.86±19.04, while PIQ was 72.86±21.21, 64.43±22.54, respectively. The PVL group demonstrated higher score in both VIQ and PIQ. Also PIQ/VIQ ratio of each group was 0.85±0.18, 0.91±0.08, without statistical significance.

Conclusion: Intellectual profiles of the CP showed no significant difference was observed in CP subtypes.Children with lower GMFCS level and with PVL on MRI tend to have higher VIQ and PIQ.

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Intramedullary spinal cavernoma with hematomyelia in a 10-year old girl – a case report

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Background: Cavernous malformations are uncommon vascular malformations of the central nervous system (CNS) characterized by abnormally dilated blood vessels, lined by a thin endothelium without intervening normal nervous tissue. Intramedullary cavernomas are very rare in children. There are only a few cases described in English literature. The reported risk for hemorrhage in intramedullary carvenomas is about 1.6%.

Case report: A 10-year-old girl presented to our emergency department with sudden lower back pain. Within hours she developed lower body dysaesthesia and paraparesis, which progressed to paraplegia from L1 downwards with bladder and bowel dysfunction. Magnetic resonance imaging (MRI) showed an intramedullary cavernoma with hematomyelia and perifocal edema in the conus medullaris. The girl was treated with corticosteroids to decrease edema. As paresis and bleeding in MRI were not progredient, microsurgical excision of the malformation with laminectomy T11-T12 was performed six days later. Postoperative paraplegia was unchanged. Intensive neurorehabilitation was started, without any significant clinical improvement.

Conclusion: Intramedullary spinal cavernoma can cause acute severe neurological symptoms, related to an acute hemorrhage within the spinal cord parenchyma, even in children. A long-term outcome is variable and not well characterized.

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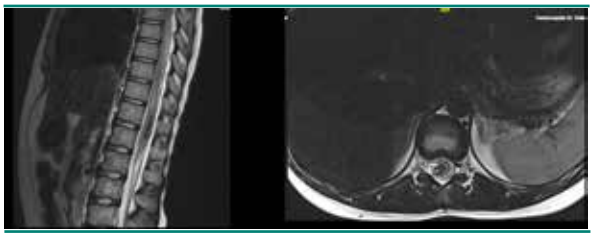
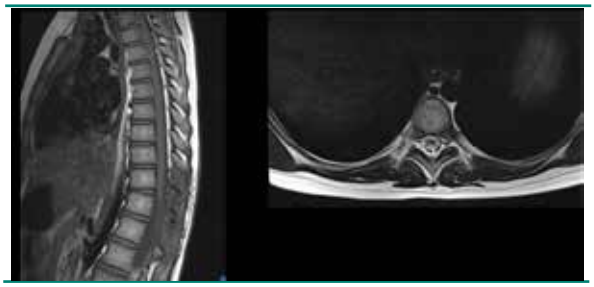


P098 **Fig. 1**



P098 **Fig. 2**

P099

Mechanisms of activity-oriented manual dysphagia therapy for Parkinson's disease

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Introduction: Loss of postural orientation in Parkinson's disease (PD) leads to changes in whole body position that is characterised by flexed forward posture with protracted and reclined head. The result of being fixed in this position for a period is a decrease of elasticity in contractile und non-contractile elements of tissues, that organise the head and cervical spine positioning process, work in a stretched or eccentric way during the bolus transport. A contracture of the perihyoidal soft tissue and muscles will result. Affected PD patients then often do not notice a pulmonary aspiration. The consequence could be an consecutive inflammation of the lung's parenchyma called aspiration pneumonia. Anti-Parkinson drugs influence the dynamic anti-gravity system in an insufficient way. Successful swallowing correlates with the a high level of life quality.
Objectives: Postural orientation ability right before the swallowing reaction can be assessed by measuring changes in relaxed and cued C7 to wall (C7TW) distance in combination with counting the numbers of swallowing during the 100-ml water drinking test (100 ml WDT).
Patients and methods: Five Single-subjects of PD affected people were assessed with a pre-post intervention protocol (C7TW, 100 ml WDT). Every subject is assessed before and after two non-intervention periods (three weeks) followed by a activity-oriented manual dysphagia therapy intervention period (three weeks as well).
Results: The cued distance between C7 to wall can be reduced and the numbers of needed swallowing reactions during drinking 100 ml water can be influenced.
Conclusion: Activity-oriented manual dysphagia therapy can influence the postural orientation ability and is a helpful method to reduce the risk of pulmonary aspiration in PD.

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Myotonic dystrophy type 1 – motor function and swallowing dysfunction

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Introduction: Myotonic dystrophy type 1 (DM1) is the most common form of muscular dystrophy in adults. Its main clinical features are myotonia and weakness of facial, axial, and distal muscles. The association with dysphagia leads to a high mortality rate in this population due to pneumonia and respiratory failure. But oropharyngeal dysphagia has received little attention in the literature. A safe and reliable method to evaluate it is fiberoptic endoscopic evaluation of swallowing (FEES). The aim of this study is to describe the swallowing function with this clinical tool and to correlate it with severity and function of DM1 patients.
Material and method: Consecutive DM1 patients underwent a motor, function and swallowing assessment, at Virgen Macarena University Hospital in Seville (Spain). Data collection included: age, gender, muscular impairment rating scale (MIRS), Ataxia rating scale (SARA), Barthel Index, standardized oromotor assessment and fiberoptic endoscopic evaluation of swallowing (FEES) protocol and Functional Oral evaluation (functional oral intake scale-FOIS).
Results: 15 patients, 77,8 % males, mean age: 45,9 year. MIRS classification: no symptoms in 7,7 %, cervicofacial symptoms, myotonia or isolated weakness in finger flexors in 30.8 %, distal weakness in 23.1 %, mild/moderate proximal weakness in 30.8 % and severe proximal weakness in 7.7 % of the sample. Just one wheelchair user. Oromotor disfunction observed in 100 %, 6 FOIS level in 88,9 %. FEES: basal secretions observed in 88,9 %, pharynx sensitivity altered in 55,6 %, postswallow vallecular/pyriform pooling in 22,2 % with thin liquids and 100 % with solids. Aspirations described in 33,3 % and delayed pharyngeal reflex in 100 % of the sample. No correlations between motor function and swallowing function.
Discussion: Dysphagia is common in DM1 patients. Its presence is underestimated in this population as patients do not usually report swallowing complaints unless specifically questioned. The food consistency adaptation is not common practice and the oral motor movements are usually slow and uncoordinated, causing a delayed motor response following the onset of swallowing. Aspiration is more often with thin liquid, athough pharyngeal residues is more usual with solids. Swallowing assessment must be included in regular clinical evaluation due to possible consequences.

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Structural brain abnormalities and type of onset in patients in amyotrophic lateral sclerosis patients

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The aim of this study was to verify the aspects of dysphagia and its relationship with spinal and bulbar ALS onset, and magnetic resonance image (MRI) findings
Methods: It is a sectional study of 16 patients (11 with spinal onset ALS, five with bulbar onset ALS). Patients underwent evaluations for swallowing (clinical and fiberoptic endoscopic evaluation), electroneuromyography (ENMG), and magnetic resonance image (MRI). Fisher's Exact test and Mann-Whitney U test were used.

Results: In the ENMG performed in diagnosis time, three of the 11 patients with spinal ALS onset had affection for tongue muscles (genioglossus), while 4 of the 5 patients with bulbar ALS onset had its alteration. Three of the 16 patients present cough during clinical evaluation of swallowing and all of them had corticospinal degeneration evidenced in MRI and older age (p=0.04). Besides age has being related with cough in assessment of swallowing, disease duration was associated with swallowing problems. Higher disease duration was associated with reduction of jaw range, evaluated in the clinical assessment (p=0.03). The MRI findings were not associated with ALS onset, gender age or disease duration neither with other aspects evaluated in the assessments of swallowing. The only variable, which was significantly different between both onsets, was the premature spill, that was more frequent in bulbar onset (<0.01). The premature spill can consequently cause larynx penetration and aspiration. Even though, in this study the larynx aspiration was not related whit ALS onset, and was observed in 3 patients (2 with spinal onset).
Conclusion: We can note that the ALS patients with bulbar onset had a worst swallowing performance, in general, but the spinal ALS patients had an important swallowing impairment, even with similar disease duration. The small sample size of both groups could be the explanation of absence of relation between the MRI findings and dysphagia components.

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Swallowing disorders and early complications after ischemic stroke – Predisposing factors?

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Introduction: Despite an increasing survival rate in stroke patients, 85% suffer neurological deficits influencing their survival and causing morbidity. Acute swallowing disorders (SD) which can induce bronchopneumonia (BP) are frequently associated. Our study evaluates these complications in patients with early management for dysphagia (water swallow test, speech therapy) and define predictive factors.
Objective: The evaluation of SD and BP after ischemic stroke patients in the first 7 days of hospitalization. The main aim is to define predictive factors.
Methodology: Retrospective study evaluating acute ischemic stroke patients, with or without SD, admitted in a stroke unit, and following factors: age, sexe, nutritional status (BMI), type of stroke (include recurrent stroke), NIHSS score at admission, dentary status, feeding tube, correlated to BP and mortality rates.
Results: During the study period (year 2015), 346 patients were admitted in the stroke unit of the university hospital of Lausanne, Switzerland, and the age was 21 to 96 years. Early SD was identified in 81 patients (23.4%) by the nurse or speech pathologist; 24 (29.6%) developped BP with SD and 15 (5.7%) without SD. An impairment in the anterior cerebral region (77.8%) and a cardiac embolism origin (39.5%) are predominant in patients with SD; the group with SD and BP involved the posterior region or together. For the SD group, the mean NIHSS score is 12.5±7.3 (vs 8.0±7.5 without SD). Thirteen (16.05%) patients had dental prosthesis and 45 (55.6%) had a feeding tube whose 18 (75.0%) with BP. SD patients with BP had higher NIHSS score (14.63±8.48) and 6 (25.0%) were recurring stroke. The mortality rate is 8.6% for SD group, 16.7% in case of SD and BP, and 8.7% without SD.
Conclusion: Our preliminary results show a predominance involvement in the anterior cerebral region in patient suffering from SD, and often a more complex impairment in the SD with BP. The eventual contributing factor to BP are : recurrent stroke, higher NIHSS score, feeding tube and presence of dental prosthesis. Age and BMI do not seem to have any significative influence.

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Secondary cervical spinal cord compression – long-term follow-ups of a rehabilitation patient with implant in the cervical spine after incomplete spinal cord injury and heterotopic ossification

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Introduction: This case study examines long-term biomechanical changes caused by a total disc replacement in a 34-year old female patient after traumatic incomplete spinal cord injury C5/C6 and cervical myelopathy, AIS D sub C5.
Objectives: 11-years follow-ups of a patient with an implant in the cervical spine and rehabilitation during this distance.
Materials and methods: First MRI was done prior to surgery. Clinical, radiological (X-rays, CT, MRI, myelography of the spine), electrophysiological examinations (Somatosensory and Motor Evoked Potentials SSEPs/MEPs, NLG, EMG) were acquired yearly over the period of 11 years because of fluctuating neurological symptoms.
Results: After implant the patient showed slight problems with bladder function and hypoesthesia in the complete left leg. 9 months later intermittent pain in the cervical spine and a worsening of bladder function occurred in spite of rehabilitation measures. CT scans, X-rays and myelography proved an osteophyte level C5/6. Slight protrusions within presurgical MRI level C4/5, C6/7 became more prominent. Heterotopic ossification in the level of implant and disc protrusions were progressive and finally diagnosed as disc bulging in 7-years follow-up report for MRI. SSEPs were normal, MEPs showed a slight increase of the resting motor threshold of the left leg. NLG/EMG was regular. The 11-years follow-up report showed further aggravation of the clinical parameters.
Conclusion: Heterotopic ossification in the level of implant and disc herniation in the adjacent spine segments were detected at least 9 months post implantation with progression in the further time course. Altered biomechanical stress due to the implant could be responsible to these secondary changes beyond age-related degenerative alterations. Long-term biomechanical effects of implantation should be taken into consideration and should lead to further research in implant improvement with regard to material and biomechanics and in rehabilitation programs for this kind of patients.
Disclosure: Nothing to disclose

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Single-stage hydroxyapatite cranioplasty under image merge guidance for autologous flap resorption in a child – technical note

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Aims: Bone resorption after autologous cranioplasty is a frequent complication occurring up to the 32% of adult patients and even more frequently in children. Bone resorption is generally multifocal and diffuse osteolysis constitutes a challenge for surgical reconstruction. Single step reconstruction with implants allows optimal anatomic and functional results. Currently available synthetic materials are polymethylmethacrylate (PMMA), porous polyethylene, polyetheretherketone (PEEK) or titatium. These materials may be produced based on 3D CT acquisition but their disadvantage is the poor osteointegration. Hydroxiapathite porous ceramic prothesis are biocompatible implants which stimulate osteoblasts colonization and osteointegration. Here we report a single stage hydroxyapatite based cranioplasty under image guidance for autologous flap resorption in a child. To date, thus is the first report of such a procedure in the pediatric population.
Methods: A 3D cranial CT scan was performed according to the implant producer's protocol (Custom Bone(r), Finceramica, Italy). The surgical implant was designed by the surgeons to cover the entire zone of the partially resorbed flap. An epoxy-resin model used for a pre-operative 3D Ct scan acquisition. The cranial 3D CT scan of the patient was than merged with the CT scan of the epoxy-resin model using the Stealth Merge Cranial Synergy(r) Software (Medtronic, USA). Surgical instruments were navigated with the Suretrack(r) technology (Medtronic, USA) for precise craniotomy. Appropriate image windowing allowed navigated bone resection. Thus, we were able to match perfectly the prosthesis for shape and size.
Results: A 3 years old child presented with a left fronto-temporo-parietal bone flap resorption 2 years after autologous cranioplasty. The patient presented with multiple sites of bone resorption of the flap. Due to the complexity of bone defect, we decided for a single stage procedure using an image merged procedure for hydroxyapatite ceramic prosthesis implantation. The postoperative period was uneventful and the patient was discharged at day 6. The esthetic and functiona result at 3 months was good.
Conclusions: Multifocal autologous bone flap resorption requires complex reconstructive solutions to achieve optimal anatomic and functional results. Image merge hydroxyapatite cranioplasty allows a single step procedure in case of complex skull defects for excellent esthetic and functional results.

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Continuous decoding of different reaching directions from EEG

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Introduction: Brain-machine interfaces (BMI) have been shown as a promising rehabilitative tool for stroke or spinal cord injury patients. They can be used to promote neuroplasticity by closing the loop between the brain signals associated with the movement intention and the stimulation of the paralyzed limb. Despite motor intentions can be decoded with acceptable accuracies, the EEG-based decoding of different movements of the same limb using EEG signals remains challenging: firstly, due to the poor signal-to-noise ratio of the EEG; and secondly, due to the close spatial representation of different movements of the same limb on the motor cortex. Several invasive studies have shown that the information related to arm movement direction can be extracted from the low-frequency components (LFC), <4 Hz. The EEG decoding of different movements from the same limb has become a growing field of interest and some works in the last years showed promising results in offline analysis. However, an EEG-decoder that could be implemented in a real-time application remains an open question.
Objectives: The main objective of this study is to propose an EEG-decoder for different arm movements using techniques that can be implemented in real-time.
Materials and methods: Six healthy subjects participated in the study. Their EEG activity was recorded while they performed center-out reaching movements to four different targets. A BMI decoder based in the LFC was built. The performance of the decoder was tested in a pseudo-online scenario, where the decoding accuracy was validated using a cross-validation.
Results: Our results show a decoding accuracy above 50 % for 4 classes, confirming the feasibility for the decoding of four different reaching directions from EEG in real time.
Conclusion: These promising results show the proposed decoder as a potential tool for being included in future BMI-based rehabilitation therapies. However, these results were achieved in healthy subjects, so that, further investigation in paralyzed patients is required.

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Differences in quality of life domains according to disease duration in patients presenting for post-stroke upper limb spasticity treatment with abobotulinumtoxinA – findings from an international observational study

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Question: How does quality of life differ in patients presenting for upper limb spasticity treatment who have recently had a stroke compared to patients with medium-term or long-term post-stroke spasticity?
Methods: The EARLY BIRD (NCT01840475) study is an international, multicentre, non-interventional, prospective, longitudinal study to investigate the effectiveness of abobotulinumtoxinA (AboBoNT-A) injections in adult patients (age≥25y) with post-stroke arm spasticity with respect to early, medium or late start of treatment. In this analysis of baseline data, patients presenting for routine AboBoNT-A treatment were categorized according to the interval between stroke event and start of study treatment (early, medium and late) as defined by the 1st and 3rd quartiles time distribution. Quality of life (QoL) was assessed using the EQ-5D-3L.
Results: This baseline analysis included data from 281 patients presenting for routine spasticity treatment with AboBoNT-A (early: n=69, mean ±SD time since event: 2.3±1.7 months; medium: n=137, time since event: 16.2±11.6 months; late: n=69, time since event: 146.2 ±106.3 months). Overall Qol appeared to be slightly better in patients presenting for later vs. early treatment; mean ±SD EQ-5D index scores were: early 0.54±0.26, medium 0.56±0.29 & late 0.61±0.30. Mean ±SD EQ-5D VAS scores were: early 47.7±21.4, medium 56.1 ±21.0 & late 56.7±20.4. Analysis by individual EQ-5D domain also revealed that the pro-

portions of patients reporting some/extreme problems (worse QoL) appeared to be higher in the early vs. later groups for the domains of mobility (early 94.2%, medium 85.1% & late 73.6%), self-care (88.4%, 78.5% & 67.7%), pain (82.6%, 64.4% & 69.1%) and anxiety (65.2%, 50.4% & 51.4%) domains.
Conclusions: The differences in patient QoL domains likely reflect the evolution of spasticity and where the patient is in their care pathway. For example, the worse QoL and higher proportion of patients reporting problems with mobility and self-care in the early vs. later groups may reflect a faster referral of more severely affected patients for spasticity management. It may also be that patients with a longer disease duration become gradually accustomed to their condition. Across all groups, the presence of upper limb spasticity significantly impacted patient QoL, supporting the idea that spasticity treatment with AboBoNT-A is warranted in the different stages of disease.

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Effect of dual-tDCS combined with physical therapy on lower limbs performances in sub-acute stroke patients

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Recently, dual-hemisphere transcranial direct current stimulation (dual-tDCS) in which, excites one hemisphere using anodal stimulation and inhibits the other by cathodal stimulation has been described to have a greater effect on enhancing motor learning compared to uni-hemisphere. The corresponding tDCS-induced changes were reported to reduce the inhibition exerted by the unaffected hemisphere on the affected hemisphere and restore the normal balance of the interhemispheric inhibition. Many studies demonstrated positive effects of using tDCS to improve motor performance, however, fewer studies have focused on the effect of tDCS on lower limb functions especially in clinical rehabilitation setting. Nineteen sub-acute stroke patients were randomly allocated to receive either real or sham dual-tDCS following by conventional physical therapy (PT) with the intervention interval at least 1 week. Dual-tDCS was applied over the M1 with 2 mA intensity for a 20-min duration. The assessment of lower limb functions was performed before and immediately after the combined intervention. Our results showed a significant improvement of functional performance of lower limbs measured by Timed Up & Go and Five-Times-Sit-To-Stand tests compared to baseline only for the active group, however such improvement was not superior over the sham group. The muscle strength evaluated by knee extensor peak torque was unchanged in both limbs in either active or sham tDCS groups. It appears that tDCS have relatively more efficacy on functional performance than muscular force. The non-superior effect found here suggests that a single session of dual-tDCS combined with PT did not enough to improve functional performance of the lower limbs over PT alone. However, repeated dual-tDCS on long-term performance is needed to further investigate its benefit on rehabilitation.

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Effect of virtual reality on upper limb function early after stroke

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Background: Many of stroke victims are suffering from limitation of the upper limb function due to hemiparesis. That`s why one of the main goals of the rehabilitation of stroke patients is to improve upper limb function. Recently the technology of Virtual Reality (VR) seems to be a valuable and promising methods for reinforcement of comprehensive stroke rehabilitation. In such type of therapy the patient's interaction with the virtual environment is used. The equipment for VR nowadays is less specialized and becomes less expensive. Till now these are few reports containing the results of clinical trials on the effectiveness of this innovative therapy – that`s why there is a reason of further research in this area.
Aim: The aim of our study was to assess the effects of Virtual Therapy on upper limb function in the early period after stroke.
Methods: Sixty patients up to three months after first ever stroke fulfilling the inclusion criteria were randomly assigned to VR or PNF therapy. Therapy was conducted three weeks, five days a week, 30 min. per session. For the outcome measure the Functional Index "Repty" (modification of FIM), Wolf Motor Function Test, Frenchay Arm Test and strenght of hands has been used.
Results: First data show the improvement of the overall efficiency of the upper limb, greater after VR than in PNF.
Conclusion: Technology of Virtual Reality seems to the effective method for enhancing the comprehensive rehabilitation in hemiparetic patient suffering from limitation of the upper limb.

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Effects of non-invasive brain stimulation on white-matter tracts in subacute stroke

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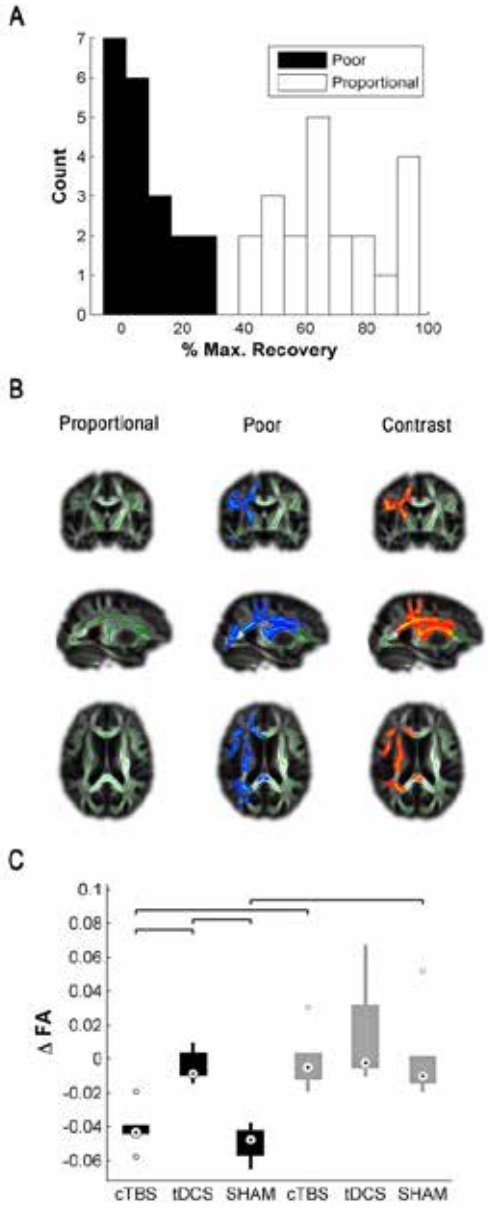
Question: Recent studies demonstrated that stroke patients with severe damage to the cortico-spinal tract (CST) show secondary degradation of ipsilesional white matter tracts and little to no motor recovery (POOR group). Conversely, patients with limited damage to the CST have preserved whiter matter tract integrity and a recover ≈70% of their maximal improvement potential within 3 months (proportional group, "PROP"). Non-invasive brain stimulation can boost motor function in stroke patients. However, we lack information on their impact on white matter microstructure and clinical recovery. We conducted a trial comparing the effects of tDCS, rTMS, or sham stimulation on structural plasticity and motor improvement in patients with subacute stroke.
Methods: 41 stroke adults with unilateral hemispheric stroke and impaired upper limb motor function were randomized to one out of three groups: continuous theta-burst stimulation, cathodal tDCS and sham. Each participant completed nine stimulation sessions combined with therapy. Diffusion Tensor Imaging and standardized motor scores could be acquired before and after the protocol in 34 patients.
Results: Patients showed two stereotypical recovery patterns **("POOR" or "PROP", Fig. 1A)**. Only patients with poor motor



P109 Fig. 1

recovery presented significant longitudinal reduction of FA in the affected hemisphere, in particular in the internal capsule **(p < 0.05, TFCE corrected, Fig. 1B)**. Among this "POOR" group, patients treated with tDCS reported more preserved white matter integrity compared with the other experimental groups **(p < 0.05, Tukey-Kramer HSD, Fig. 1C)**. However, this effect white matter integrity in tDCS group was not was associated with improved motor recovery.

Conclusions: Our findings provide evidence that tDCS can prevent white-matter degradation in patients with severe CST damage. Future investigations need to determine how this structural benefit can be translated into clinical gains.

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Effects of Pilates training on pain and postural control in patients with chronic neck pain – a randomised controlled study

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Introduction: It is known that chronic neck pain causes sensorymotor disturbances. Postural control was also affected by chronic neck pain. Pilates exercises was thought to be effective in order to improve postural control. However, there is limited research about the effect of Pilates training on postural control.
Objectives: The aim of this study was to investigate the effect of Pilates exercises on pain and postural control in patients with chronic neck pain.
Materials&Methods: Thirty-six patients with chronic neck pain were enrolled. Pain and postural control (anteroposterior, mediolateral, overall postural stability and limits of stability) were evaluated by Visual Analog Scale and Biodex Balance System SD, respectively. Patients were randomly divided into Pilates and home exercise group. Patients underwent eight-week exercise training. All assessments were repeated before exercises, after exercises (at the 8th week) and at the 12th week.
Results: While both treatment methods had positive effects to decrease pain in short and long term, Pilates exercises were found to be more effective than home exercises to decrease pain ($p<0.05$). Pilates exercises were also more effective than home exercises to improve anteroposterior postural stability in short term (8th week). Limits of stability was significantly increased in both groups in the short and long term ($p<0.05$). There was no superiority in terms of contributing to the improvement of postural control between Pilates exercises and home exercises in the long term ($p>0.05$).
Conclusion: Pilates exercises were more effective than home exercises in order to reduce pain in the short and long-term in patients with chronic neck pain. Both Pilates and home exercises had similar effects to improve postural control, with no superiority between them. More studies are needed to compare the effectiveness of Pilates exercises and different exercise interventions on pain and postural control in patients with chronic neck pain.

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Learning neuromotor rehabilitation through serious games – a physiotherapist students perspective

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Question: The use of Serious Games is spreading across the educational context because they are promising tools supporting and enhancing learning (Perttula et al., 2017). Serious Games could represent a new way for the transfer of knowledge also in neurorehabilitation field. our aim was to assess the experience of a class of physiotherapy students with a 3D Serious Game on neuromotor rehabilitation for learning purposes in real context.
Methods: A 3D Serious Game was developed to enhance physiotherapists" practical knowledge on the administration of dual task rehabilitation procedures. The game was validated in a previous phase with a user centric approach. The game allowed users to practice in reading clinical reports of patients, to set the rehabilitative procedure, and to decide for the administration of a dual task training on treadmill. A class of 23 university students of physiotherapy tested the Serious Game experience with a battery of questionnaires and scales including Positive Affect and Negative Affect Schedule (PANAS), System Usability Scale (SUS), the subscale Interest/Enjoyment of Intrinsic Motivation

Inventory (IMIINT/ENJ), the short version of Flow State Scale (FSS) and a quiz on the achievement of learning objectives.
Results: Findings reported a high level of students' intrinsic motivation (IMIINT/ENJ, M=4.96±1.14) and a statistically significant increase of their positive affect and decrease of their negative affect index in the PANAS (ps= .02) after using the game. High results of Concentration on Task at Hand (M=4.00±0.78) and Sense of Control (M=3.54±0.81) factors of FSS were also registered. Results on learning objectives achievement reported a high mean score (M=88.19 ± 3.97) and a statistically significant correlation between the performance to the game and the score to the learning objectives quiz (p=.03).
Conclusions: The results supported the application of the Serious Game in an educational context as a learning experience enhancing students' engagement and motivation.
Acknowledgments: This research was based on SeniorLudens platform and games developed for an Ambient Assisted Living (AAL) Joint Programme [AAL-2013-6-039]. We thank the SeniorLudens consortium for providing the opportunity to conduct this research.

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Lockomat training for motor fitness in a case series of cerebral palsy children

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Introduction: Children affected by Cerebral Palsy (CP) have a decreased level of daily physical activity and some studies underline the importance to enhance endurance of CP children. Robotic Assisted Gait Training (RAGT) could be a complement for conventional therapies in CP with walk impairment, but studies demonstrated some effect in terms of increased endurance. The aim of this study was to investigate the effects of RAGT on motor fitness/endurance in children affected by CP.
Methods: A case series of consecutive outpatients affected by CP who performed 2 rehabilitation programs including RAGT during a 24 months period. Each program consisted of 20 daily session 5/days/week. No over 2 programs were performed by each patients within the observation period. We collected for each patients GMFCS score, the mean distance for session, the mean total distance.
Results: Data from 11 children (5 female, age range 5.8–17.2 years) including clinical features, GMFCS, and robotic measures were evaluated. At the end of the first program we recorded a mean total distance of 15486.27±1223.86 meters, and a mean distance for session of 822.73.5±83.12 meters, with a mean velocity of 1.64±0.13 Km/h. At the end of the second program the mean total distance ($p<0.05$), and the mean distance for session ($p<0.05$) were significantly increased, while no difference were reported for velocity ($p>0.05$).
Discussion: Data showed that RAGT performed by CP patients seems to improve motor fitness/endurance as expressed by measures of distance. In this study we used indirect measures, to quantify over the time the ability of the patient to maintain/improve performance. The results of this study although exploratory, indicate that robotic devices may be introduced within a multidisciplinary rehabilitation treatment also with the aim of improving motor fitness.

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P113

Patients with early post-stroke upper limb spasticity have different goals to those with medium and long-standing spasticity - findings from an international observational study of abobotulinumtoxinA for upper limb spasticity

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Question: Do patients presenting for upper limb spasticity treatment with botulinum toxin (BoNT) who have recently had a stroke have different treatment goals compared to patients with medium-term or long-term post-stroke spasticity?
Methods: EARLY BIRD (NCT01840475) is an international, non-interventional, longitudinal study to investigate abobotulinumtoxinA (AboBoNT-A) effectiveness in adults (age≥25y) with post-stroke arm spasticity with respect to early, medium or late start of treatment. Effectiveness is assessed by reductions in muscle tone (composite Modified Ashworth Scale [MAS] scores for elbow + wrist flexors) and goal attainment. Patients could choose ≥1 goal from 6 predefined goal domains. Patients were categorized according to the interval between stroke event and start of study treatment (early, medium and late) as defined by the 1st and 3rd quartiles time distribution.

Pt	Sex	Age	Height (cm)	Type	GMFCS	Surgery	Bo.Tox.	Total distance		Mean distance		Velocity	
								I session	II session	I session	II session	I session	II session
1	M	13.2	150	Tetraplegia	III			15436	16388	968	943	1.9	1.8
2	M	5.8	116	Tetraplegia	V			14229	14687	837	864	1.6	1.7
3	F	6.0	117	Paraparesis	I	•	•	16261	17381	914	969	1.6	1.7
4	M	9.0	100	Tetraplegia Hyperkinetic	II			15860	17403	793	870	1.6	1.8
5	F	6.0	120	Tetraplegia Hyperkinetic	II	•	•	15648	16753	834	987	1.6	1.9
6	M	10.0	115	Tetraplegia	V		•	13364	13672	668	684	1.4	1.3
7	M	9.0	140	Tetraplegia*	IV	•	•	15948	16814	886	934	1.7	1.7
8	F	17.2	116	Tetraplegia	III			14721	14729	736	736	1.5	1.5
9	M	8.0	110	Tetraplegia	IV		•	14412	16371	709	809	1.5	1.8
10	F	9.3	144	Tetraplegia	I			17138	22372	902	1177	1.8	2.2
11	F	9.0	150	Tetraplegia	III		•	17322	20100	866	1005	1.7	2.0

* Baclofen pump

P112 Tab. 1: Patients' clinical features and Lokomat messures

Results: This baseline analysis included data from 281 patients presenting for routine spasticity treatment with AboBoNT-A (early: n=69, mean±SD time since event: 2.3±1.7 months; medium: n=137, time since event: 16.2 ±11.6 months; late: n=69, time since event: 146.2±106.3 months). Mean ±SD composite MAS scores were higher in the early group vs. the later groups (early 5.1±1.3, medium 4.6±1.5, late 4.8±1.4). Analysis of baseline goal choice revealed that patients with recent post-stroke spasticity (i.e. early group) were more likely to select pain reduction as a treatment goal than those who had been living with their spasticity longer (early 53.7%, medium 44.0%, late 42.4%). Conversely, improving ease of care/hygiene (early 47.8%, medium 52.2%, late 71.2%) and supporting ease of physio/occupational therapy (early 43.3%, medium 53.7%, late 62.1%) was chosen more frequently by the later two treatment groups than in the early treatment group. Similar proportions of patients in all groups selected improvement of mobility (early 74.6%, medium 74.6%, late 78.8%) and functional improvement (early 35.8%, medium 37.3%, late 31.8%) as treatment goals.
Conclusions: Treatment goals for patients presenting for routine AboBoNT-A treatment differ according to disease duration and may also reflect differences in tone. Whereas patients presenting for early treatment tend to have higher tone and frequently choose pain as a treatment goal, improving ease of care and ease of physio- and occupational therapy appear to be more relevant for patients with longer established spasticity.

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Searching for standardised measurements of strength in patients with multiple sclerosis – a literature review

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Question: Which valid and reliable measurements of muscle strength in persons with multiple sclerosis (MS) are described in the literature?
Methods: In order to answer the research question, the following databases have been searched: PubMed, PEDro, Cochrane Central Register of Controlled Trials and Google Scholar. Studies were included if they evaluated the validity and reliability of measurements of muscle strength, applied on persons with MS. The quality of the included studies was assessed with an adapted Version of the diagnostic critical appraisal sheet of the Center of Evidence Based Medicine.
Results: Four studies have been analyzed. Fry et al.1 evaluated the validity and reliability of three types of measurements for trunk muscles (curl-up test, trunk flexor endurance test and pelvic tilt test). Moller et al.2 tested the validity of the 5 repetition sit-to-stand (STS) as a functional strength test of the lower limb. Paltamaa et al.3 and Surakka et al.4 assessed the strength of the knee muscles with a dynamometer.
Conclusions: The analysis shows that the curl-up test1 (isotonic testing of the trunk flexor muscles) and the 5 repetition STS2 are valid and reliable measurements and can be recommended for clinical practice. The dynamometer3,4 has been shown to be a reliable measurement tool for testing knee muscle strength, due to the time-consuming procedure and the expensive equipment, its clinical application is limited. The pelvic tilt test1 and the trunk flexor endurance test1 are only moderately reliable. Due to a high measurement error and a high minimal detectable change value their clinical application seems to be limited. Additionally, the performance of these two tests raises further questions according to if strength or motor learning has been tested and which muscle groups actually have been assessed.

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[3] Paltamaa et al. Reliability of physical functioning measures in ambulatory subjects with MS. Physiother Res Int 2005; 10: 93–109.
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P115

The effect of seat width on sitting and balance in T1–T6 paraplegic patients

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Background: Most people with spinal cord injuries (SCI) use wheelchairs as their sole means of locomotion. An appropriate wheelchair and cushion are essential for preservation of the individual's health and optimization of his functional independence and participation in life situations. Correct wheelchair adjustment could compensate for three major problems that most individuals with paraplegia face: the ability to sit erectly, the lateromedial shift control, and finally the ability to maintain balance without the aid of upper limbs.
Objectives: The objective of this study was to examine the effect of seat width on posture and balance, specifically the erect sitting, lateromedial shift control and the ability to maintain balance without the aid of the upper limbs in individuals thoracic SCI.
Patients and methods: Twenty male subjects with T6-T12 AIS A were recruited from the outpatient clinics of a national spinal cord injury rehabilitation unit. Exclusion criteria included orthopedic and neurologic disorders such as severe spine deformities, movement disorders, pain and dizziness that might interfere with sitting in wheelchair. A single physical therapist performed three sets of measurements as follows: Test A and Test B referred to two repetitions of the same three measurements whereas Test C included a pelvic stabilizer. Test A and Test B were done with a 30 min time interval in order to obtain test retest cut off values for the three outcome measures. The outcome measures were as follows:

1. The ability to shift from relaxed to erect sitting measured by the kyphotic angle in degrees using a digital inclinometer.
2. The ability to reach laterally out of the base of support without falling measured in centimeters by a wall mounted tape measure.
3. The time (seconds) taken to put on and take off a T shirt.

Results: The T shirt test showed no improvement between Test A and Test B. However, there was a significant improvement when compared to the Pelvic stabilizer test. Similar results were obtained for the lateral reach test, however the ability to shift from relaxed to erect sitting did not improve using the pelvic stabilizer.
Conclusions: Our results suggest that a narrower seat width may improve certain aspects of balance and posture in active male subjects with complete thoracic paraplegia, T6-T12.

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Which effect does endurance training have on fatigue in persons with multiple sclerosis? – a literature review

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Question: Which effect does endurance training have on fatigue in persons with multiple sclerosis (MS)?
Methods: The following databases have been searched: PEDro, PubMed, and Google Scholar. Studies were included if they were randomized controlled trials or clinical controlled trials, participants had a maximum Expanded Disability Status Scale (EDSS) score of 6 and the intervention was endurance training, measured with objective parameters (heart rate or VO2). Fatigue had to be measured with standardized clinical assessment tools. The following interventions were allowed for the control groups: any training except endurance training, a combination of endurance training and any other training (as long as the main focus was not on endurance training) or no training at all. The PEDro scale was used to assess study quality.
Results: Three studies 1,2,3 (PEDro score 5-6/10) have been identified. Interventions were treadmill training 1,2 or a combination of cycling ergometer training for the first 20 minutes and a stepper-, cross-trainer-, arm-ergometer-, treadmill-, recumbent-ergometer- or rowing ergometer-training for the second 20 minutes 3. The entire training period lasted for 81,2 to 12 weeks 3. The training was based either on age-related maximum heart rate 1,2 or individual VO2 peak 3. Fatigue has been measured with the Fatigue Severity Scale 1,2 and the Modified Fatigue Impact Scale 3. The control groups received no training 1,2, Yoga training2 or a combination of endurance training and dynamic resistance training 3.
Conclusions: Eight to twelve weeks endurance training may show significant beneficial effects on fatigue, although results might not be clinically relevant. Endurance training is superior to no training 1,2, but as efficient as a combination of endurance and dynamic resistance training 3 or as Yoga 2 in order to reduce fatigue in persons with MS.

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P117

Work-oriented therapy in neurorehabilitation – a specialised link between medical and work rehabilitation

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Introduction: Neurorehabilitation aiming at a successful reintegration of the patient into working life requires specific rehabilitation concepts. To respond to the need of neurologic patients for occupation-focused training starting already in the medical phase of rehabilitation, Bellikon Rehabilitation Clinic (Switzerland) developed a specialized intervention called Work-oriented Therapy (Berufsorientierte Therapie) about 15 years ago.
Objectives: Clinical studies and evidence on early work-oriented neurorehabilitation have been scarce. The objective of this presentation is to give an outline on current state of research and to illustrate conceptual foundations, assessment instruments, training methods, and intervention process in Work-oriented Therapy. Clinical experience is shared and discussed with the congress audience by means of exemplary case histories.
Patients and methods: Work-oriented Therapy is offered as a combination of single and group therapy in an interdisciplinary rehab setting, mostly during in-patient treatment. Patients have neurological diagnoses (mostly Traumatic Brain Injury) and show enough endurance to participate for 60–240 minutes per day. An individual analysis of the work place requirements and the patient's qualification as well as motor, procedural and social interaction skills is carried out. On the base of this comparison, treatment goals and methods of training are determined.
Results: Work-oriented Therapy is a client-centered and goal-directed intervention for neurologic patients who are still in or at the end of the medical stage of rehabilitation. It offers a thorough assessment and recommendation about the patient's working ability and the potential for further occupational reintegration. Research evidence, internal rehab clinic data and clinical experience indicate a positive effect on rehabilitation outcome.
Conclusion: For patients not able to participate in more advanced occupational training, Work-oriented Therapy represents a crucial link between medical and work rehabilitation.

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Baseline characteristics in patients from an international prospective, non-interventional study to assess long-term effectiveness of abobotulinumtoxinA (ABO) in post-stroke arm spasticity (PSAS) with respect to time of ABO treatment-initiation post-stroke

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Question: Botulinumtoxin-A (BoNT-A) is an effective and well tolerated treatment in alleviating post-stroke arm spasticity (PSAS). However, there is limited real-life evidence available regarding the relationship between time of treatment-initiation post-stroke and development of spasticity. The EARLY BIRD study (NCT01840475) aims to assess long-term effectiveness of abobotulinumtoxinA (ABO) in PSAS. We present here the methodology and patient baseline characteristics (interim pre-planned analysis).
Methods: 302 adult patients with PSAS, naïve or previously-treated with BoNT-A, were allocated according to time between stroke-occurrence and treatment-initiation (early, medium, or late initiation, according to first, second, or third quartile, respectively). Patients will receive 4 ABO injection cycles. Demographics, arm spasticity patterns1, composite MAS-score (elbow+wrist flexors), and pain (VAS) were recorded at baseline.
Results: Baseline data were available for 281 patients. Compared to the early treatment-initiation group, the late treatment-initiation group were on average older (early: 58.3, late: 62.1 years) and more likely to be female (early: 31.9%, late: 50.7%). Distribution of arm spasticity patterns was similar to previous reports1. Time (mean (SD)) between spasticity-onset and first ABO treatment was 2.3 (1.7), 16.2 (11.6), 146.2 (106.3) months for early, medium and late treatment-initiation groups. Pain was higher in patients from the early group vs medium and late groups (mean (SD): 3.9 (2.9), 2.9 (2.9), 2.5 (2.8), respectively). Composite MAS-score was similar across groups.

Conclusion: Approximately 11 years separated patients with early vs. late treatment-initiation in this non-interventional study, indicating ABO treatment remained appropriate many years post-stroke. Patients in the early-treatment group had higher baseline pain scores than those treated later. EARLY BIRD will assess long-term effectiveness of ABO according to time of treatment-initiation post-stroke, which could lead to improvement of clinical practices.

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Robot-assisted stair climbing training for improving mobility and participation in daily activities in persons affected by stroke: a pilot randomized clinical trial

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Introduction: People with stroke may have impaired the ability of climbing up and down the stairs. To reduce the disability, the current physiotherapy approaches focus on lower limb muscle strengthening, real floor walking and stairs climbing practice, but these methods might not stress patients during the specific exercise in terms of intensity.
Objectives: To compare whether an intensive robot-assisted stair climbing training (RASCT) is more effective than real stair climbing training (SCT) for reducing disability and improve gait in people affected by stroke.
Materials and methods: This is a pilot single-blind randomized clinical trial. Patients received 20 sessions of RASCT or SCT, ten 50-minute treatment sessions, 3 days a week, for seven consecutive weeks. Stair climbing up and down time to accomplish 9 stairs, Time Up and Go Test (TUG), 10-Meter Walking Test (10MWT), 6-Minute Walking Test (6MWT), Berg Balance Scale (BBS), Dynamic Gait Index (DGI), Modified Ashworth Scale (MAS), and gait analysis were assessed before, after treatment and with 3-month of FU.
Results: Eighteen patients were randomly assigned to RASCT (n=8) or SCT(n=8) group. No differences were found between the two groups for all outcome measures after treatment and at follow-up evaluations. A statistically significant improvement was found after treatment (p=0.012) and at the FU (p=0.017) in performance on the stair climbing up in favor of RASCT. The stair climbing down time, TUG, 10MWT, 6MWT, BBS, DGI, MAS improved significantly in both groups post-treatment and at FU evaluations. No significant changes were found in the gait analysis.
Conclusions: Both training modalities can reduce disability in the stair-climbing task and improve balance during walking. RASCT showed to significantly improve the ability of climbing up the stairs. A larger sample is required to reveal the superiority of one approach rather than with another one.

P121

Effects of dalfampridine in persons with multiple sclerosis on mobility in daily life and on activities of daily living – a pilot study

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Introduction: Reduced mobility and gait impairments – two of the most burdensome symptoms in individuals with multiple sclerosis - entail a decrease in physical activity and are related to performance decline in basic and instrumental daily activities (ADL) and therefore participation. Dalfampridine is a novel drug for symptomatic management of MS. Its effects on daily living outcomes is, however, widely unknown.
Objectives: The goal of this pilot study was to evaluate the feasibility of the testing protocol and to preliminarily evaluate effects of Dalfampridine on daily mobility and on performance of ADLs. Feasibility testing should determine whether subjects are able to perform all tests within one session and if there is a change in perceived fatigue during testing session.
Patients and methods: Initially, three subjects (inclusion criteria: EDSS 4-7) were tested before and after a six-week period of Dalfampridine intake. The primary outcome measure of feasibility was the Visual Analogue Scale for Fatigue (VAS-F) used to determine testing-induced fatigue. The test protocol for evaluating effects of Dalfampridine on daily mobility and ADLs were: accelerometry over a 7-day period, the Canadian Occupational Performance Measure (COPM), Jebsen Taylor Hand Function Test, Timed 25-Foot Walk, 12-Item Multiple Sclerosis Walking Scale, and the Fatigue Severity Scale. Following feasibility testing data from 15 subjects were collected and are being analyzed.
Results: All tests could be conducted within one testing session, but two subjects showed a clinically relevant increase of fatigue (≥ 20 %) during testing. Preliminary results of the effects of Dalfampridine showed improvements in gait speed and in subjective walking ability, but not in daily mobility using accelerometry. Additionally, COPM performance and satisfaction scores of identified ADL problems, hand function, and fatigue improved.
Conclusion: The testing protocol is feasible; however, the increase in fatigue during testing showed that an incomplete counterbalance in the test administration should be applied in order to prevent a sequence effect during testing. The preliminary results show improvements in some areas of ADL. Importantly, improvements seen during simple clinical gait tests do not necessarily carry over to mobility in daily life. Sponsored by Biogen.

P123

Cross-cultural translation and validation of the German version of the Balance Evaluation Systems Test

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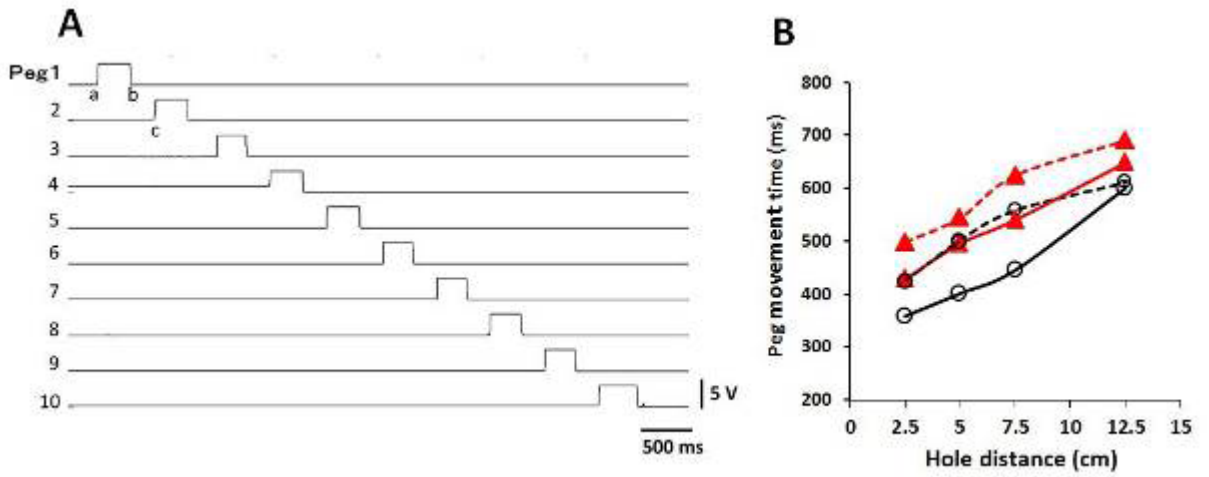
Introduction: The Balance Evaluation System's Test (BESTest) is the most comprehensive balance assessment to date. Based on the systems model of motor control it assesses biomechanical constraints, stability limits, anticipatory and reactive postural control, sensory integration and stability in gait and it allows to identify underlying causes of balance deficits in neurological and geriatric populations (1).
Objective: Our goal is to provide a validated, cross-cultural translation of the BESTest into German.
Materials and methods: The original BESTest (27 items) and its short version (6 items), the Brief BESTest (2), were cross-culturally translated according to international guidelines. Understandability of the preliminary versions and their usability were evaluated by physical therapists (PTs) at various work settings (private practice, in-patient rehabilitation, teaching institution) in Germany, Austria, and Switzerland.
Results: Minor wording changes in both therapist and patient test instructions were suggested by all PTs. Importantly, test instructions for the therapist of the Brief BESTest were not deemed sufficiently detailed for those PTs, who do not know the original BESTest version. The Brief BESTest, but not the original version, was considered to be usable in clinical practice. The original BESTest was deemed suitable and beneficial for educational settings.



P124 **Fig. 2:** A Typical 10-channel electrical output from a peg transfer trail (Hole distance=50 mm, a=peg 1´s pull out onset moment, b=peg 1´s insert – end moment, c=peg 2´s pull-out moment, peg movement time = b-a, hand movement time = c-b)B Mean peg movement time for 25, 50, 75 and 125 mm distance conditions for young (unfilled circles: black) and elderly (filled triangles: red line) groups. Solid lines=dominanthand, dashed lines=non – dominated hand

Conclusion: Both versions were revised according to the PTs' feedback. After consulting the author of the Brief BESTest the test instructions were replaced by the detailed instructions of the original version. Upon final approval of the test developers the validity of the final German versions will be determined using the Berg Balance Scale and the Activities Specific Balance Confidence Scale in neurological and geriatric patients. Validation will be completed in August. A validated German version of the BESTest will help improve both evidence-based management and teaching of balance impairments in German-speaking countries.

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[2] Padgett PK, Jacobs JV, Kasser SL. Is the BESTest at Its Best? A Suggested Brief Version Based on Interrater Reliability, Validity, Internal Consistency, and Theoretical Construct. Phys Ther 2012; 92(9): 1197–207.

P124

Development of a pegboard for automated time measurement of individual's peg and hand motion

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In research and clinics of neurorehabilitation for hands, pegboards have been often used as a tool for acquisition of behavioral data. A common measure from conventional pegboards is total time for moving pegs in a given time. To evaluate more detailed behavior, time for moving individual pegs is useful. We introduces a new pegboard developed for automatic measurement of individual peg's insert- and pull-out-moments to help in more accurate assessment of hand's visuomotor function. Two single row 10-hole pegboards were built in reference to a commercially available pegboard **(Fig. 1)**. A miniature photo-interrupter with a self-built analogue amplifier was installed at the bottom of each hole to detect the emitting light interruption moment by a small plastic peg (diameter = 7.4-mm, length = 30 mm). Amplified signals were A/D converted (500 Hz/channel) to store in a PC. For this preliminary report, testing and retest (2 wk after) were done by 20 healthy young, and 10 elderly volunteers. Each performed five behavioral tasks, which consisted of fast and accurately moving of 10 pegs aligned in one row to other rows at different distances (25, 50, 75, and 125 mm), and a task to turn-over and transfer for the 25 mm distance. The dominant and non-dominant hands were tested for each participant. Repeated 40 trial data were gathered for each test condition. Temporal variables evaluated were mean, median, and coefficient of variation (CV = SD/Mean) of peg movement time (from the pull-out moment of a peg to its insert moment), the corresponding parameters of hand movement time (from the insert moment of a peg to the pull-out moment of another peg), total execution time, and number of trials having excessively long execution time (>3 SD) due to dropping a peg during pull-out and/or transfer action. The gathered data showed a clear-cut light interruption moment by the pegs, allowing readily and objectively determine the pull out and insertion time of each peg **(Fig. 2 A)**. Mean movement time for the peg, and hand exhibited significant distance, hand-dominance, turn-over, and age effects **(Fig. 2 B)**. The CV of peg movement time also showed significant effects of distance, turn-over, and hand-dominance. A high test-retest reliability (r>0.9) was further confirmed in most parameters. The present sensor installed pegboard can clearly give richer behavioral data than the conventional ones for assessing hand function in neurorehabilitation research and clinics.

P124 **Fig. 1:** Pegboard and photo-interrupter circuit

P125

Effect of kinesthetic illusion induced by visual stimulation on ankle dorsiflexion dysfunction in a stroke patient – ABAB single-case design

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Introduction: Kinesthetic illusion induced by visual stimulation (KiNvis) is a new method that produces kinesthetic perception through observation of a person's physical exercise on a computer screen. KiNvis enhances lower-limb corticomotor excitability and activates the motor association area in healthy individuals, but its therapeutic effect on ankle dorsiflexion dysfunction in stroke patients has not been explored.
Objectives: This ABAB single-case study investigated the effect of KiNvis on ankle dorsiflexion dysfunction in a stroke patient.
Materials and methods: The participant was a 48-year-old woman with post-stroke right hemiparesis. The study had an ABAB single-case design and was conducted in 5-day phases. In phases A1 and A2, the patient underwent a 60-min session of conventional physical therapy and ankle dorsiflexion movement. In phases B1 and B2, she underwent KiNvis for 5 min and did the same physical therapy program used in phases A1 and A2. For KiNvis, a first-person–perspective video of ankle dorsiflexion on the participant's non-paralytic side was flipped horizontally and shown on a computer screen placed over the participant's paralytic foot so she could observe the recording. She performed exercises of ankle dorsiflexion voluntary movement during KiNvis. Ankle dorsiflexion voluntary movement angle (ADVMA) and 10-m maximum walk test (10MWT) were evaluated to assess the effect of KiNvis. The vividness of the kinesthetic illusion was evaluated using a visual analogue scale (VAS). In the analysis, we used the central division method to find the celeration line from A1 and A2 and tested the upper values in the B1 and B2 periods compared with the extended celeration line by using a binomial distribution. The level of significance was set at 5%.
Results: Mean VAS score in phases B1 and B2 was 97 ± 2 mm. ADVMA was significantly improved in phase B2 compared with A2. 10MWT was not significantly improved in Phase A1 and A2 compared with B1 and B2.
Conclusion: These results suggest that ankle dorsiflexion dysfunction in a stroke patient was. Improved by performing voluntary movement with KiNvis.

P126

Effects of hippotherapy in upper limb function of children and adolescents with spastic cerebral palsy

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Introduction: Cerebral Palsy (CP) is a group of permanent movement and posture disorders due to a non-progressive disturbance during the process of brain maturation. Many children with CP have limitations regarding the use of one or both affected upper limb. This limitations negatively impact on activities of daily living. Hippotherapy is a method of treatment that uses the horse and promotes physical, psychic and educational improvement, seeking for better development of motor and psychic functions. The purpose of this study was evaluate whether the hippotherapy affect the upper limb functionality in children and adolescents with cerebral palsy.
Methods: six children and adolescents aged from 5 to 14 years old, with spastic CP levels I, II and III of Gross Motor Function Classification System (GMFCS) participated of this longitudinal study. The Teenager Motor Activity Log (TMAL) e Pediatric Motor Activity Log (PMAL) scales were used to evaluate the functional use of more affected upper limb. These scales are composed by two sub-scales that evaluate amount of use (AOU) and the quality of use (QOU). Each questionnaire is adequate to functional performance according with age and both are composed by 22 questions, with equivalent score. The adult responsible for most of the child's care was asked to answer to the questionnaire before and after 3-months weekly sessions of hippotherapy. The hippotherapy treatment was individualized according to participant's characteristics. Wilcoxon test was applied to compare the pre- and post-treatment final scores and significant level was set at α=0.05.
Results: There were not significance differences in AOU and QOU scores between pre- and post-treatment.
Conclusion: three-month of hippotherapy does not influence at the amount and quality of more affected upper limb use in children with CP. Although hippotherapy approaches improves upper limb function, the exercises are not task oriented for functional use of upper limb in daily activities.

P127

Effects of modified constraint-induced movement therapy in the recovery of upper extremity function affected by a stroke – a single blind randomised parallel trial – comparing group versus individual intervention

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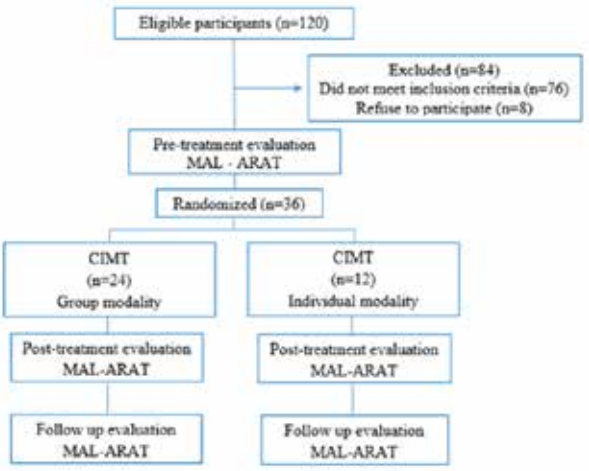
Background: An extensive corpus of literature supports the positive impact of CIMT on neuroplasticity and the recovery of function. However, its clinical applicability is limited by the time of intervention and individual modality. We propose to assess the efficacy of modified CIMT (mCIMT) protocols through a group therapy intervention.
Objective: To determine the effectiveness of a group therapy, as compared to individual mCIMT, in increasing the use and functionality of movement of a paretic upper limb.
Method and subjects: The study was a single blind, randomized parallel trial. Thirty-six patients who had had a stroke more than 6 months previously were randomly divided into two intervention groups. The independent variable was the implementation of group or individual modalities for 3 hours for 10 consecutive days and the dependent variables were evaluated by the



P127 **Fig. 1:** Diagram showing recruitment and allocation of participants

Motor Activity Log (MAL) and Action Research Arm test (ARAT), at baseline (pre-intervention evaluation), end (post-intervention evaluation) and six months after intervention (follow-up).
Results: By controlling the pre-intervention evaluations, analyses of covariance indicated that both dependent variables presented significant differences in favor of the group therapy at both the post-intervention evaluation and follow-up evaluations.
Conclusions: Both types of intervention generated increases in the function and use of the upper extremity, with these increases being higher in the group therapy. The effects of the group therapy modality were maintained 6 months after the intervention ended **(Fig. 1)**. Means (and standard deviations) of the dependent variables by treatment modalities and measurement time.

P128

Effects of Pilates exercises on limits of stability and upper extremity functions in patients with multiple sclerosis

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Introduction: Decreased postural control was thought to effect upper extremity functions in patients with multiple sclerosis (pwMS). Pilates can improve postural control in pwMS and increase upper extremity functions.
Objectives: To examine the effect of modified clinical Pilates exercises on limits of stability and upper extremity functions in pwMS.
Materials&Methods: Eleven patients with multiple sclerosis were recruited in this study. 'Biodex Balance System SD' and 'Nine Hole Peg' test were used to evaluate limits of stability and upper extremity functions, respectively. Pilates exercises were applied two times a week for 10 weeks and measurements were repeated to pwMS after exercise training.
Results: There was no significant improvement in overall limits of stability after 10-week modified clinical Pilates training($p=0.721$). No significant changes were detected in upper extremity functions after the pilates exercises ($p>0.05$).
Conclusion: Ten-week Pilates training was not effective to improve neither limits of stability nor upper extremity functions. 10 week Pilates training can may not be enough to improve postural control and upper extremity functions. Maybe Pilates exercises should be applied longer than 10 weeks in ambulatory pwMS to combat decreased postural control and upper extremity functions.

P129

Feasibility of two novel interactive software modules for the rehabilitation of patients with neuromuscular upper limb impairments using the YouGrabber training system – the KAYO study protocol

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Introduction: In the recent past, medical training systems using virtual reality (VR) have been introduced to neurorehabilitation to train motor function deficits in patients. The usage of VR-based training systems is based on the evidence of neuroplasticity, which is responsible for recovery of patients suffering from motor dysfunction. Such systems are increasingly used to encourage purposeful limb movements in a VR environment and its efficacy has been found comparable with conventional therapeutic intervention. VR training systems, e.g. the YouGrabber® (YG), will increasingly also be used at home. Therefore, it is essential to integrate valid and reliable assessment tools to monitor the recovery process.
Objectives: The aim of the clinical study is to evaluate the usability, feasibility and validity of the digital version of the Action-ResearchArmTest (d-ARAT) using the YG system as a platform. Additionally, the feasibility and usability of the implementation of two rehabilitation measures that only recently became integral part of neurorehabiliation, e.g. Action Observation (AO) and Motor Imagery (MI), into the YG training software will be evaluated.
Patients and methods: This observational study is designed as a single-arm trial for testing the assessment software including pre- to post rehabilitation comparison either with additional training involving AO and MI or with no additional training. Therefore, 75 adult patients with Parkinson's disease, MS, Stroke, traumatic brain injury or Guillain-Barré syndrome will be included. 30 out of the 75 patients will take part in the additional 4-week training on the enhanced VR-based system with a total of 16 training sessions of 45 min each. Primary outcomes will be the score on the System Usability Scale (SUS) and the ARAT as well as the d-ARAT scores. Secondary outcomes will be hand dexterity (Box-and-Block Test), upper limb impairment (Chedoke-McMaster Stroke Assessment), upper limb activities of daily living (CAHAI) and quality of life (EQ-5D-5L).
Results and conclusions: The study was designed to evaluate the d-ARAT and the training software modules for the YG system. Currently AO and MI specific tasks are being integrated and the ARAT subscales will be implemented on the basis of the redesigned glove equipped with new sensors. The results are expected to give recommendations for necessary modifications. They might also contribute knowledge concerning the application of AO and MI tasks within VR training.

P130

Navigated brain stimulation for upper limb recovery after stroke – quality of life outcomes from a randomised sham-controlled clinical trial of low-frequency rTMS to non-injured hemisphere combined with upper limb rehabilitation

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Upper limb (UL) recovery in stroke is limited with a negative impact on quality of life (QOL). We studied whether navigated brain stimulation (NBS) using a low-frequency protocol to non-injured hemisphere combined with UL therapy would improve QOL.
Method: 199 hemiplegic subjects were enrolled 3–12 months (mo) post stroke and randomized to NBS or NBS sham (non-targeted low-intensity E-Field) with 18 therapy sessions over 6 weeks. Outcomes were 1 week, and 1, 3 and 6 mo post-therapy. Our primary end-point was motor recovery by Upper Extremity Fugl-Meyer (UEFM), plus QOL measures using the Stroke Impact Scale (SIS) and EQ-5D-3L. Clinically meaningful levels of change were drawn from the literature.
Results: Of 199 subjects enrolled, 167 completed therapy and follow up due to early stoppage of data collection after interim futility analysis for the primary endpoint. All subjects achieved

clinically meaningful gains on UEFM 6 mo after therapy (NBS chg 8.1±7.4, p<0.001; sham chg 8.5±8.7, p<0.001) without significant differences between groups and no group differences on any QOL outcome 6 mo post therapy. Subjects did on average report clinically meaningful improvement on SIS perceived recovery score (NBS chg 11.0±17.1, p<0.001; sham chg 13.1±16.9, p<0.001), and strength, ADL and mobility domains showed similar trends, all with significant time effects on rmANCOVA (p<0.001). Despite the therapy focus on hand recovery, change in SIS hand function domain showed no significant time effects (p=0.83) due to wide variance. In this domain the mean sham change was clinically meaningful (18.9±27.0, p<0.001) but NBS change was not (9.5±20.0, p<0.001). EQ-5D-3L index change had a significant time effect on rmANCOVA (p<0.001) with improvement in both groups at 6 mo after therapy (NBS chg 0.05±0.16, p<0.001; sham chg 0.04±0.17, p<0.001), though not reaching clinically meaningful levels. The EQ-5D-3L VAS change did not show a time effect on rmANCOVA (p=0.13) but achieved significance 6 mo after therapy (NBS chg 7.7±15.7, p<0.001; sham chg 6.9±14.7, p<0.001) approaching clinically meaningful range.
Conclusion: We observed clinically meaningful gains in perceived stroke recovery 6 mo post-treatment in our study cohort despite less then clinically meaningful changes in the SIS hand function domain suggesting that functional changes beyond those achieved by hand performance alone can explain perceived stroke recovery.

P131

Neurorehabilitation of haemorrhagic stroke in patients presenting racemoce neurocysticercosis in rural Eastern Cape, South Africa

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Objectives: To quantify the frequency of complete physical rehabilitation and headache by adult population aged >13 years presenting haemorrhagic stroke duet to racemoce neurocysticercosis(HSRNCC) in rural Mthatha, Eastern Cape Province, South Africa.
Methods: The cross-sectional study using systematic sampling of households was conducted in region C and D of Eastern Cape Province and its outskirts (in Lusikisiki) from January 2005 to December 2016. It comprised 248 individuals above 13 years of age who were interviewed using a structured questionnaire. SPSS 16 was used for data analysis.
Results: Of the total, 138(54.8%) were females and 112 (45.2%) were males. The overall mean age was 30±12.5 years, 217 (86.9%) suffered from headache and 61 patients got complete physical recovery (25%). Out of those suffering from headaches, 179 (80.7%) employed self-management. Pharmaceutical drugs (n=155; 87.1%) were the commonest modality employed, while vitamins (n=6; 3.4%), massage (n=8; 4.5%), herbal remedies (n=4; 2.2%) and homeopathic medicines (n=5; 2.8%) were infrequently utilized. Acetaminophen was the commonest pharmaceutical drug used (n=91; 58.7%), followed by salicylic acid (aspirin) (n=46; 29.7%). Self-management and home physiotherapy was slightly more frequent among females (n=95; 53.37%) and in the above-matriculation group (n=103; 57.8%). A total of 156 (84.7%) people claimed to be satisfied with their self-management.
Conclusion: Self-management of headaches is highly prevalent among the general public. The majority opts for pharmaceutical drugs, mostly preferring acetaminophen. Most are satisfied with their self-management. High prevalence of complete physical neurorehabilitation in females with self management and physiotherapy at home was observed

P132

Simultaneous intervention involving action observation and actual exercise to improve walking ability of chronic stroke patients

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Introduction: Action observation therapy has been reported as a neurorehabilitation for post-stroke motor disturbance. The subjects watched a video in a static sitting position in many of these studies, but brain activation due to a combination of the mirror neuron system and actual exercise may promote a marked motor function-recovery effect.
Objectives: To investigate the effect of a combination of action observation and actual exercise to improve the walking ability of chronic stroke patients.
Materials and methods: The subjects were 8 chronic stroke patients(mean age 81.5±7.8 years) at 6 months or later after the onset of stroke. For the video viewed by the subjects, 2 types were prepared: videos of a healthy subject walking and scenery unrelated to walking. They watched the individual videos for 5 minutes on separate days using a head-mounted display. When they watched the video of walking, they were instructed to step and perform flexion/extension of the shoulder joint in accordance with the gait rhythm of the healthy subject. When they watched the video of scenery, they were instructed to do these at their own pace. The maximum 10-m walking speed, number of steps, and joint angles during walking were measured before and after the Timed Up and Go Test. In statistical analysis, the value of each item was compared between before and after intervention using the t-test.
Results: The combination of action observation and actual exercise significantly improved the 10-m walking speed and maximum flexion angle of the knee joint on the paretic side in the swing phase after intervention. When they watched the video of scenery, no change was noted after intervention.
Conclusion: It was suggested that simultaneous intervention by action observation and actual exercise activated both the mirror neuron system and cerebral motor-related area, and the movement can be easily imagined by actually performing it, which improved the walking function. The incorporation of exercise therapy while watching a video into conventional physical therapy may improve the walking ability of chronic stroke patients.

P133

Toilet training in a group setting – patient's opinion and success

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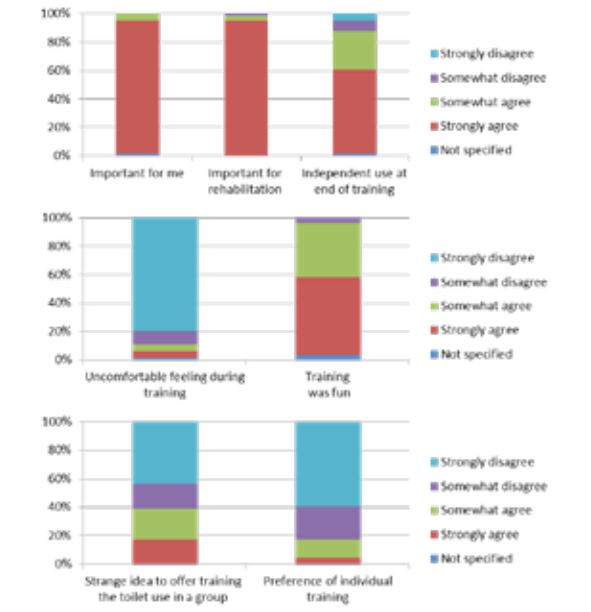
Question: Using the toilet independently stands as a favored goal of patients with neuropathological conditions. Re-learning this activity is part of the rehabilitation primarily provided by nurses. Due to ethical concerns the toilet training is usually performed in an individual training paradigm. In the St. Mauritius Therapy Clinic, Meerbusch (Germany), physio- and occupational therapists implemented a 3 patients / 1 therapist group to train the toilet use. The toilet training group (TGT) is exercising in an especially for this purpose prepared setting. During TGT doffing of clothing is simulated. Patients are invited to attend TGT if they (1) have the primary goal of independent toilet use, (2) are able to pull up from sit to stand and (3) have the cognitive capacity to participate. TGT lasts 30 minutes, 5 times a week for a maximum of 10 sessions. Patients are logged off earlier if

P133 **Fig. 1:** Training sessions per patient



P133 **Fig. 2:** a-c Perceptions of patients who trained to use the toilet in a group

they prove to be independent. Afterwards the primary nurse authorises autonomous toilet use. The purpose of this project was to understand the patients' success and perception about this training due to concern over lack of privacy of the group setting for toilet training.

Methods: A 5-level scale questionnaire will be presented to the first 100 patients who took part in TGT.

Results: Since the beginning of the TGT in February 2017, 61 patients attended the training. They all answered the questionnaire. On average 4,8 sessions were completed **(Fig. 1).** 37 participants (60%) were independent, 17 (28%) almost independent after the training. The vast majority of the participants recognized the importance of the subject for themselves and for rehabilitation. Although 40% found the idea of TGT strange before the training started, only 11 (18%) would prefer an individual training. 51 (80%) did not feel uncomfortable at all and 56 (91%) enjoyed TGT fully or partly. **(Fig. 2a-c).**

Conclusions: From the view point of the participants, TGT is a reasonable method to relearn the independent use of the toilet. In addition to cost-effectiveness, the training in groups has several advantages compared to individual training such as a clearly defined goal of the session, motivation, attention and psychosocial benefits from the group comradery. Such training allows high numbers of repetition of the whole or partial task without the training becoming monotonous.

P134

Physical Fitness in Subacute Stroke (PHYS-STROKE) – Effects of a structured fitness intervention in stroke rehabilitation

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Introduction: Given that stroke is one of the major causes for lifelong disabilities worldwide, more effective treatment and rehabilitation interventions are needed. As shown by a recent Cochrane Review (Saunders et al., 2016) physical fitness training holds promise of minimizing burdens on stroke patients in the rehabilitation phase. So far, multicenter randomised clinical trials are missing to demonstrate its longer-term effectiveness on activities of daily life, and its immediate and longer-term impact on cognition.

Patients and methods: 204 subacute stroke patients (ischemic and hemorrhagic; Barthel-Index ≤ 65) were included in the trial (NCT01953549). After inclusion (5–45 days post onset) patients were randomised to either aerobic fitness training or a relaxation program for four weeks (5 days/wk). Aerobic fitness training incorporates walking on either a gait trainer or a treadmill with body weight support (depending on severity of stroke) at approximately 50–60 % of maximum heart rate capacity. Co-primary endpoints were gait speed (m/sec) and Barthel-Index three months post-stroke. Secondary endpoints included motor function, cognition, quality of life, sleep, serum and safety parameters, among others. A detailed study protocol has been described elsewhere (Flöel et al., 2014).

Results: The data entry is closed but the analysis still ongoing. Results will be presented at the ECNR 2017.

Conclusion: By determining the impact of physical fitness training in the subacute phase on patient-centered outcome parameters, the trial may help to establish an important intervention in the rehabilitation after stroke.

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P135

Defining optimal robot assisted gait training protocol for locomotor rehabilitation in stroke patients

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Introduction: Robot assisted gait training (RAGT) is an innovative rehabilitation treatment which improves locomotor function in post-stroke patients. However, optimal rehabilitation programme protocol still needs to be established. Our objective was to evaluate the effect of duration of RAGT on locomotor rehabilitation in patients after stroke.
Methods: 32 post-stroke patients were assigned to two training protocols combining conventional physiotherapy (CP) and RAGT. Group one (16 patients) underwent 8 weeks (48 sessions, 6 times a week, each session lasting 45 minutes) of RAGT and CP.Group two (16 patients) underwent 12 weeks (72 sessions, 6 times a week, each session lasting 45 minutes) of RAGT and CP. Each patient was assesed before and after training with Fugl-Meyer Lower extremity (FMA-LE), Functional Independence Measure (FIM), modified Ashworth Scale (MAS), 10 Metre Walk Test (10MWT) and Berg Balance Scale (BBS).
Results: Posttreatment results showed improvements for all evaluation parameters in both groups. However, group with 12 weeks duration protocol training showed significantly better improvements in FMA-LE, MAS, 10MWT than group assigned to 8 weeks protocol training.
Conclusion: 12 weeks training protocol induced better improvements of muscle strength, muscle tone and gait velocity. Our results indicate that longer duration of RAGT has a more beneficial effect on enhancing motor recovery in stroke patients.

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Auditory speller system for communication with patients in completely locked-in state

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Patients in completely locked-in state (CLIS) due to amyotrophic lateral sclerosis (ALS) cannot communicate with any motor response despite intact cognitive and emotional response systems. To help these patients to communicate, recently we demonstrated a novel non-invasive functional near infrared spectroscopy (*f*NIRS) based brain computer interface (BCI) for communication in ALS patients in CLIS. Patients learned to answer affirmative "yes" and negative "no" question with 70 – 75% accuracy using blood oxygenation change of their fronto-central brain region. The existing auditory BCI works by constructing a list of 20 questions randomly for each session from a list of 100's of questions recorded individually for each patient. Here we present a system which using the "yes" and "no" response obtained from the *f*NIRS BCI, can guess what a patient is thinking, allowing the patient to express his/her own thoughts and not simply to answer asked questions. The system is a variation of the Ulam's game, also known as "20 Questions". The patient is asked to think a simple sentence that s/he wants to communicate, and then the system starts to ask yes/no questions in order to narrow down the possible thoughts, until it can reasonably guess what the patient was thinking. After each question, based on the "yes/no" answer, a rating algorithm scores the possible thoughts previously stored in a database, and based on this score it chooses the next question. This procedure leads the algorithm to start with general questions and then going deeply to more specific ones. Since the system is not deterministic, it can handle misunderstood answers and can correctly guess even with low answer accuracy. In order to make a guess the system needs between 15 and 20 questions lasting 9 minutes, which is less than other error-handling systems that use binary signals. Tests with CLIS patients have been scheduled as the results from healthy subjects are encouraging and show good guess accuracy.

P137

Comparing MEG and EEG for monitoring the modulation of the 20-Hz motor-cortex rhythm to tactile and proprioceptive stimuli

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Introduction and objectives: Modulation of the 20-Hz rolandic rhythm reflects alterations in motor cortex excitability. Studies using magnetoencephalography (MEG) have shown that the 20-Hz rebound is associated with motor recovery after stroke. However, only a fraction of stroke patients can be reached with MEG. Here, we compared MEG and the more easily accessible electroencephalography (EEG) in quantifying the suppression and rebound of the 20-Hz rhythm to tactile stimulation and passive movement. Our motivation was to assess whether EEG is equal to MEG in quantifying modulation of the 20-Hz rhythm.
Materials and methods: Rhythmic brain activity of 15 healthy subjects was recorded with a 306-channelMEGand 60-channel EEG simultaneously. Tactile stimuli were given to the index finger tips of both hands alternately every 3 sec. The passive movement was performed with a pneumatic movement actuator to one index finger every 5 sec.Temporal spectral evolution (TSE) method was used to quantify the modulation of 20-Hz rhythmic activity.
Results: Both MEG and EEG revealed an initial suppression followed by a subsequent rebound of the 20-Hz rhythm in all subjects. The suppression of the rhythm was significantly stronger in the contralateral hemisphere when measured with MEG than with EEG ($p<0.05$), however no significant differences in the rebound strength were observed between MEG and EEG measurements.
Conclusion: Our results indicate that EEG equals MEG in quantifying the strength of the 20-Hz rebound, which particularly has been shown to reflect the functional state of the motor cortex after stroke. EEG allows quantification of the 20-Hz rebound in larger patient groups and also in severe stroke patients not suitable for measurements outside the ward. EEG based evaluation of motor rhythm would enable studies of motor cortex recovery even in rehabilitation centers outside hospital environment.

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Correction of sleep during brain-computer interface based communication in completely locked-in state patients

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Recently we demonstrated a successful functional near infrared spectroscopy (fNIRS) based brain computer interface (BCI) communication with 70-75% accuracy in four patients in completely locked-in state (CLIS). One of the major factors limiting the performance of the fNIRS-BCI is the sleep-wake cycle of patients

in CLIS as they may have an irregular circadian cycle. Very little is known about the sleep-wake cycle of patients in complete locked-in state (CLIS) due to amyotrophic lateral sclerosis (ALS). Patients in CLIS are completely motionless sometimes over years often with restricted vision because of eye-muscle paralysis and due to drying of cornea and reduced or absent afferent input from the sensorimotor system affecting their vigilance state. Hence the goal of the present study is to elucidate the sleep pattern in patients in CLIS, understanding sleep pattern can be very important to evaluate the performance of the BCI. Two nights of sleep EEG, lasting for 12 hours each, was recorded from 5 patients in CLIS. The EEG of patients in CLIS is not comparable with the EEG of healthy people. It is characterized by general slowing during daytime and sleep. Most advanced patients show a dominant frequency of 6-7 Hz with high amplitudes during waking states, an EEG-signature which usually indicates in healthy people sleep-stage 1 to sleep-stage 3. REM-sleep in CLIS (REM is difficult to detect because of absent eye-movements and absent EMG) appears at different times of the day and night. Short periods of sleep stage 1, 2, 3 and 4 during the day mark the irregularity of sleep in advanced ALS. The outcome of this study is the definition of the criteria for slow wave sleep (SWS) in each individual patient to classify sleep episodes, and circadian rhythm in order to reduce BCI error rate during the day and waking hours.

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Event-related potential-based cognitive assessment of patients in completely locked-in state

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Several studies have shown that patients in Locked-in state (LIS) due to amyotrophic lateral sclerosis (ALS) have intact cognitive processing but once the patient transition from LIS to completely locked-in state (CLIS) no assessment resources are available to understand the cognitive processing capabilities of the patient. The goal of this study is to develop an event related potential (ERP) based assessment procedure to elucidate the cognitive status of patients in CLIS. A patient in CLIS due to ALS was recruited for this study. It was carried out through Crawford and Howell's single-case methodology, which provides strong statistical foundations to compare a single case with a control sample. This design treats the control sample statistics as sample statistics, using the t-distribution with n − 1 degrees of freedom to estimate the abnormality of the patient's scores and to test whether it is significantly lower than the scores of the control sample. EEG was recorded in order to extract N1, an ERP component that reflects an early stage of auditory processing. Selective attentional processes can modulate the amplitude of this component. To prove this ability in ALS patients who have already entered the CLIS, we measured evoked potentials from Fz, Cz, Pz, F3, F4, C3, C4, P3 and P4 while presenting a dichotic oddball paradigm. According to previous studies, we expected: Bigger N1 amplitudes in Cz for the attended ear compared with the unattended one. Differences in N1 amplitude would reflect the underlying attentional process of favoring one ear over the other, and selectively excluding sensory input to the unattended ear for further processing. By visual inspection of the ERP´s and posterior statistical comparisons, we observed a common wave pattern between the healthy participants and the patient, which might reflect a relatively preserved attentional process of directing attention to one ear.

P140

Impact and effect of neurological rehabilitation on cognitive fatigue in multiple sclerosis

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Question: Fatigue is one of the three most frequent symptoms for 65 % of the Multiple Sclerosis patients1 and has a huge influence on the quality of life as well as on the ability to work2. Neurological rehabilitation is a socio-medico intervention to reduce the fatigue experience. Below, the effectiveness of rehabilitation on the experience of fatigue is investigated, considering depression, apathy and extroversion. Besides the effect of the psychoeducative FACETS program3 on the fatigue experience and depression is investigated.
Methods: The fatigue experience (FSMC, FSS), apathy (AES) and depression (BDI) were assessed four weeks pre rehabilitation, during rehabilitation as well as six weeks post rehabilitation.
Results: The rehabilitation measure results in a significant decline of fatigue (FSMC: $F(3,228) = 3.318$, $p = 0.021$), whereby cognitive aspects (FSMC cognition: $F(2.665,205.200)=3.296$, $p= 0.026$) and motor aspects [FSMC motor: $F(2.639, 203.208) = 2.942$, $P = 0.041$) decline equally. The fatigue score at the beginning of the investigation, the extroversion and partly the apathy score predict the fatigue score at clinic discharge and the follow-up assessment. The fatigue score decline is in the lower area of clinical relevance.The FACETS program does not show specific implications on fatigue. However, female participants show a significant reduction of depression ($F(2, 32) = 3.668$, $p = .037$) compared to the control group.
Conclusion: It is shown that rehabilitation has a lasting positive impact on the fatigue experience, especially cognitive fatigue. The integration of the FACETS program in neurological rehabilitation does not result in additional profit in fatigue reduction. Nevertheless, female participants of the intervention group show an improvement of mood, enduring three months after intervention. Further research is needed to significantly decline the fatigue experience in the context of a rehabilitation measure.

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P141

Impedance analysis of body composition and bioelectric activity of rectus abdominis and external oblique muscles – prospective observational study

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Question: Surface Electromyography (SEMG) is an electro-diagnostic method used in medical sciences for recording and evaluating bioelectric activity of skeletal muscles. This form of diagnostics is increasingly being used also in modern neurological rehabilitation, however, in order to obtain reliable and repeated results, factors affecting electromyography should be considered. It seems that these factors should include body fat

or total body water. Therefore, the following research question has been put forward: whether the analyzed components (by bioimpedance) of the human body affect electromyographic evaluation of rectus abdominis and external oblique muscles?
Methods: The target group consisted of 37 healthy volunteers. On the basis of the criteria for inclusion and exclusion for the study 29 people were qualified. Body composition analysis was performed by bioimpedance (Tanita BC 545N). Estimation of resting and functional bioelectric activity of muscles was performed by Noraxon MyoSystem 1400L. Correlation analysis was performed using Statistica 12 software. The project was funded by the Wroclaw Medical University allocated on the basis of the decision number ST.E060.16.059.
Results: Statistically significant negative correlations between the percentage of body fat and resting and functional sEMG muscle activity were found ($p < 0.05$). In addition we found that the higher percentage of water was positively correlated with the resting and functional bioelectric activity of the examined muscles ($p<0.05$).
Conclusion: Electromyographic evaluation of abdominal muscles depends on the amount of fat mass and the amount of water in the body. The amount of fat mass and the amount of water in the organism should be taken into account when determining the target group and during the design of surface electromyography studies while evaluating these muscles.

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Implementation and feasibility of a screening tool for neuropsychological assessment

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Introduction: Patients referred for neurorehabilitation often present with various cognitive and affective impairments relevant for everyday functioning. A comprehensive neuropsychological assessment is obligatory for detection of relevant dysfunctions, for referral to appropriate therapy, and to monitor the rehabilitation process. However, due to limited resources and short durations of stay, time for diagnostic evaluation is restricted.
Objectives: To develop and evaluate the feasibility of a time-efficient comprehensive neuropsychological-behavioral screening tool for assessing patients with stroke, traumatic brain injury, haemorrhage or neurodegenerative diseases as dementia, parkinson or multiple sclerosis.
Materials and methods: Attention, executive, language, episodic and semantic memory, visuoconstructive and visual functions as well as depressive mood and behaviour are screened. The single components of the screening represent well-established or newly developed tasks. The screening tool is being normalized in healthy controls and it is applied in very different patients for validation and testing its feasibility.
Results: First results confirm the feasibility of this screening tool. Importantly, mild aphasia, neglect, hemianopia and hemiplegia are no exclusion criteria. First data from both patients and a normative control sample are presented. In patients without significant psychomotor speed or attentional deficits, the total screening can be performed within 30 minutes.
Conclusion: We present a time-efficient neuropsychological screening tool which can be performed in the majority of respective patients with very different conditions in neurorehabilitation.

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Low- vs. high-density EEG conFig.urations for brain computer interfaces based on movement imagination in patients after spinal cord injury

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Background: While the greatest interest about brain computer interfaces (BCIs) within neurosciences has slightly declined recently, clinical applications of BCIs are still an emerging field. BCIs are typically based on the electroencephalogram (EEG) and on imagination of movement. Clinical applications such as neurorehabilitation after spinal cord injury (SCI) yield promising results with these techniques. One notable problem is a low performance of these systems in patients because most developments were targeted at healthy populations. We aim to document the potential improvement of this technique by use of high density (HD-)EEG instead of conventional 10-20 system recordings.
Methods: We recorded HD-EEG with 256 channels in 22 healthy controls and 6 patients with 11 recordings (3 patients with repeated recordings) in an event related design. Participants were instructed acoustically to perform imagination of movement of the foot or the hand. Every trial lasted 6 sec, during which the movement-imagination was paced to form 6 complete movements. From each of the 25 repetitions per condition we calculated two measures of interaction (connectivity): full frequency directed transfer function and partial coherence. We classified these feature vectors of the two conditions with support vector machines, nested cross-validation and a wrapped feature subset selection technique, based on four conFig.urations of low vs. high density and whole-brain vs. sensors from the somatosensory cortex, only.
Results: As in recent publications, classification accuracies were higher in healthy participants than in patients. In both groups, whole brain coverage increased the classification accuracies, but high-density results had to be traded off with the complexity of the feature vector, which decreased the capability of the feature subset selection process to find the most informative channels.
Conclusions: The performance of BCI systems in patients with SCI may be increased by use of measures of interaction and efficient feature subset selection techniques. We suggest to use high-density recordings and to not restrict recordings to the sensomotoric region.

P144

Neurovascular reactions to animal-assisted therapy in patients with severe disorders of consciousness – a randomised controlled pilot study

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Introduction: Experiences from practice and a first case study indicate that animal-assisted therapy (AAT) is an emerging treatment for patients with severe disorders of consciousness (DOC) that can lead to a rise in vegetative, emotional and motoric reactions (Bardl, 2013).
Objectives: The aim of this pilot study is to investigate the effect of animal presence and contact on awareness and reactivity in patients in a minimally conscious state (MCS), reflected via brain activity.

Methods: Six adults (three MCS inpatients of REHAB Basel, GCS=9-11, and three healthy adults; mean age=42.2, SD=13.9) participated in this randomized, controlled within-subject study with repeated measurement. Participants were measured during six sessions over a period of two weeks, with three experimental (small therapy dog, guinea pig or rabbit present) and three control sessions (robotic fury animal present). Each session consisted of five different phases: Two baselines, watching animal, animal on lap, stroking animal. Participant's neurovascular response was measured using a portable, non-invasive, near-infrared spectroscopy (NIRS) device. Blood oxygen levels (HbO2, HbR, total Hb) during the session served as a correlate for brain activity.
Results: To date, common artefacts were removed and data prepared for further analysis. The total haemoglobin concentration (total Hb) was normalized for one patient so far. The total Hb neuro vascular response measured was bigger in the presence of a lively animal than during the control condition (robotic animal). The total Hb increase was largest when the patient was in physical contact with the lively animal (e.g. animal on patient's lap and while stroking it). The neurovascular response with the lively animal on the patient's lap without stroking it was more persistent than when stroking.
Conclusion: The preliminary data indicates that DOC patients react to the presence of and contact with an animal. The presence of an animal leads to a measurable difference in the neurovascular reaction in the investigated patient. NIRS can therefore serve as a non-invasive method for investigating the benefits on brain activity during an animal assisted therapy session in MCS patients. Complete results and clinical implications will be presented.

P145

Physical exercise, neuroplasticity and cognition following mild traumatic brain injury

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Introduction: Following mild traumatic brain injury (mTBI), cortical inhibitory/excitatory imbalance and alterations in synaptic plasticity mechanisms occur. Changes in cognition are frequently noted and so it is conceivable that changes in brain physiology may be associated with early cognitive deficits. Physical exercise (PE) may improve cognitive functions, possibly via improvements in brain physiology and measurements of Insulin-like grown factor -1, may allow for greater mechanistic insight. **Objectives:** To assess the effects of a bout of PE on mechanisms of brain plasticity and executive functions following mTBI whilst measuring IGF-1 response to exercise.
Patients and methods: Healthy controls and patients with mTBI (<6months post injury) are being recruited. Transcranial magnetic stimulation (TMS) is used to probe mechanisms of cortical reactivity (paired pulse TMS) and synaptic plasticity (intermittent theta-burst stimulation). Serum samples IGF-1 are taken pre/post intervention. Executive functions (CANTAB software) are assessed pre/post intervention. The exercise intervention involves 30-minutes of static cycle ergometer cycling 40–60% heart rate reserve with a control intervention consisting of a seated rest.
Results: 9 (of 20) healthy controls and 1 (of 20) mTBI patient have enrolled. Preliminary analysis (healthy controls) show mean heart rate of 49% heart rate reserve in exercise intervention. Serum IGF-1 pre/post changes in the exercise condition appear larger (178.3/3 ng/mL–183 ng/mL) compared to the rest condition (178 ng/mL–179 ng/mL). Paired pulse TMS data demonstrates a significant increase in intra cortical facilitation (increase in cortical excitability) after the exercise intervention (118.33%) compared to after the rest intervention (63.23%) (p=0.0178). An approaching significant 56.77% pre/post improvement in incongruence cost (P=0.062) of the multi tasking test is seen in the exercise condition with a 24.02% improvement in the rest condition (p=0.67).
Conclusions: Preliminary results in healthy controls suggest that exercise may increase cortical excitability and potentially modulate levels of IGF-1. Early cogntive results are promising. Continuing aims are to assess if these results are similar in mTBI patients currently being recruited. If so, these mechanistic insights may help improve therapeutic targets as well as gauge the effects of different exercise parameters on cognitive recovery.

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Quality of life in amyotrophic lateral sclerosis patients in completely locked-in state

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Amyotrophic Lateral Sclerosis (ALS) is a neurodegenerative motor neuron disorder which causes an individual to be in locked-in state (LIS) and maybe finally in a completely locked-in state (CLIS). Once the patients are in CLIS, they have no means of communication and for a long period, it was believed that patients in CLIS are depressed due to a very bad quality of life (QoL). So far all attempts to establish communication with patients in CLIS had been unsuccessful because which it was impossible to investigate their QoL. Only recently, we for the first time demonstrated a successful functional near infrared spectroscopy (fNIRS) based brain-computer interface (BCI) communication with patients in CLIS. The fNIRS based BCI have now provided us the means to investigate the QoL of patients in CLIS. Hence the main focus of this study is to use the fNIRS-based BCI to understand the QoL of patients in CLIS. We developed a QoL questionnaire for patients in CLIS based on the QoL questionnaire for patients in LIS. Three patients in CLIS were asked the developed QoL questionnaire, auditory, using the fNIRS-BCI, and all the three patients in CLIS used their metabolic brain activity for answering QoL questions with "yes" or "no" thinking. The sample questions asked were, "Are you happy today?", "Are you tired?" We included questions in reference to time to evaluate the change in emotional levels, e.g., "You feel relaxed today". Our results show that the QoL in CLIS is better than what relatives perceive their QoL to be. Potential reasons of underrated QoL of ALS patients could be the inability of family members and caregivers to imagine how a completely paralyzed person might be feeling about their day to day experience. Investigation of QoL in these patients provides a better perspective, which will help ALS patients to make an informed decision about their life in the later stages of the disease and the healthcare programs can be tailored as per the requirement of these patients.

P147

The Cognitive Assessment scale for Stroke Patients (CASP) – validity and reliability

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Introduction: The "Cognitive Assessment scale for Stroke Patients" (CASP) is a brief quantitative measure of post-stroke cognitive impairments. Its items do not require verbal answers (apart from language items). Therefore, it can be administered to patients with severe expressive aphasia. We have previously shown that the CASP is more suitable than the Mini Mental State Examination and the Montreal Cognitive Assessment in aphasic and in non-aphasic sub-acute stroke patients [1, 2].
Objectives: To assess the validity and reliability of the CASP, and to set normative scores.
Patients and methods: Seventy four sub-acute stroke patients (sex-ratio 1.55, 61±13y, 42 right lesions) admitted to 4 neurorehabilitation units and 33 control patients (sex-ratio 1.06, 57±15y) admitted to 3 musculo-skeletal rehabilitation units were included. Stroke patients underwent a comprehensive neuropsychological assessment (CNA) at Day-1and the CASP at Day-1 (examiner A), Day-3 (examiner B) and Day-5 (examiner B). The CNA resulted in a 5-point Likert score (from "no deficiency" to "severe deficiency") for each of the six following dimensions: language, praxis, short-term memory, temporal orientation, visuo-spatial and executive functions (same dimensions as the CASP). The CASP was administrated once in controls patients for normative data.
Results: For each of the six above-mentioned dimensions, correlations between CASP and CNA (criterion validity) were high (r=0.62 to 0.81, p<10-4), except for Praxis (r=0.44, p=0.0004), although statistically significant. Intraclass correlation coefficients between Day-1 and Day-3 CASP scores (inter-rater reliability) and between Day-3 and Day-5 CASP scores (intra-rater reliability) were high (0.75, 0.87 respectively). Median score [interquartile range] in control patients were 34/36 [33-35/36].
Conclusion: The CASP is a valid and reliable tool for assessing cognitive impairments in sub-acute stroke patients. As inclusions are still ongoing, more results will be presented, including normative data sorted by age and responsiveness.

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P148

Imagine there is no plegia: Mental motor imagery difficulties in patients with spinal cord injury.

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Introduction: In rehabilitation of patients with spinal cord injury imagination of movement is a candidate tool to promote long-term recovery or to be used in research and application of brain-computer interfaces (BCIs). However, little is known about the ability of patients with spinal cord injury (SCI) to perform this task. It is likely that without the ability to effectively performing the movement, the imagination of movement is also problematic.
Objectives: We therefore examined, whether patients with SCI experience increased difficulties trying in motor imagery (MI) compared to healthy controls.
Materials and methods: We examined 7 male patients with spinal cord injury (aged 23–70 years, Md=53) and 20 healthy controls (aged 21–54 years, Md=30). Four patients were graded as AIS (ASIA Impairment Scale) D and three as grade C. All had cervical lesions, except one who had a thoracic injury level. Duration after injury ranged from 3 to 214 months. We performed the Movement Imagery Questionnaire Revised as well as the Beck Depression Inventory in all participants.
Results: The self-assessed ability of patients to visually imagine movements ranged from 7 to 36 (Md=30) and differed significantly from healthy controls (ranged 16–49, Md=42.5; W=326.5, p=0.0393). Also the self-assessed ability of patients to kinesthetically imagine movements (range=7-35, Md=31) differed significantly from the control group (range=23-49, Md=41; W=234, p=0.0035). Two patients yielded tendencies for depressive mood and they also reported most problems with movement imagination. Statistical analysis however did not confirm a general relationship between depressive mood and increased difficulty in MI across both groups.
Conclusions: Patients with spinal cord injury seem to experience difficulties in imagining movements compared to healthy controls. This result might not only have severe implications for training and rehabilitation programs, but also for applications like BCIs used to control neuroprostheses, which are often based on the brain signals exhibited during the imagination of movements.

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Development of an auto-adapted rehabilitation serious game for hemineglect

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Introduction: Patients with hemineglect are impaired at perceiving and responding to contralesional space and/or objects. The condition significantly hinders daily activities, including personal grooming, eating and moving around the environment. Despite spontaneous recovery, persistent signs can remain at least one year after the brain damage. Current rehabilitation have shown positive effects, but none are completely effective. Our objective is to develop a serious game that evaluates and rehabilitates hemineglect in correspondence to the patients individual impairment severity.
Objectives: The two studies presented in this poster investigated factors that could precisely regulate a robotic therapeutic serious game for hemineglect. In Study 1, we investigated the relevance of different attentional cues to facilitate attention, and in Study 2 we investigated the impact of distractors to increase game difficulty.
Methods: Study 1: Eight hemineglect patients were tested using a target detection task on an interactive robotic device. Eight different cues were presented in each trial to help the patient find the target among a fixed number of distractors. In addition, a condition without cue was presented as control condition. The cues were presented randomly. Study 2: Eight healthy participants were tested using the same task as Study 1. The target was presented among a variable number of distractors (0, 48, 96, 144). For both studies, reaction time for each trial was recorded.
Results: Study 1: A repeated measures ANOVA showed that four

of the eight cues significantly helped the patient find the target on the neglected side, relative to the control condition. Study 2: A linear mixed model demonstrated that reaction time increased linearly with the number of distractors, providing a mathematic equation for determining game difficulty.
Conclusion: The two studies reported in this poster allow us to regulate game difficulty, creating an auto-adapted serious game. In the final game, patients with major deficit will first receive exercises with a small number of distractors and salient cues to reorient attention. As the patient improves, the number of distractors will increase following the mathematic equation, and the cue will be less presented. This new serious game provides an auto-adapted rehabilitation matched to the patients level of performance.

P150

Contra-lesional evaluations of resting-state functional connectivity after stroke: a pilot study

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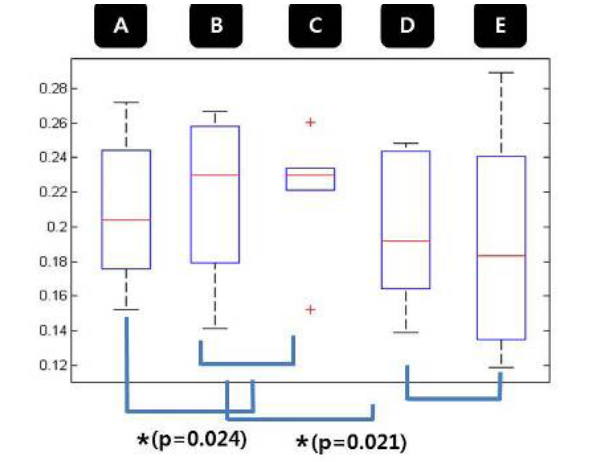
Question: The purpose of this study is to investigate the longitudinal changes in the neural correlates of contra-lesional hemisphere among stroke patients with disparate motor recovery using functional near-infrared spectroscopy(fNIRS).
Methods: 14 first-ever acute to sub-acute stroke patients and 8 age-matched control subjects were recruited for a longitudinal observational study. Patients were evaluated with fNIRS at around day 1(To) and day 15(T2) of in-patient rehabilitation program, and 3 months after onset of stroke(T3) in their resting state for 7 minutes. Motor evoked potential(MEP) in the hemiplegic upper extremity was done initially, and the recovery of patients was evaluated using outcome measures such as Fugl-Meyer assessment of upper extremity(FMA-UE), Box and block test(BBT), Finger tapping test(FTT) and Brunnstrom stage(BS) at each time point. Patients were divided into two groups according to the degree of initial motor impairment. Patients with FMA-UE under 25 score and without MEP response were classified as severely impaired(SG) and the remaining patients were classified as mild impaired(MG). The sequential changes in neural network in the brain were analyzed regarding 6 regions of interest(ROI) which were dorsolateral prefrontal cortex(DPC), supplementary motor cortex(SMC), premotor area(PMA), primary motor cortex(PMC), primary sensory cortex(PSC) and parietal association area(PAA).



P150 Fig. 1

Results: Among 14 stroke patients, 6 participants were classified as MG. The resting-stage functional connectivity analysis regarding the evaluation of contra-lesional hemisphere showed that global efficiency of the contra-lesional hemisphere increased at To and remained at T2 in MG. The global efficiency of the contra-lesional hemisphere tended to decrease in SG but did not show a statistically significant difference compared to the normal control group(Fig. 1). Clinical indicators did not show a statistically significant association with neural network changes on contra-lesional hemisphere.
Conclusions: The efficiency of resting-state global transfer has increased in contra-lesional hemisphere during recovery only in subjects with mild motor impairment. The current study provides new evidence of the neurophysiological mechanisms underlying neuronal plasticity processes after stroke, and suggests that these changes related with initial severity of impairment.

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Application of botulinum toxin for spasticity after subarachnoid hemorrhage – a case report

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Introduction: The use of Botulinum Toxin type A (BoNT/A) has been reported for the treatment of spastic neuromuscular conditions. By acting selectively on peripheral cholinergic nerve endings, botulinum toxin leads to chemodenervation and local temporary paralysis. This relieves muscle over-activity, wich has been shown to be a cause of muscle shortening and the associated limitations in both active and passive range of motion. Case
Diagnosis: Female patient, 49 years, with history of epilepsy, who suffered a subarachnoid haemorrhage Hunt & Hess II, Fisher 3 complicated with bilateral middle cerebral artery infarct and secondary hydrocephalus. A ventriculoperitoneal shunting was performed but two-time replacement was required. After these interventions the patient developed a preferential position of the neck in flexion (25º) and left lateralization (30º) with associated pain refered on the left side of the neck, wich scored 6 on the visual analogue scale (VAS). Initially treated 4 weeks with NSAIDs and Physical Therapy, with poor improvement. Application of BoNT/A was perfomed. We applied 100U of Botox in muscles of left sido of the neck: 20 UI in two points of Sternocleidusmastoideus, 30UI in levator scapulae and 30UI in splenius capitis. After 3 weeks, the patient does not report pain (VAS=0) and presents

P151 Fig. 1

P151 Fig. 2

an adequade position of the neck (0° of flexion), with a slight left lateralization of about 10 degrees, wich we documented photographically (**Fig.1.** Images after 4 weeks of conventional teraphy; **Fig.2** Images 3 weeks after application of BoNT/A) .

Conclusions: We conclude that this minimally invasive technique should be considered for the management of pain and muscle contractures resistant to conventional therapy. This procedure, alleviating muscle over-activity also ease extrinsic stretching of the muscle, thus facilitating subsequent therapeutic stretching modalities.

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P152

Facial synkinesis after Bell's palsy are caused by neuroplastic changes in patient's dominant mimetic patterns, not by aberrant regeneration of the facial nerve

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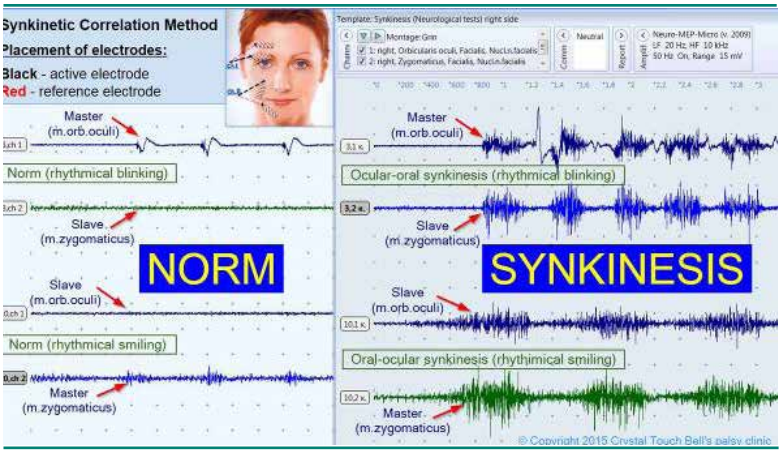
Question: Primary: substantiate (based on concrete results achieved by patients of Crystal Touch clnic) that the main cause of facial synkinesis is a change in patient's dominant mimetic behavior that results in forming of new, pathological mimetic patterns. Secondary: can the theory of aberrant regeneration adequately explain the reversibility of facial synkinesis without medications, injections of Botox or surgical interventions?

Methods: For 65 patients (52 female and 13 male, age 8–75, time since the onset >1year) we measured oral-ocular and ocular-oral synkinesis using Synkinetic Correlation method during 6 to 9 months of Neuro-Proprioceptive Rehabilitation (NPR) programs. Patients learned to perform specially composed tasks that were aimed at distracting the subject from paying excessive attention to the execution of given exercises and techniques. We monitored progress by regular measurements (interference patterns of synkinetic activity), by test-pictures (9 standard facial expressions) and adjusted the programs accordingly. We also analysed positive changes in patients' mimetic patterns and improvements in their mimetic behavior in an attempt to explain those improvements from the position of the concept of aberrant regeneration.

Results: After rehabilitation programs, Synkinetic Correlation in 63 patients reduced on average from 0.5–1.3 to 0.2–0.6. Two patients showed no improvement. The use of complex, multilayer exercises and techniques that engage elements of attention distraction, had demonstrated that when the mind of a patient is actively busy with a distracting task, the intensity of synkinetic movements decreases. When a patient is made conscious of this phenomenon and learns to make it his or her new mimetic habit, synkinesis gradually decrease and then reverse permanently. We could not explain positive changes in mimetic patterns from the position of aberrant regeneration of facial nerve.

Conclusions: Facial synkineses result from new, subconscious dominant mimetic behavior that forms during long recovery period: to engage volitional mimetic center of the brain and constantly "ämplify" facial movements. This dominant behavior gradually transforms into a conditioned reflex that controls all mimetic movements on the affected side - emotional, volitional and reflexive. This approach explains appearance of synkinetic movements in a blink reflex test that was the foundation of aberrant regeneration concept by Prof. J.Kimura (1975).

P152 **Fig. 1**



P152 **Fig. 2**

P153

Novel multi-pad functional electrical stimulation in stroke patients

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Objective: To evaluate efficacy of additional novel multi-pad FES system to conventional therapy in comparison to conventional therapy only in facilitating motor recovery in the lower extremities and improving walking ability after stroke.

Methods: Sixteen stroke patients were randomly allocated to the FES group (novel multi-pad FES therapy plus conventional rehabilitation program) (n=8), and control group (conventional rehabilitation program) n=8. Conventional therapy included 60 minutes each for physiotherapy and occupational therapy. FES was delivered for 30 min during gait to induce ankle plantar and dorsiflexion. Main outcome measures: gait speed using 10 Meter Walk Test (10 MWT), Fugl-Meyer Assessment (FMA), Berg Balance Scale (BBS) and modified Barthel Index (MBI).

Results: Results showed a significant increase in gait speed in FES group ($p<0.001$), improvement in functional independence in the activities of daily living and motor recovery.

Conclusion: The present study's findings suggest that initiation of our novel FES therapy combined with conventional rehabilitation is more effective on walking speed, mobility of the lower

extremity, balance disability and activities of daily living compared to a conventional rehabilitation program only.
Keywords: Foot drop, Multi-pad FES, Stroke, Rehabilitation

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Physical therapy for freezing of gait in Parkinson's disease – a systematic review

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Introduction/aim: Freezing of gait (FOG) is a major cause of falls and disability in Parkinson's disease (PD) and often refractory to medication. Physical therapy (PT) including treadmill and cueing reduces FOG. The aim of this systematic review is to assess the evidence for the various interventions for FOG and to establish recommendations for clinical practice.
Method: Systematic search in PubMed, Embase, Physiotherapy Evidence Databases (PEDro) and Cinahl for randomized controlled trials (RCT) of Physical Therapy for FOG in PD with the adapted search equation for the keywords Parkinson's disease, freezing of gait, physical therapy, cues, treadmill, coordination and balance (up to May 2017) was performed. Both investigators independently assessed methodological quality using the PEDro Scale and based their writing on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA Statement).
Results: Sixteen randomized controlled trials were included (median PEDro Scale score of 6, range=4–8): in 8 RCTs, physical therapy for FOG was assessed which was primary outcome measure in 6 RCTs. In 8 RCTs, physical therapy for gait disturbances (without specifying presence of FOG) in PD was assessed. Following PT interventions reduced FOG: treadmill walking (8 studies with class II) cueing strategy learning: visual (6 studies with class I–II), auditory (8 studies, Class I–II), tactile (3 studies, class I–II) and balance and training (2 studies, class II). The results show there is an important and immediate effect on FOG and gait disturbances in kinematic gait analysis (cadence, stride and step length) with auditory and visual cues, and treadmill (class II). The results show that the combination of the intervention has good results, too. In majority, the interventions have short effect.
Conclusion: There is evidence level A (effective) for treadmill and cueing (visual and auditory) and level B (probably effective) for tactile cues and balance exercises. We can propose the cueing and treadmill intervention for the management of FOG in PD patients and to improve the gait disturbances.

P155

Rehabilitation of Lance-Adams Syndrome – a multidisciplinary approach

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Introduction: Chronic post-hypoxic myoclonus, also known as Lance-Adams syndrome (LAS) is a rare complication of cardiorespiratory resuscitation (CPR). It is characterized by uncontrolled action myoclonus and cerebellar ataxia. There have been only 150 cases reported in the literature, making it one of the rarest movement disorders. The exact pathophysiology of LAS is still not clear, there is no guideline for treatment of the disease, and it constitutes a challenge for neurologists and physiatrists.
Case report: We report a case of a 67 year-old woman, who had a cardiac arrest after an anaphylactic shock due to lisinopril intake. CPR was performed for about 5 minutes. All her vital signs were back to normal; she underwent immediate sedation and was admitted in intensive care unit for 1 week. After suspension of the sedation, she showed myoclonic jerks in limbs, which were aggravated by voluntary movements, but disappeared with relaxation of the body and sleep. She had normal muscle strength and reflexes. She was entirely dependent in ADL and unable to walk. Cranial CT and MRI showed no abnormalities. EEG was negative for seizure. She was medicated with clonazepam 5mg id, with only slight improvement. She was transferred in an inpatient rehabilitation center 2 months after the cardiac arrest, where she underwent a tailored rehabilitation program, involving adjustment of drug therapy, physiotherapy, occupational therapy, hydrotherapy and psychotherapy. After 2 months of treatment she showed notorious improvement in Unified Myoclonus Rating Scale and Functional Independence Measure.
Conclusions: The prognosis of LAS seems good when the treatment is started early. However, additional research is needed to understand its pathophysiology and to establish guidelines for its treatment.

P156

The effects of semantic auditory cueing on lexical retrieval in chronic Broca's aphasics

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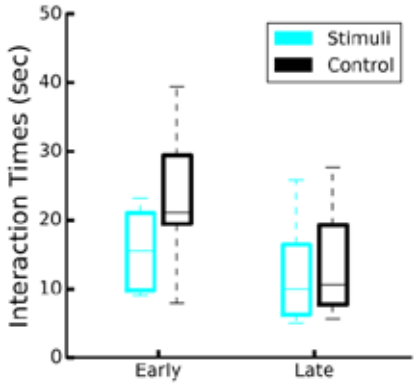
One third of stroke patients suffer from aphasias. Word retrieval disorders compromise quality of life of affected individuals often leading to depression which can adversely influence recovery [1]. Traditional methods for counteracting anomia include semantic, phonemic or orthographic cueing [2]. Grounded in the theory that concepts are functionally coupled to sensory brain regions [3], here we propose an alternative, semantic auditory cueing (SAC). In particular, we predict that providing lexicon with semantically related sounds (i.e. ringing for "telephone") will facilitate verbal execution in Broca's aphasics resulting in faster responses. Present results constitute a part of an ongoing longitudinal clinical intervention. 8 chronic Broca's patients participated in the study, which lasted 8 weeks and consisted in 5 daily training sessions. Following the principles of ILAT [4], all patients underwent a multiplayer VR-based language therapy[5] delivered in a form of a language game **(Fig. 1)**. During each session, 2 patients played with each other by requesting objects. To determine whether SAC facilitates word retrieval, half of the stimuli were provided semantic auditory cues. Cued and

P156 **Fig. 1**



P156 **Fig. 2:** Effects of SAC

non-cued stimuli were presented in a pseudorandom manner, counterbalanced within every session. We computed interaction times (ITs), defined as the time interval between the selection and collection of an object, throughout the therapy interval. To further quantify the improvement, prior to the intervention and at every second week we administered a vocabulary test (VT). Our results show faster ITs, in the cued compared to the non-cued stimuli ($p<.05$), only in the early sessions ($N=15$) when the exposure to the lexicon is still low **(Fig. 2)**. Additionally, we report a high, significant correlation between the ITs and performance on the VT ($r=-.99$, $p<.001$). Taken together, our results suggest that the proposed semantic auditory cues facilitate word retrieval in chronic Broca's aphasics, which might be a promising treatment strategy for anomia.

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The relationship of cortical activity and recovery of upper limb sensorimotor impairments after stroke – a systematic review

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Introduction: At six months post-stroke, 33–66% of survivors do not present with full recovery of upper limb function (Kwakkel & Kollen, 2013). Identified predictors for poor upper limb sensorimotor recovery are increased stroke severity, more severe somatosensory and motor impairments and the presence of visuospatial neglect (Meyer et al., 2016). Two methods of measuring cortical neurophysiological mechanisms of brain recovery in relation to sensorimotor recovery in stroke, are electroencephalography (EEG) and magnetoencephalography (MEG). Disruption of neural connectivity can then be measured by event related potentials such as somatosensory evoked potentials (SSEPs) and event related synchronisation analyses.
Objective: To examine the current evidence about the changes of cortical activity measured by EEG or MEG in association with sensorimotor upper limb impairments in stroke.
Materials and methods: In order to identify the relevant studies, electronic searches, abstract and full-text papers were independently reviewed by two reviewers. From 1614 papers, 32 papers were selected for risk of bias assessment. Nine papers were then included in the review; 7 used EEG and 2 used MEG methodology.
Results: In total, 321 people with stroke were included. Preliminary findings showed that: (a) presence, latency and amplitude of SSEPs in the acute stage could give an indication about the outcome of upper limb motor impairment post stroke and (b) inter-hemispheric imbalance involving higher alpha event related synchronisation in the ipsilesional hemisphere could be more pronounced with moderate than mild upper limb motor impairments.
Conclusion: SSEPs could give neurophysiological insight of upper limb motor outcome of people with stroke. However, further in-depth research exploring event related synchronisation and functional connectivity analyses in ipsilesional and contralesional hemispheres in people with sensorimotor upper limb impairments from the acute to chronic stages of stroke is required.

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P158

Traumatic brain injury – a 5-year Portuguese rehabilitation centre experience

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Purpose: To characterize a Portuguese population of TBI patients, with first admission in an inpatient rehabilitation centre between January 2010 and August 2016.
Methods: Retrospective study, in which were analysed: demographic data, TBI etiology, severity based in Glasgow Coma Scale (GCS), anatomic classification, presence of seizure at onset, need of neurosurgical treatment, Functional Independence Measure (FIM) at admission and at discharge, time between lesion and rehabilitation centre admission and the main complications.
Results: The sample included 123 patients, of which 83% were male, 45% had between 31 and 50 year-old. In patients younger than 50 year-old the main cause of lesion was motor vehicle accidents and in those older than 65 year-old the leading cause were falls. The majority of patients had severe TBI (GCS 3–8). There were onset seizures in 12%, 32% needed craniotomy and 15% showed diffuse axonal lesion. The main complications were: spasticity (45%), bladder or bowel disorders (44%), dysphagia (38%), seizures (8%), antidiuretic hormone inappropriate secretion (7%) and heterotopic ossification (4%). The mean motor FIM value was 38 at admission and 63 at discharge. The mean cognitive FIM value was 20 at admission and 24 at discharge. The majority of patients (40%) had an inpatient rehabilitation stay of 3 to 6 months of duration.
Conclusion: This study is a contribute for the understanding of epidemiological characteristics of TBI in the Portuguese population. These results are similar with those of international literature.

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Virtual reality activities and multimedia content into rehabilitation programme in Parkinson's disease – application of the Human Empowerment Aging and Disability (HEAD) protocol

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Question: Living with chronic disability has a crucial impact on quality of life (QoL) due to motor and cognitive difficulties and social restrictions in daily life. The integration of new technology with innovative exercises performed in a virtual reality environment within rehabilitation programs offer to persons with chronic disabilities new effective and motivating ways of rehabilitation. The present study aims to verify the feasibility and efficacy of an innovative rehabilitation treatment (Human Empowerment Aging and Disability- HEAD) based on neuromotor activities in virtual reality environment for patients with Parkinson's Disease (PD) in clinic.
Methods: 31 outpatients with chronic PD with a mean age of 66.84±9.13 were enrolled. Three times a week participants conducted a 1-hour-HEAD-rehabilitation session (N=12) in addition to usual care. The HEAD activities consisted in neuromotor exercises (motor, cognitive and dual task) in a virtual reality environment incorporated in short video clips. The interaction with the scenario occurred through movement sensor devices such as Kinect and Leap Motion. The efficacy of the treatment was assessed on balance (Berg Balance Scale), walking performance (2 Minutes Walk Test, for endurance ; 5 Meters Walk Test, for speed), mobility (9 Hole Peg Test and Box and Block Test), global cognitive function (Montreal Cognitive Assessment) and affective state (Positive and Negative Affective Schedule). The comparison of outcome measures before (To) and after (T1) HEAD rehabilitation were performed using Paired or Wilcoxon tests as appropriated (.05, two tailed).
Results: Data reported a good adherence of patients to treatment (84.94%). After the 12 HEAD session training, outcome measures highlighted an increase in balance, walking endurance bur not speed, motility, global cognitive level and also in the affective state, in term of an increment of the Positive Affect Index (all ps <.05).
Conclusion: Data supported the feasibility of HEAD rehabilitation in clinic on different functions. Results also suggested the effectiveness of HEAD protocol treatment in enhancing patient engagement and motivation. Future steps will test the applicability and effectiveness of HEAD protocol for the continuity of care at home in patients with chronic disability.
Acknowledgments: This research was supported by Fondazione Cariplo. We thank the HEAD consortium for providing the opportunity to conduct this research

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Evaluation of the plantar fascia thickness along its length in equivalent locations in both feet

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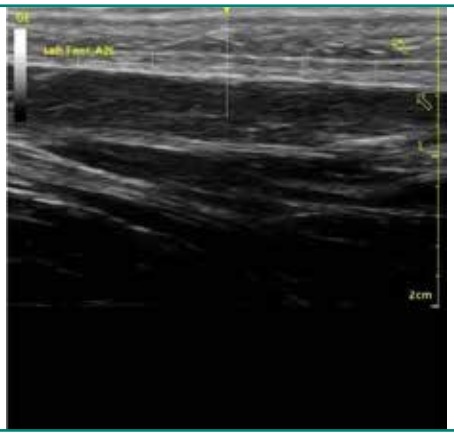
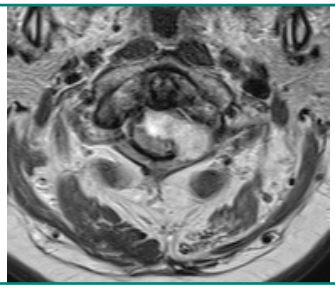
The purpose of this research is evaluating plantar fascia thickness along its length and quantifying plantar fascia thickness in equivalent locations in both feet in living individual. It is believed quantified plantar fascia thickness is parameter to study plantar fascia structure, plantar fascia function and plantar fascia injury in both feet. Thickness of the plantar fascia



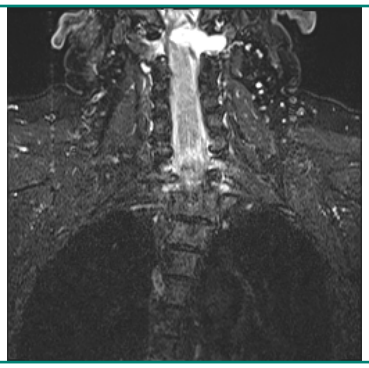
P160 Fig. 1

P160 Fig. 2

is different along the length of the plantar fascia and plantar fascia thickness is unlike in equivalent locations in both feet. So it was decided that plantar fascia thickness is evaluated along its length in equivalent locations in both feet. This research was done through a three-step method; Step1) Literatures were reviewed to search the results, gaps and problems within previous studies about plantar fascia evaluation with Ultra sound. Step2) Plan of investigation to evaluate plantar fascia thickness was designed based on six landmarks and three reference lines. Step3) Plantar fascia thickness was scanned and evaluated in equivalent locations on both feet in sagittal and frontal planes in three areas of the plan of investigation.
It was found to approach the real thickness of the plantar fascia in living individual is achievable, individually. Outcome of the plantar fascia thickness evaluation of an individual with70 Kg was; in areas 1, 2 3 longitudinally; (3.8±0.4mm), (1.2±0.7mm), (1.3±0.3mm), transversely; (2.3±1.0mm), (1.1±0.6mm), (1.4±0.2mm).The percentage of the body weight applied in identified locations of the plantar fascia in erect posture in areas 1, 2, 3 was (0.6%±0.18%), (0.7%±0.09%), (0.6±0.67%), in mid stance was (0.8%±0.25), (1.0%±0.052%), (0.8%±0.28%) and in double support was (1.1%±0.27%). In locomotion; range of length, width and applied load in area 1 was (82–86mm), (14–27mm), (35–90 KPa), in area 2 was (108-119mm), (40–50mm), (65–75KPa) and in area 3 was (163–176mm), (40–53mm), (35–100 KPa). In static; range of length, width and applied load in area 1 was (72–76mm), (24–30mm), (35–65 KPa), in area 2 was (101–103mm), (44–53mm), (45–60 KPa) and in area 3 was (149–155mm), (38–45mm), (40–50 KPa). Concluded quantitative information can be useful and applicable in differential diagnosis, rehabilitation and to relieve pain in static and locomotion.



P161 Fig. 1



P161 Fig. 2

P161

Improving outcome after spinal neurinoma surgery with neurorehabilitation

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Introduction: Intraspinal neurinomas present with unspecific symptoms, leading to delay until diagnosis. Surgery can achieve total tumor removal but residual symptoms are common.
Objective: To highlight the importance of Neurorehabilitation in order to improve outcome after spinal neurinoma surgery.
Method: Case report. Case description: We report about a 68-year-old female, who was suffering from night pain in her extremities starting 01/2016. MRI of the cervical spine was done a year after first consultation with neurologist. It showed intraspinal tumor located dorsally to cervical vertebra 2/3, with contrast enhancement. Surgical total tumor removal was performed 02/2017 at Neurosurgery, Jena University Hospital. Histology revealed neurinoma (WHO grade I). Patient was admitted to Mediclin, Klinik Am Brunnenberg Neurorehabilitation Unit, Bad Elster a month after surgery. At admission, patient complained of persistent neck pain, reduced general strength, gait ataxia with increased risk of slipping, maximal walking distance was 70m, climbing stairs was reduced to few steps up and down, fine motor problems with difficulties in Activities of Daily Living, especially in writing and depressed mood. Neurorehabilitation was 3 weeks of intensive physiotherapy, functional occupational therapy, balance training, treadmill, water aerobic exercises, muscle relaxation and, general muscle building training, soft massage of neck muscles, neuropsychological individual treatments sessions.
Result: Neck pain recovered completely and considerable improvement in all functional areas was made, patient was able to walk 300 m with safe gait, climb 36 stairs up and down, accomplishment of Activities of Daily Living had become much easier and mood was happy. The importance of Neurorehabilitation lies in improvement of all functions and patient's quality of life after surgery. According to a study by Peng Li et al 50% of patients are symptom free and go back to normal life without any functional impairment after intraspinal tumor surgery. Intensive targeted Neurorehabilitation could be very useful in order to increase this percentage.
Conclusion: Neurorehabilitation fastens recovery of function but also increase cardiovascular capacity mood and well being. Neurorehabilitation is a good adjunct to surgery in order to improve long term functional outcome after spinal neurinoma surgery.

P162

Increased psychological distress among individuals with spinal cord injury is associated with central neuropathic pain rather than the injury itself

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Background: Central neuropathic pain (CNP) is common after spinal cord injury (SCI). The psychological impact of CNP is not clear. Previous studies reported depression and pain catastrophizing among patients with SCI and CNP, however the lack of control groups prevented discerning whether these were attributed to CNP or to the SCI itself.
Objective: The aim was to examine the psychological distress among SCI subjects with and without CNP and controls in order to evaluate its impact and possible source.
Patients and methods: SCI subjects with CNP (n=27) and without CNP (n=23) and able-bodied controls (n=20) participated. Data collection included socio –demographics, and SCI characteristics. CNP was determined by neurological examination based on its definition and characteristics. The Pain Catastrophizing Scale measured pain- related reactions. The McGill Pain Questionnaire provided a quantitative evaluation of the subject's pain experience. The Posttraumatic Stress Disorder Questionnaire measured the level of PTSD. The Depression Anxiety Stress Scale quantitatively measured distress along the axes of depression, anxiety and stress. The State-Trait Anxiety Inventory indicated the level of anxiety and the Perceived Stress Scale the degree to which situations in one's life over the past month are appraised as stressful, unpredictable or uncontrollable. The sensory, affective and cognitive dimensions of CNP were analyzed.
Results: CNP subjects exhibited significantly elevated levels of PTSD symptomatology, psychological distress and pain catastrophizing compared to SCI subjects without CNP and controls. SCI subjects without CNP and controls had similar levels. The psychological variables among the CNP group correlated positively only with the affective dimension of CNP
Conclusions: SCI alone does not seem a source for psychological distress; rather it is the CNP. Irrespective of the sensory dimension of CNP (intensity), the affective dimension (suffering) is associated with increased psychological distress. Rehabilitation programs should prioritize stress management and prevention among SCI subjects with CNP.

P163

Influence of visual biofeedback treatment in syllable frequency

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Introduction: Persons with neurodegenerative diseases are often affected by progredient dysarthria and as a resulting symptom,

articulatory deficits. Methods of Biofeedback were already used successfully in the treatment of articulation disorders in former studies (Yano et al., 2015).
Objectives: The present study examines the effects of Visual Biofeedback (VBF) on articulation in persons suffering from neurodegenerative diseases.
Patients & methods: The Experimental Group (EG) consisted of 4 people with Multiple Sclerosis and 1 with Parkinson's Disease (age=53.6±16.3, EDSS<6, Hoehn & Yahr=3). None of them suffered from further neurological illnesses. The Control Group (CG) included 9 healthy persons (age=27±3.1). All subjects started measures alternating with or without VBF. The determined parameter was the average produced syllable frequency per second. Referring to the German UNS diagnostic instrument the syllables <pa>, <ta> and <ka> were produced particularly and always in a fast order for about 5 seconds. VBF was represented via Surface-Electromyography derived from Mm. masseter at both sides. Audio data were recorded and analyzed slowed down.
Results: Considering the pretest results in EG and CG without Biofeedback (BF) syllable frequencies showed no significant differences in all 3 tasks. Additionally, results of healthy controls demonstrated no significiant differences in syllable frequency comparing task performance with and without BF. For the syllable <ta> a trend to a significant increase in syllable frequency has shown up (p=0.066) compared task performance BF to no BF. Performance for <ka> turned out to be significantly improved (p<0.05) in EG using BF. The mean score for produced syllable frequency for <pa> increased by 12.89 %, for <ta> by 15.65 % and for <ka> by 9.52 % in use of VBF.
Conclusion: VBF has a positive effect on increasing speed of articulatory movements in persons suffering from neurodegenerative diseases. Gathering this information, VBF is most likely to be an effective resource for speech therapy in individuals with acquired dysarthria. Further studies should aim at investigating long-term effects of BF treatment in speech therapy.

[1] Yano et al. Effect of visual biofeedback of posterior tongue movement on articulation rehabilitation in dysarthria patients. Journal of Oral Rehabilitation 2015; 42(8): 571–9.

P164

Pareidolias and creativity in Parkinson's disease

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Question: Recently, it has been proposed that pareidolias may represent a prodrome of visual hallucinations in Parkinson's disease (PD). Literature on this topic, hoewever, is still scarce. Besides PD is characterized by a reduction of essential skills for creativity such as cognitive flexibility, conceptualization and visuo-spatial perception. Nevertheless, individual case studies show an increase in creativity and a creative urge during PD progression. The aim of the present study was to investigate the type and prevalence of pareidolias in PD. Besides the relationship between visual creativity and PD was addressed.
Methods: A pareidolia test which has been designed to evoke both induced and spontaneous pareidolias and a creativity test for the measurement of constructed pareidolias (i.e., the creative visual production of ideas) were performed in 15 PD patients and 15 healthy controls. The PD sample included 6 patients with incipient dementia, 7 with visual hallucinations and 3 with deep brain stimulation.
Results: The healthy controls showed more induced pareidolias (correct answers) while PD patients showed more spontaneous pareidolias (illusory reponses), especially those with incipient dementia. Only a small difference in visual creativity between PD patients and healthy controls was observed.
Conclusions: Further studies seem warranted to investigate whether spontaneous pareidolias may be used as a predictor for visual hallucinations in PD. The apparently preserved visual creativity in PD patients may be interesting with respect to the employment of expressive therapies in these patients.

P165

PD_manager European project – mHealth platform and wearable devices for Parkinson's disease monitoring – preliminary results and pilot study planning

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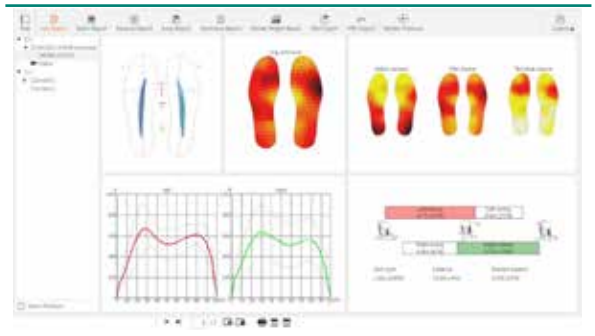
Introduction: Parkinson's disease current clinical management and rehabilitation are mostly based on the patient's subjective feedback towards therapy strategies adopted by healthcare professionals. This traditional approach requires time and could not be completely reliable. The EU funded project PD_manager aims to build and evaluate an innovative, mhealth, patient-centric system for remote monitoring of Parkinson's disease.
Objectives: The purpose of this study is to collect raw motor data together with clinical observations in order to develop algorithm for automatic detection of motor symptoms. Nevertheless, raw data about non-motor aspects have been taken into account (e.g. cognitive abilities, speech data). Here we present the first data on 20 patients and we show the big Pilot Study planning that will test the System at patients' home.
Method: Motor data have been collected using innovative wearable devices and video recordings. To evaluate the effectiveness of our devices, all the recordings were performed in a standardized setting, in On and Off state. All patients worn devices with

P165 **Fig. 1**



P165 **Fig. 2:** Gait analysis using the Motion software (screenshot)

built-in movement sensors: a smartband, a smartphone and a pair of sensor-pressure insoles.
Results: Sensor insole data (pressure and acceleration) showed 91% accuracy of detecting presence of gait impairments (i.e. UPDRS gait item >0). The presence of FOG events was detected with 88% accuracy. UPDRS Tremor Amplitude and constancy estimations have high correlation with expert annotation (>0.9). Dyskinesia detection accuracy in PD patients varies from 88% (when a 5-min window estimation is used) to a 98% percent for a 30-min window. A non blinded parallel two-group controlled study has been designed to compare this automatic System with the current standard care (symptoms diaries) at home in 200 patients.
Conclusion: The defined recording protocol allowed to gather a large amount of labelled, homogeneous and synchronized data from sensors. First results seem to be promising within the context of mHealth environment, showing a good reliability of mobile devices in detecting motor symptoms and differentiating ON and OFF conditions. The automatic monitoring of motor and non motor symptoms could allow to plan rehabilitation strategies and pharmacological treatments tailored for each patient.

P166

Physical and occupational theraphy in Parkinson's disease

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The quality of life of the Parkinson patient is in centre of our attention and I hope that we can say that it is significantly improved in the last decay, tank to chemiotherapeutic but also thak to phisiotherapeutic intervention. The phisical therapy try to enrich the alternative mouvement controll: the central patern, the equilibrium who is not directly afflicted in basal ganglia neuronal circuit. My prupose is a synthetic presentation of the best practice in actually state of research in Phisical and occupational therapy applied in Parkinson disease, in some of the best centre of research In Italy, without to have the pretention of exhaustivity.

P167

Physical fitness training programme for stroke survivors

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Purpose: Physical fitness is often particularly low in stroke survivors. The VO2 max is 50–70% lower than the VO2 max in age-matched, healthy subjects and it may limit their ability to perform everyday life activities. In the latest studies, including a systematic revision of the Cochrane Database, there is sufficient evidence to incorporate cardiorespiratory and mixed training, which combines cardiorespiratory and resistance training, within post-stroke rehabilitation programmes to improve the speed and tolerance of walking, the cognitive function and the quality of life, and it could reduce cardiovascular risk factors. The objective of the work is to describe a mixed training in stroke population implemented in a Physical Reahabilitation Medicine service.
Method: A program consists of cardiorespiratory training (40%–80% heart rate reserve) and resistance training (1–3 sets of 10 repetitions of 7 exercises involving the major muscles groups) 2 days a week in a total of 8–12 weeks. Subjects have to be able to walk independently and have more than one week after the ischemic event. At pre and post-intervention all the patients are evaluated with a health quality questionnaire (36-Item Short Form Health Survey), neuropsychological assessment (Montreal Cognitive Assessment) and a six minutes walk test. Nutritional and smoke cessation counselling is included.
Results: The items evaluation mentioned in the methods will be reviewed one year from the date of the program implementation.
Conclusions: Improvement is expected in cardiovascular risk factors, physical fitness, quality of life and neuropsychological measurements.

P168

Predictors of outcome in patients with Guillain-Barré syndrome after early neurorehabilitation

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Progress and degree of severity of the disease differ in patients with Guillain-Barré syndrome (GBS). Early identification of expected outcome may influence clinical decision making by helping to prescribe targeted interventions what may reduce medical costs. Objectives were to explore correlations between symptoms at early stage of the disease and the success of rehabilitation in patients with GBS. In this retrospective study on 88 predominantly severely affected patients with GBS, the functional status was compared at onset and at end of rehabilitation using the Early Rehabilitation Barthel Index (ERBI), Early Rehabilitation Index (ERI), Barthel Index (BI) and gait ability. Bivariate rank correlation and Pearson's chi-squared test were used to statistically verify if severely affected patients who demonstrated early symptoms, such as problems with swallowing and breathing having medical devices,autonomic dysfunction or cranial nerve and bladder paralysis, obtained a poorer outcome compared with slightly affected patients or patients without early symptoms. An ERBI-value >30, a BI-value of at least 60 and an ERI-value of 0 points as well as gait ability were considered as a positive outcome at the end of rehabilitation. It was shown, that patients with early symptoms, although they considerably improved, demonstrated significantly lower assessment values compared with patients without early symptoms ($p \leq 0{,}05$). Furthermore, these patients were less able to walk following discharge from rehabilitation compared with those without symptoms. Additionally, less of these patients demonstrated a positive outcome. A similar result was found for patients with low assessment values before rehabilitation compared with those presenting higher assessment values before rehabilitation ($rs \geq 0{,}5$). Significant correlations between the factors "early symptoms" as well as "degree of severity of the disease at admission" and "the outcome following rehabilitation" were found. This result possibly facilitates an early identification of those patients, who have an increased risk of negative outcome and should therefore be considered for the selection of adequate interventions related to the degree of severity of the disease. Further multivariate analyses are necessary to identify possible interactions between the factors "early symptoms", "functional status before rehabilitation" and "duration of rehabilitation" as well as to clarify their overall effect on functional status.

P169

Rehabilitation of Guillain-Barré syndrome – a rehabilitation centre experience

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Purpose: Characterize a population of Guillan Barré syndrome, admitted in a rehabilitation center between January 2010 and august 2016.
Methods: Retrospective study, in which were analysed: demographic data, existence of previous event, need of ventilator

support, EMG, occurrence of dysphagia and bladder dysfunction. Functional Independence Measure (FIM) and the New Functional Ambulation Classification (nFAC) were assessed at admission and at discharge.
Results: The sample included 24 patients, of which 54% were male and 58% had between 50 to 69 year-old. The majority of patients had a prior infectious event, being more frequent the gastroenteritis (46%). Regarding EMG, 62% showed an axonal form and 17% an Acute Inflammatory Demyelinating Polyneuropathy (ADIP). At admission 50% of patients presented a FIM score between 19 and 60 and at discharge 83% of patients showed FMI score between 104 and 126. Regarding ambulation, at admission 83% were unable of gait (nFAC O), and at discharge 33% had nFAC 5 and 25% nFAC 6. The mean time of inpatient rehabilitation was 191 days. There was no association between worst outcomes in FIM and older age, prior gastroenteritis or axonal form.
Conclusions: In our sample the majority of patients had axonal features. In the literature, the most common form is ADIP. It is possible that the difference may due to the fact that in the rehabilitation center there are admitted only severe cases. In our study the functional evolution was positive in all group ages, which evidence the need of an individualized intensive and multidisciplinary rehabilitation program.

P170

Strength training after stroke – Which impact does it have on gait?

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Question: The aim of this bachelor thesis is to examine which effects strength training after stroke has on gait.
Methods: In November 2016, a systematic research on the online databases PubMed, Cinahl and PEDro was conducted. Six randomized controlled trials were found and used for this paper.
Results: In two out of six trials the Six-Minute-Walktest improved significantly as one of the gait specific parameters. In general, gait was improved, although not all measurement results improved statistical significantly. Another outcome was that muscle strength increased significantly in all six trials. Furthermore, a relation between the increase of muscle strength and the improvement of the gait was recognisable.
Conclusion: Processing the trials in this bachelor thesis has provided no clear evidence of the exact influence of strength training after stroke on gait. Although strength training is one possibility to improve gait after stroke, not all outcomes were changed significantly.

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[2] Flansbjer U-B, Lexell J, Brogårdh C. Long-Term Benefits of Progressive Resistance Training in Chronic Stroke: A 4-Year Follow-Up. Journal of Rehabilitation Medicine 2012; 44: 218–21
[3] Lee M-J, Kilbreath SL, Singh MF, Zeman B, Lord R, Raymond J, Davis GM. Comparison of Effect of Aerobic Cycle Training and Progressive Resistance Training on Walking Ability After Stroke: A Randomized Sham Exercise-Controlled Study. Journal of American Geriatrics Society 2008; 56: 976–85.
[4] Ouellette MM, LeBrasseur NK, Bean JF, Phillips E, Stein J, Frontera WR, Fielding RA. High-Intensity Resistance Training Improves Muscle Strength, Self-Reported Function, and Disabilty in Long-Term Stroke Survivors. Stroke 2004; 35: 1404–9.
[5] Severinsen K, Jakobsen JK, Pedersen AR, Overgaard K, Andersen H. Effects of Resistance Training and Aerobic Training on Ambulation on Chronic Stroke. American Journal of Physical Medicine & Rehabiliation 2014; 93: 29–42.
[6] Yang Y-R, Wang R-Y, Lin K-H, Chu M-Y, Chan R-C. Task-oriented progressive resistance strength training improves muscle strength and functional performance in individuals with stroke. Clinical Rehabilitation 2006; 20: 860–70

P171

tDCS plus cognitive training (CT) – a pilot study for the treatment of morbid obesity

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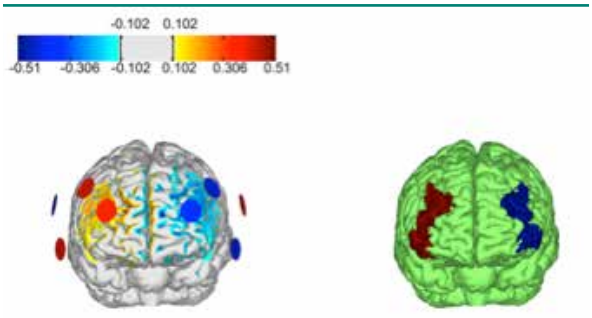
Introduction: Transcranial Direct Current stimulation (tDCS) is being used in clincal domain to modify brain function in Parkinson's, stroke, epilepsy or addiction among other pathologies (Lefaucher 2016). Recent studies report a reduction on food craving scores after prefrontal-tCS (Montenegro et al. 2012, Sauvaget et al. 2015) as well as reduced calorie intake in healthy controls (Gluck et al. 2015). Morbid Obesity (MO) patients show an abnormal activity in the left dorsolateral prefrontal cortex (ldlPFC), an area that supports reward-related aspects of eating behaviour and cognitive control (Alonso-Alonso 2013), in hand with cognitive impairments involving executive functions (EF) such as working memory, decision-making and risk-taking behaviour (Sellbom and Gunstad, 2012). Current treatments for morbid obesity (MO) are however based on dietary intervention and bariatric surgery, without tackling behavioral or functional brain alterations.
Objective: Here we study the impact of tDCS over the ldlPFC combined with CT on EF performance in MO.
Patients and methods: A total of 18 MO patients participated in a randomized, sham controlled study with 4 treatment sessions (20-min each). Anodal tDCS (1.5 mA) was applied on the rdlPFC (cathodal on the ldlPFC) using an optimized multi-electrode montage (Stimweaver, Ruffini et al., 2014). The normal component of electric field distribution is shown in **Fig. 1** (left) and the dlPFC target area (right). EEG was recorded before and after treatment using the same device (Starstim, Neuroelectrics).
Results: By means of coherence and power analysis of EEG data, we analyse the impact of the tDCS-CT in the oscillatory activity before and after the treatment. Despite the small number of patients involved, we observe a broadband increase in oscillatory activity after CT, as well as an enhanced frontal coherence after tDCS+CT only. Additionally, trends on variables related to flexibility, impulsivity and inhibitory control are observed, with the tDCS group committing fewer errors as subjects take more time before responding to the stimulus, differentially pre and post treatment.
Conclusion: Overall, tDCS combined with CT appears to have a positive effect on the cognitive impairments related to obesity and may provide a promising approach for treatment of MO patients.



P 171 **Fig. 1**

P172

The pain in Parkinson's disease questionnaire – first data from a multi-centre validation study

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Introduction: Pain is a common non-motor feature in patients with Parkinson's disease (PD) with high impact on quality of life. Our experimental studies revealed increased pain sensitivity in the OFF phase and early during the clinical course presumably leading to the high prevalence of pain in PD (Mylius V. et al. 2011 Mov Dis)
Objectives: In clinical practice, it is not easy to differentiate between the different PD related pains and non-PD related pain. Therefore, we developed a questionnaire allowing assignment of the association of pain and PD by assessing the impact of motor fluctuations as well as of PD medication and disease progression. Thereafter, PD associated pain is subdivided in three different pain types including all pain types associated with PD (i.e. musculo-skeletal pain, psychomotor restlessness pain and neuropathic pain). Finally pain intensity is scored by a rating scale. The proposed questionnaire has been published in 2015 (Mylius V. et al. 2015 Mov Dis Clin Pract) and validation is ongoing in a multicentre study.
Methods: The validation study in three centres in Switzerland (Valens, St. Gallen and Zihlschlacht) compares data from the Pain in PD Questionnaire (PPD-Quest) with data from the Brief Pain Inventory (BPI), disease related scores, scores of mood and cognition as well as quality of life scores. In addition retest reliability and interrater variability are assessed. Data of the first 25 patients (100 patients planned) are available and will be presented at the congress.
Results: First data clearly show the relevance of the different PD-related pain types in PD patients with considerable impact on quality of life. The PPD-Quest seems to allow an accurate diagnosis and appropriate therapy of the different pain types associated with PD or non-PD-associated pain syndromes. Even in this small group we were able to detect some unexpected causes changing treatment approach (polyneuropathy due to cobolamin deficiency and abdominal pain in the OFF phase responding to dopaminergic medication).
Discussion: Our data suggest that discrimination of PD related pain and non-PD related pain types on the basis of three issues (motor fluctuations, clinical course and impact of medication) is very useful for an accurate diagnosis with a major impact on the treatment of the specified pain type. These preliminary findings of our validation study are encouraging in terms of providing a valid questionnaire for pain in PD.

P173

Urinary incontinence after stroke – How to assess and how to treat?

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Purpose: Urinary incontinence (UI) after stroke is a common, complex and multifactorial complication. The main purpose of this study is to review the literature about UI in stroke patients.
Method: It was made a literature review about UI in stroke patients: the presence of UI, identify key factors for the assessment of the etiology and severity of UI, and to review the treatments available.
Results: UI can affect as much as one third of patients admitted in hospitals for stroke. The most reported etiology in the literature is detrusor hyperreflexia, nonetheless, there can be others causes as detrusor hyporreflexia and functional incontinence. As much as 25% of patients present UI one year post-stroke, and it is related with worst functional outcomes and higher rate of institutionalization and mortality. It may also have direct implications in the rehabilitation program. The current guidelines recommend assessment and treatment protocols for the promotion of continence in Stroke Units and other facilities with stroke patients.
Conclusions: The resolution of UI is associated with better outcomes in stroke patients and should be an objective for all the health team. It is important to assess the type of voiding disorder and its severity in order to address an individualized therapeutic intervention.

P174

1-Hz repetitive transcranial magnetic stimulation over contralesional triceps area improves kinematic parameters of reaching movements in chronic stroke patients

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Introduction: The inhibition of the contralesional primary motor cortex (CM1) through repetitive transcranial magnetic stimulation (rTMS) has been shown to improve motor recovery in stroke patients. These data have been obtained through the stimulation of the contralesional cortical representation of the hand's muscles. Nonetheless, and there is no evidence on the effects of contralesional inhibitory rTMS on the proximal muscles of the upper extremity.
Objectives: The aim of this study was to assess the effects of the low frequency-rTMS over the contralesional triceps area on reaching movements of chronic stroke patients.
Patients and methods: Ten chronic, first ever stroke patients having different motor impairment have been enrolled in this perspective, randomized cross-over study. Patients undergone five daily sessions consisting of 1200 stimuli at 1 Hz, 90% of resting motor threshold, over the contralesional triceps area, and five daily sessions of sham stimulation, in a randomized sequence. The primary outcome measure was the change of kinematic parameters of reaching movement between the five baseline- and the five post-rTMS assessments.
Results: After rTMS, responding patients showed improved accuracy, smoothness, and velocity of reaching movements. These indices improved by no more than 10% ($p<0.001$).
Conclusions: 1-Hz rTMS of the contralesional triceps area improved the execution of reaching movements of paretic limb in a sample of chronic stroke patients.

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Abnormal paired associative stimulation in patients with traumatic spinal cord injury and poor recovery

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Introduction: The motor cortical plasticity can be studied by using an experimental intervention known as paired associative stimulation (PAS)1. The physiological and pharmacological profile of modifications in primary motor cortex (M1) excitability suggests that an LTP-like mechanism may underlie the PAS induced synaptic plasticity2.
Objectives: The primary aim of this study is to see whether PAS elicits neuroplastic changes or reverses any maladaptive plasticity induced by SCI and to investigate whether LTP-like phenomena induced by PAS correlate with functional state.
Patients and methods: A group of chronic incomplete cervical SCI patients with good functional recovery (n=5), a group of SCI patients with poor functional recovery (n=5) and a group of normal subjects (n=10) were examined. PAS protocol consisted of 0.05 Hz electrical median nerve stimulation (90 stimuli), paired with 0.05 Hz TMS (90 stimuli) over the hot spot for stimulating the abductor pollicis brevis (APB) muscle given 25 milliseconds after the onset of the electrical stimulus (PAS 25). Corticospinal excitability recorded in APB muscle, as indexed by motor evoked potential (MEP) obtained after single stimulus, was tested before and up to 30 minutes after PAS protocol.
Results: RMT was slightly increased in the SCI patients of both groups, although not statistically significant. There was no significant baseline difference between the SCI patients of both groups regarding MEP amplitude. In healthy subjects and in SCI patients with good motor recovery, PAS 25 protocol significantly increased resting MEP size as long as 30 minutes while it was followed by a non-significant increase of resting MEP amplitudein the SCI patients with poor functional recovery.
Conclusion: The findings of the present study demonstrate that PAS is capable of enhancing motor cortex excitability with increased MEP amplitude in normal subjects and only in SCI patient with less severe clinical features for at least 30 minutes. The level of LTP-like phenomena correlates with functional state.

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P176

Can the ptosis of the Horner's syndrome be improved with botulinium toxin injection? – a case report

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Introduction: Horner syndrome is characterized by miosis, loss of hemifacial sweating and parcial ptosis, a very disturbing symptom. Injected chemodenervation agents such as Botulinum Toxin type A temporarely paralyse muscles. This is a minimally invasive technique that is helpful in restoring facial symmetry at rest and during movement. Goal Attainment Scaling (GAS) is used to quantify the achievement of goals set (from -2 to 2), and it can be used to acess de results of chemodenervation agents.
Case description: We present the case of a 54 year old woman with a history of a left Pancoast tumor She developed Horner's Syndrome with falling of the upper eyelid and blepharospasm of the left eye. To apply GAS scale, we determine the importance and difficulty of achieving goals. For the symptom of blepharospasm of the left eye, from 0 to 3, the importance and difficulty were 2. For facial symmetrization the importance punctuated as 2 and difficulty 3. Were applied 10UI of BoNT/A (ONABOTULINUM TOXIN-A / Botox®): 7,5UI on the left Orbicularis oculli and 2,5UI on the right Orbicularis oculli. Five months later we assessed the patient. There was a good efect. Regarding to the proposed objetives she punctuated 0 in GAS, which means that she achieved the expected level. We redefined our goals and for both, blepharospasm and symmetrization, we proposed a GAS of 0. So, we reapplied 10UI of BoNT/A (ONABOTULINUM TOXIN-A): 7,5UI on the left Orbicularis oculli and 2,5UI on the right Orbicularis oculli. Eight months later, still with the goal of 0 on GAS, the patient refers already loss of effect of BoNT/A, so we applied 7,5UI of BoNT/A on the left Orbicularis oculli and 2,5UI on the right Orbicularis oculli.
Conclusion: With this case we can conclude that, relaxing effect of BoNT/A on the Orbicularis oculli muscle, helps the Levator palpebral superior muscle elevating the eyelid. The results of the toxin application are satisfactory in the short and long term management of ptosis associated with Horner syndrom so we conclude this should be considered as a treatment.

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P177

Evaluation of a music guided treadmill training for hemiparetic patients following stroke

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In a three-armed prospective randomized and controlled parallel group design we investigated the effects of a four-weeks treadmill training with RAS (RAS-TT) on functional changes in gait of hemiparetic patients following a stroke. Accordiningly we assigned 35 independently walking patients to one of three training interventions: 1. RAS-TT, 2. treadmill training (TT), 3. Neurodevelopmental training based on Bobath (NDT). For RAS-TT functional music was set to a therapeutically optimized cadence on the treadmill. Tests to assess functional changes in gait and balance were used (Fast Gait Speed Test (FGS), 3-min-Walking-Time-Test (3WT), apparative gait analyses with locometer from Bessou (LOM) and a static posturography (SPG)). An ANCOVA was run to determine the effect of the three interventions on post-intervention gait parameters after controlling for the corresponding pre-intervention parameter and the time between stroke and start of training. Statistics revealed significant group differences for adjusted FGS post-measures in gait velocity ($F(2,34)=3,864$, $p=0,032$, partial $\eta 2=0,205$) and cadence ($F(2,34)=7,656$, $p=0,002$, parital $\eta 2=0,338$). Comparison of adjusted means for both parameters showed significantly higher values for RAS-TT (gait velocity: RAS-TT = 1,26 m/s; standard error (SE)=0,06; TT=1,08, SE=0,05; NDT=1,07; SE=0,06/ cadence: RAS-TT=117,9; SE=3,7; TT=102,0; SE=3,4; NDT=99,1; SE=3,7). The group comparison of LOM values did not reach level of significance ($F(2,34)=3,242$, $p=0,053$, partial $\eta 2=0,178$). Nonetheless the group contrast showed a significant difference between RAS-TT and NDT ($p=0,023$), while the contrast between RAS-TT and TT was not significant ($p=0,06$). The LOM parameter stride length and gait velocity and also the single leg analyses for step length, cycle time and stance phase duration as weel

a steh 3WT and the SPG did not point towards supremacy of a certain intervention. The study gives first hints of evidence for a higher efficacy of RAS-TT in comparison to the established therapeutic approaches of TT and NDT. It provides a basis for further studies on the implementation of functional music in gait rehabilitation for people after stroke.

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P178

Head-mounted display adaptation for reaching behaviour in unilateral neglect – a case study

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Background: Prism adaptation (PA) is a therapeutic treatment for Unilateral spatial neglect (USN), where a patient's visual field is artificially shifted laterally resulting in sensory-motor adaptation. However, patients with USN also tend to perceive a left-leaning subjective vertical in the frontal plane. Traditional PA cannot correct a tilt in the subjective vertical because a prism can only polarize and not twist the surroundings. However, this can be accomplished using a head mounted display (HMD) and a web-camera. This study investigates whether a HMD system could be used to correct the spatial perception of USN patients in the frontal as well as the horizontal plane.
Methods: Three USN patients (A, B, C) participated in this study, case A was 81 years old male with occipital lobe infarction, case B was 55 years old male with putamen caudate infarction, and case C was 81 years old male with striatocapsular infarction. The subjects were asked to sit on a chair while wearing a HMD with a web-camera that displayed 10-degree leftward rotation and 10-degree counter-clockwise rotation along the frontal plane. Subjects attempted to point a finger at one of the four targets assigned randomly for a total of 48 times. Before and after the intervention, each subject's body-centre judgment (BCJ) was tested by asking them to point a finger on a touch panel directly in front of their xiphisternum 10 times sight unseen. Three standard neuropsychological tests were also conducted (Line biception, Line cancelation, and Star cancellation).
Results: Intervention caused the location pointed at, during the BCJ, to shift leftward in the horizontal plane (case A: 63 mm, case B: 90 mm, case C: 33 mm) and upward in the frontal plane (case A: 29 mm, case B: 79 mm, case C: 87 mm). The result of the neuropsychological tests also improved.
Conclusions: The results for the horizontal plane are consistent with those observed after PA. Furthermore, the HMD and web-camera were able to elicit 3D effects, in both the horizontal and frontal planes. Future work will focus on applying this method for patients with and without USN, and investigating whether subject posture is also affected by the HMD system.

P179

Influence of botulinum toxin injection on gait speed and endurance in adults with chronic stroke

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Question: Decrease of gait speed, cadence and stride length are common following a stroke. The weakness of ankle dorsiflexors and the spasticity of ankle plantarflexors are primary factors associated with reduced gait speed and walking endurance in stroke survivors (1). For many patients, independent walking is one of the most important goals. Therefore, the neurorehabilitation aims should include the improvement of gait speed and walking endurance to achieve a community ambulation. Botulinum toxin injection (BTI) represents the gold standard therapy for focal spasticity after stroke (2). However, it remains unclear whether BTI is really effective in functional improvements (3). Walking abilities are frequently secondary outcomes and are often poorly investigated. The aim of this study is to assess influence of BTI on gait speed and walking endurance in adults with chronic stroke.
Participants: 11 out of 17 patients are actually included in the study. Methods: Before and one month after BTI, walking abilities are assessed using the 10 meter walk test (10mWT), the 6 minutes walk test (6MWT) and foot-worn inertial sensors (Physilog® - BioAGM, CH) at the service of Neuropsychology and Neurorehabilitation at the Lausanne University Hospital (CHUV). Secondary outcomes are spasticity and strength of the lower limbs and two questionnaires on physical activities (Voorrips) and independence in activities of daily living (Barthel Index).
Results and conclusions: The expected results are a significative improvement for the spasticity but not for the 10mWT and 6MWT.

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P180

Predictive value of intraoperative bulbocavernosus reflex during untethering surgery for post-operative voluntary voiding

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Introduction: Neurogenic bladder is one of the major disabilities in tethered cord syndrome. Intraoperative monitoring of bulbocavernosus reflex (BCR) is known to be helpful to predict and prevent bladder dysfunction after untethering surgery. However, its predictive value for post-operative voiding function has not been confirmed in children with spinal dysraphism.
Objective: To evaluate clinical significance of intraoperative BCR during untethering surgery of tethered cord syndrome to predict post-operative voiding function.
Methods: We performed a retrospective review of 64 pediatric patients who underwent untethering surgery and whose BCR at baseline was obtainable. They were classified based on whether

BCR was preserved or lost during surgery. As a functional outcome, voluntary voiding without need of assistive technique (such as intermittent catheterization or Valsalva maneuver) was checked at admission, at discharge, 2 months, 6 to 12 months after surgery.
Results: Among the 64 patients, BCR was lost during surgery in 12 and preserved in 52. The positive predictive value of intraoperative BCR (failure to void / loss of BCR) was 58.3%, 50%, and 44.4% at discharge, 2 months, and 6 – 12 months after surgery, respectively. The negative predictive value (independent voiding / preservation of BCR) was 67.3%, 76.9%, and 91.7% at the same time points. The sensitivity and specificity of BCR was 29.2%, 87.5% at discharge, 33.3%, 87.0% at 2 months, and 57.1%, 86.8% at 6 - 12 months.
Conclusion: Intraoperative BCR during untethering surgery in children with spinal dysraphism can predict long-term bladder function with high specificity (86.8%) and moderate sensitivity (57.1%). It indicates that when BCR is preserved, voluntary voiding function can be reliably expected after surgery.

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Predictor for positive response to a selective implanted drop foot stimulator (ActiGait®) – post-stroke

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Introduction: Drop-foot is a common problem following stroke. Functional electrical stimulation is one intervention that is used to stimulate the ankle dorsiflexor muscles during the swing phase to correct drop-foot. Recent studies indicate that functional electrical stimulation of the peroneal nerve with a selective implantable stimulator (ActiGait®) is an effective intervention in improving functional gait outcomes in the chronic stroke population.
Methods: Six post-stroke hemiplegic patients were included in this study. Functional electrical stimulation was delivered to the peroneal nerve during the swing phase via single foot switch in combination with surface electrode or implanted stimulator. Kinematic data were collected using a computerized motion analysis system with force plat. Data of functional electrical stimulation with surface electrode (FES) and with selective implantable stimulator (ActiGait®) group were compared among each other. In order to examine the relationship between kinematic data under FES and ActiGait® a ranked correlation, respectively a Pearson correlation was computed.
Results: In all patients preoperative FES was applied for a period of at least 3 months. The evaluation of the functional outcomes among ActiGait® stimulation followed at 6 months after activation of the implant. Improvements were seen in all gait parameters under stimulation with both FES and with ActiGait®, even if no statistically significant differences in improvements could be detected between the 2 stimulation modalities. To investigate the effect of FES as a predictor of the effect of ActiGait® stimulation, a Pearson correlation was expected between individual kinematic parameter. There was found a close correlation with the kinematic data between FES preoperatively and ActiGait® stimulation 6 months after activation of the implant ($r=0.81$, $p<0.001$).
Conclusion: In the preliminary study, we showed that FES with surface electrodes can very well serve as a predictor of functional outcome of ActiGait® stimulation. In light of these results, we see it as essential to perform FES with surface electrodes for a period of at least 1 month prior to implantation of the ActiGait® system.

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Study design of a Phase 2a proof-of-concept clinical trial of HT-3951 in upper extremity motor function following ischemic stroke

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Introduction: Stroke is a leading cause of disability worldwide, with motor deficits representing the most prevalent and enduring impact on quality of life. The degree of post-stroke motor impairment is related to lesion size, location and structural integrity of white matter tracts facilitating interhemispheric sensory-motor communication. Post-stroke rehabilitation involves motor learning mediated by cellular mechanisms of long-term potentiation (LTP) and expression of brain derived neurotropic factor (BDNF) facilitating neuroplasticity. While rehabilitation enhances motor function, recent research suggests that pharmacological augmentation of rehabilitation may facilitate motor recovery.
Objectives: The primary objective is to assess the safety and efficacy of HT-3951 vs placebo on upper extremity motor function in subacute or chronic stroke patients using the Fugl-Meyer assessment of upper extremity. Additional outcome measures include the 9-hole Peg Test and Arm Motor Ability Test. Secondary objectives include the effect of HT-3951 on the behavioral and functional activation of motor networks associated with handgrip task performance using functional MRI (fMRI) and diffusion tensor imaging (DTI) to characterize functional recovery.
Methods: Here we describe a Phase 2a, randomized, double-blind, placebo-controlled parallel group study utilizing standard stroke rehabilitation assessments, as well as fMRI techniques in a subset of patients, to evaluate the effect of HT-3951 on motor recovery following ischemic stroke (RESTORE Trial) (NCT02530307). At least 20 sites within the US are expected to participate. Enrolled subjects (n=72) include those with mild to moderately severe upper extremity motor impairment who will begin investigational treatment 2 to 52 weeks post-stroke, and undergo standard motor rehabilitation. Subjects will be grouped by time post-stroke: Subacute, between ≥2 and ≤6 weeks, and Chronic, between >6 and ≤52 weeks. The fMRI sub-study will be conducted as a sub-study at approximately 10 of the 20 sites.
Results: Preliminary results from the POC trial are expected in the second half of 2017 and will give an indication of baseline patient characteristics, safety and efficacy outcomes.
Conclusion: New pharmacological interventions including HT-3951 aim to improve functional outcomes in subjects with post-stroke upper extremity impairment.

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tDCS in memory training – a pilot study on verbal recognition performance

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Introduction: Anodal tDCS of temporal areas facilitates memory and recognition processes in participants with memory deficits (Boggio et al., 2008; Ross et al., 2010). With the aim of enhancing memory functions in patients with deficits Khedr et al. (2014) showed increased memory performance with tDCS applied in ten sessions on different days. The present study deals with the question to which extend a single tDCS session already influences recognition performance in a verbal memory task.
Objectives: In this sham-controlled double-blinded pilot study an elderly and a control participant both without memory deficits

underwent a verbal recognition task. We hypothesized that already a single anodal tDCS session will lead to a better performance in a memory training compared to sham.
Patients and methods: An older healthy man (80 y) and a young healthy man (33 y) participated in this pilot study. Both were right-handed and monolingual native speakers of German. Participants had two sessions, one sham and one anodal tDCS, with a wash-out period of at least ten days. They were to memorize auditorily presented words in a learning phase. After that, they were to recognize single words out of several distractors (semantically or phonologically related words) via button press. 20 minutes of anodal tDCS was applied on the left temporal cortex.
Results: First results indicate a positive influence of anodal tDCS compared to sham. Both participants seem to profit from stimulation in maintaining their recognition time through a tough 20 minutes long memory task. In the sham condition their recognition speed tend to be reduced towards the end of the task.
Conclusion: Participants profit from a single tDCS session not by speeding up but rather by not slowing down in recognition time. Thus, anodal tDCS provides a processing advantage for memory training and is a probable tool in rehabilitation for patients with memory deficits.

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P184

Transcranial direct current stimulation as add-on to neuromotor rehabilitation of Pisa syndrome in Parkinson's disease

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Introduction: Pisa Syndrome (PS) is a dystonic lateral trunk flexion described in patients affected by idiopathic Parkinson's disease (PD). It is known to be resistant to common anti-parkinsonian therapy and the improvements reached with rehabilitation last in 6 months or less. Transcranial Direct Current Stimulation (t-DCS) is a non-invasive approach for neuromodulation, recently tested in focal dystonia with promising results.
Objectives: The main objective of our study is to evaluate the role of t-DCS as add-on of neurorehabilitation in the treatment of PS.
Patients and methods: Seven patients affected by PD and PS was enrolled and assigned to: 1) t-DCS group underwent 5 daily sessions (20 minutes, 2 mA) of stimulation with cathode over the M1 cortex contralateral to PS and anode over the M1 cortex ipsilateral to PS; 2) SHAM group underwent five daily sessions in which the electrodes were placed without any current flow. Patients were tested with UPDRS-III and FIM, EMG analysis of trunk and cinematic motion analysis of trunk at hospital admission (To) and after 1 month of neurorehabilitation (T1).
Results: According to a recent classification the EMG analysis in the t-DCS group showed a Pattern 1 in 3 cases and a Pattern 2 in 1 case, while in the SHAM group Pattern 1 was present in 1 case and Pattern 2 in 2 cases. In the t-DCS group we found a significant improvement at T1 in the lateral (18.5±4.1° at To and 13.8±3.5° at T1, p=0.04) and anterior (27.2±5.8° at To and 22.2±3.8° at T1, p=0.026) trunk flexion in upright standing position. At T1 we recorded an increase of ROM of all the dynamic tasks, anyway none of these were significant. The UPDRS-III and FIM scales significantly improved at T1 (respectively p=0.042 and p=0.014 vs. To). In the SHAM group we did not detect significant modifications of the cinematic analysis of trunk at T1 respect to To. The FIM scale significantly improved from 85.7±7.6 at To to 92.0±8.9 at T1 (p=0.019). When comparing groups we found that the improvement in ROM of lateral bending contralateral to the side of PS was higher in the t-DCS groups respect to SHAM group (p=0.046).
Conclusion: Our preliminary data supports the use of a cathodic stimulation with t-DCS as add on to neurorehabilitation for the treatment of PS, with a major effect on the static alterations of upright standing position. We hope to confirm these data in a larger population, and we aim to complete a 6 months follow-up.

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Using a dopamine abstract to treat hemispatial neglect during post-stroke neurorehabilitation – a case series

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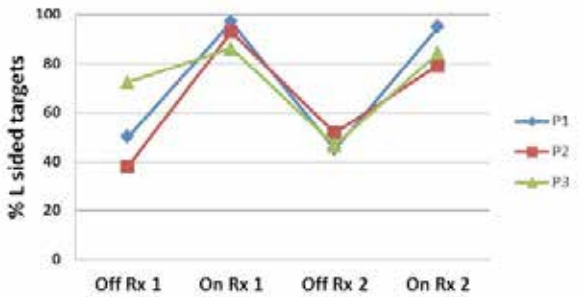
Question: Stroke is the largest worldwide cause of adult neurodisability. Hemispatial neglect (HSN) is the inability to respond to stimuli from one side of space and is common in the early period after stroke. It is a particularly disabling impairment, and correlates with poor functional outcome more strongly than either hemiplegia or initial stroke severity. Deficits in spatial working memory and ability to sustain attention are important components of neglect, and are both supported by prefrontal dopamine receptors. Data in chronic stroke patients suggest that dopaminergic medication may improve neglect, but the efficacy of this approach during intensive post-stroke neurorehabilitation is not known.
Methods: We treated 3 patients with left HSN following ischaemic stroke in the right MCA territory with the D1/D2 dopamine agonist Rotigotine given transdermally (4mg/24 hours). All were undergoing intensive in-patient neurorehabilitation at the time of treatment. Patients completed the star cancellation task over 4 consecutive weeks in an A1-B1-A2-B2 design (off-on-off-on Rotigotine, 1 week each) in order to assess their response.
Results: One patient felt transiently drowsy while taking Rotigotine but no other side-effects were reported. We observed an apparent effect of treatment on HSN in these patients, with a 79% improvement in left-sided targets identified (On Rx vs Off Rx). There was a significant effect of session (ANOVA P=0.0013) and improved performance on vs off treatment (t-test P=0.029). Moreover while on active Rotigotine treatment the treating therapy team observed improved attention to the affected side during functional tasks, and a consequent beneficial effect on the ability to engage with neurorehabilitation.



P185 **Fig. 1:** Star cancellation task in 3 patients

Conclusions: Dopaminergic medication warrants investigation as a treatment for HSN during early post-stroke neurorehabilitation, as this is when its impact is greatest and when greatest gains may be made in therapy. Our experience from this small group shows this to be a feasible approach, but a randomised controlled study is needed to establish efficacy. Such a study should include an outcome measure that captures the effect of neglect on functional tasks, and we suggest the Kessler Foundation Neglect Assessment Process (KF-NAP) for this purpose.

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VRGait – an immmersive virtual reality system for gait-specific neurorehabilitation and therapy

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Introduction: Fortunately, physiotherapy and repetitive movement during exercises allows to regain motor functions lost by neurological injuries, i.e., caused by strokes. Exercising is exhausting and patients' motivation plays a central role in the effectiveness of such therapies. Unfortunately, dedicated therapy equipment often requires to restrict users or to be setup in lesser attractive environments due to, e.g., building statics. In addition, such systems currently do not exploit the potential of adaptive training stimuli based on movement mimicry.
Objective: We introduce first results of a VR based gait rehabilitation system: VRGait immerses patients into alternative virtual environments and maps their movements on the therapy device to movements in the virtual worlds **(Fig. 1)**. VRGait's goals are

P186 **Fig. 1:** VRGait system with user performing a virtual walk

to strengthen therapy effectiveness (1) by increased motivation from inspiring walking escapes (think beach or mountain scenes) and gamified tasks and (2) by exploiting motor mimicry caused by their controlled virtual avatars or counterparts walking together with them.
Material and methods: VRGait uses the HTC Vive VR system to provide the immersive visual stimulus to the users via a HMD with a resolution of 2160 x 1200 pixels and 110° field of view at 90Hz refresh rate. The walking movements are captured by the Vive's controllers attached to the patients' feet to be independent from the training device, in our case the G-EO by Reha Technology. Unity 3D V5.5 is used to generate the virtual content. Our initial usability evaluation measured simulation sickness, task load, presence, efficiency, and preference with respect to two movement models (constant and adaptive) and two tasks (walking on a plane and up a stair).
Results: Task load and simulator sickness were reasonable low in all conditions. Presence was high in all conditions and did not change significantly between them. Adaptive movement was preferred on the stairs, and step length was significant longer in the plane scenario with adaptive movement.
Conclusion: The first evaluation verified general usability of the VRGait system. Differences between walking models should be considered during content creation. Clinical experts gave first positive feedback after try-outs at the therapy site. Further evaluations, e.g, of effectiveness are under way and ongoing results of the latter might additionally be presented at the ECNR venue.

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The effects of combined repetitive transcranial and peripheral magnetic stimulation on cortical excitability and motor function in stroke patients

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Introduction: Repetitive transcranial magnetic stimulation (rTMS) is a well-known rehabilitation modality that can modulate excitability of the human cortex. It was also recently shown that repetitive peripheral magnetic stimulation (rPMS) promotes a functional cortical reorganization in healthy subjects.
Objectives: To investigate the effect of combined rTMS and rPMS against the background of korvitin therapy on cortical excitability and motor function in stroke patients.
Materials and methods: 77 patients (mean age – 63,02±1,21 years) with ischemic stroke were randomized to receive 1 Hz real or sham rTMS and rPMS for 10 consecutive days against the background of korvitin therapy. We evaluated the Motor Club Assessment Scale (MCAS) and cortical excitability before and after the intervention. Single-pulse, rTMS and rPMS performed using magnetic stimulator MagPro R100 (Medtronic A/S, Denmark).
Results: The improvement of motor function was greater in the real stimulation group (40,4% in MCAS) when compared to the sham group (17,1% in MCAS). The MEPs of the affected hemisphere in the real stimulation group became shorter in latency and higher in amplitude and area after the intervention in comparison with the sham group. The RMT of the affected hemisphere in the real stimulation group became lower after treatment in comparison with the sham group. No significant changes were observed of cortical excitability of both affected and intact hemispheres of sham group, as well as the intact hemisphere of real stimulation group.
Conclusion: Combined rTMS and rPMS against the background of korvitin therapy improved motor functions and increased cortical excitability of the affected hemisphere in stroke patients.

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A European registry for neurorehabilitation practice using neurotechnologies – Léman registry

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Objective: There is increased interest in neurotechnologies such as Virtual Reality (VR), Brain-Computer Interfaces, robotics,

P188 Fig. 1

P188 Fig. 2

and neurostimulation as adjuncts to standard therapies in neurological rehabilitation. Recent Cochrane reports reviewing these technologies indicate a growing supportive evidence base. However, many of the studies included in these reviews are limited to the research setting, and therefore, real-world clinical performance data could potentially improve our understanding in this area. We introduce a web-based European registry aimed at benchmarking clinical performance of VR-based neurorehabilitation platform. The registry will capture patient characteristics, system usage, rehabilitation outcomes and their interrelationship.

Methods: Registry participants will include patients undertaking rehabilitation with MindMotionTM PRO as part of routine clinical care in the post-acute hospital and neurorehabilitation units. MindMotionTM (MindMaze SA, Switzerland) is a multimodal system designed to provide integrated evidence-based therapies addressing cognitive and motor training objectives. The system utilises motion capture technology in order to track upper limb movements and present an avatar with a first person perspective embodied VR feedback in real-time. It also allows evidence-based therapies such as constraint-induced movement therapy and mirror therapy. The system aims to encourage shoulder, elbow, forearm and wrist movements (goal-directed) in a motivating game-like environment & help increase the rehabilitation dose early after stroke. Data capture will be achieved using a web registry (Electronic Case Report Form, with appropriate consent, ethical and data governance clearance), while patient training data will be captured directly from MindMotionTM PRO (including exercises performed, the number of repetitions, speed and accuracy of movement, and training duration). The registry covers patient characteristics (medical history), and therapy outcome measures at admission and discharge in three key categories: motor, functional independence, and other disease-specific outcomes. System usage data will allow us to explore the relationship between device usage and outcomes. Finally, the registry will also include semi-structured questionnaire-based interviews for patients and therapists.

Conclusion: The Léman registry results are expected to increase real-world data on VR-based neurological rehabilitation.

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Early neurorehabilitation in the intensive care unit

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Objectives: Does having access to early neurorehabilitation in units such as a Neuro Intensive Step Down Unit (NISA) influence the prognosis of patients who have experienced severe brain injuries?

Background: The Danish National Healthcare Board highlights the importance of starting initial rehabilitation of patients with brain injury as soon as the patient's condition permits (1). In Silkeborg/Denmark, the Neuro Intensive Step Down Unit (NISA) provides care for patients who have sustained brain injuries and have been discharged from neurosurgical specialist departments in other hospitals within Denmark. The NISA Unit is a part of the hospital's Intensive Care Unit (ICU), this allows for the patients to receive intensive care whilst starting their highly specialized neurological rehabilitation. The patient's treatment, training and care are handled by doctors , physiotherapists/ occupational therapists associated from Hammel Neuro Centre (HNC) and ICU nurses. The NISA Unit is working closely in conjunction with the teams based at the Hammel Neuro Centre. Hammel Neuro Centre (HNC) provides ongoing neurorehabilitation and is one of two neuro rehabilitation centres in Denmark.

Purpose: To ensure the best possible prognosis for severely brain-damaged patients. To reduce or prevent complications related to patient immobility and critical illness.

Results and conclusion: It is difficult to measure the effect the NISA model of care has on the prognosis of a brain injury patient. It is the assumption that patients did benefit greatly from the early neurorehabilitation, but it is difficult to provide quantifiable indicators for this. This is because it would be ethically irresponsible to do a randomized study. There is a need for further studies to describe research areas for the comparison of the patient's progress through NISA, opposite scenario without the NISA to HCN.

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Feasibility pilot study using a virtual reality device in upper limb early rehabilitation

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Introduction: Using virtual reality (VR) can contribute towards increasing intensity in rehabilitation. For the early phase of upper limb rehabilitation in severely affected neurological patients there is a lack of evidence.

Objective: To assess feasibility of a virtual reality device in upper limb early rehabilitation.

Patients and methods: Mind Motion Pro (MMPRO) is a mobile device based on VR technology from MindMaze. Over 3 months MMPRO was used to increase the dose of therapy in addition to conventional therapy and to evaluate the feasibility of VR in the early phase of motor and cognitive rehab. The number of interventions per patient was on average 6 (2–11), with 2–4 sessions per week. Six severely affected patients were recruited (4 men, age 51–84 y). The diagnoses were 2 ischemic cerebrovascular infarctions, one patient with severe head trauma with subsequent frontal lobe syndrome, one patient with intracerebral frontal hematoma and comorbid Alzheimer's disease, one patient with frontal brain abscess and one patient with critical illness polyneuromyopathy. The MMPRO was used with a net session length of 10–40 min. Motivation to use MMPRO was evaluated in each intervention. Duration and difficulty of exer-

cises (reach, point, grasp) were chosen depending on vigilance and functional impairment. All patients were assessed, using FIM (Functional Independance Movement) and EFA (Early Functional Abilities), weekly in a interdisciplinary setting.
Results: All patients were motivated in all sessions to use the VR technology. One patient discontinued therapy due to a complication leading to acute hospitalization. One patient was discharged to another rehab unit. Functional measures were: admission: FIM: 23 (18–37), EFA 17 (12–24); discharge: FIM 39 (19–50), EFA 21 (18–24). Quantitative analysis from MMPRO showed continuous increase of the duration of the intervention and the precision of movements.
Conclusion: In the setting of early rehabilitation, the use of MMPRO was feasible in this pilot study. MMPRO was suitable for severely affected patients with different neurological disorders. Rehabilitation intensity was increased and patients remained motivated to use VR technology during the course of treatment. We conclude that a certain core stability in combination with the ability to focus on a task is a prerequisite for using MMPRO.

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Influence of Sudoku on attention and concentration parameters

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Introduction: Besides physical limitations and impairments, persons suffering from Parkinsons disease (PD) show several deficits in concentration and attention parameters. They can feel overstrained and rather be frustrated and/or depressed (Nombela et al., 2011).
Objectives: The aim of this study was to investigate the influence of Sudoku puzzles in concentration and attention performance in healthy subjects. Furthermore a case study was executed to investigate the improvement in 2 PD patients by using the same Sudoku puzzles.
Patients & methods: 10 healthy controls (age=27.7±3.63) and 2 PD patients (Mini Mental Status Test (MMST)1=28, Age1=88, MMST2=30, Age2=73) were recruited. All subjects were tested in a standardized concentration and attention assessment pre and post 3 weeks. Healthy controls were randomized in 2 smaller groups (group A, group B). PD patients and group A (n=5) were asked to solve one Sudoku puzzle per day. Group B (n=5) underwent no intervention.
Results: The assessment evaluation revealed tendencies of improved skills in all investigation parameters (the amount of found subjects within a certain time limit (BZO), concentration performance (KL), amount of missed subjects (AF) and the percentage of mistakes (F%)). Both groups (A, B) showed significant improvements within 3 weeks, group A even a better outcome in BZO (+22.3%), F% (-11.53%) and KL (+47%). The case study of the 2 PD patients exposed very different outcomes (Patient1: BZO=-6.57%, AF=-79.17%, F%=-77.73% and KL=+10.81%; Patient2: BZO=+11.67%, AF=+71.43%, F%=+53.46% and KL=+6.41%).
Conclusion: Due to outcome data an improvement can be found in all parameters of d2-R in the study with healthy participants. A higher BZO combined with a lower F% indicates increased skills in concentration capacities. As group A reached better results, Sudoku puzzles seem to have influence on concentration and attention performance in healthy persons. The case study revealed rather different results; Patient1 scored a higher level compared to Patient2. This can be caused by individual conditions. Therefore, Sudoku puzzles may offer a supplementation in treatment of PD-induced cognitive symptoms. Further research should explore the effectiveness of Sudoku puzzles in concentration and attention skills.

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P193

Influence of visual EMG biofeedback on gait parameters in people with multiple sclerosis

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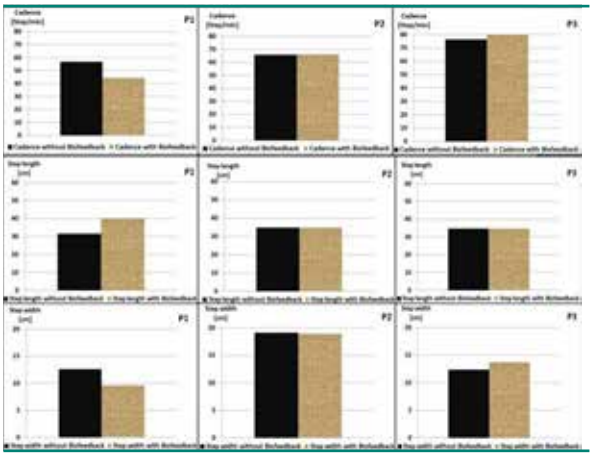
Introduction: Multiple sclerosis (MS) is a neurodegenerative disorder that often causes gait disturbances. In particular, impaired gait parameters include cadence, step length and step width. Biofeedback is used to control and regulate movements using the stimuli from the own body, for example auditory and/or visual stimuli.
Objectives: The aim of the study was to investigate whether visual Electromyography Biofeedback (EMG-BF) has a positive impact on gait parameters in people with MS (pwMS).
Patients and methods: Diagnosed pwMS (n=3; EDSS <6; mean age 51.7±21.6 years; all female) were included in this case study. Gait analyses were performed on a treadmill with integrated pressure measurement plate, both with and without visual EMG-BF. Surface-EMG was derived from the raw signals of both Mm. tibialis anterior. Quantitative and qualitative analyses were conducted using parameters like cadence, step length and step width compared intraindividual with and without Biofeedback.
Results: Using Biofeedback the value of cadence increased in two subjects (P2: +0.15%, P3: +5.56%) and decreased in one subject (P1: -21.38%). The step length increased in two subjects (P1: + 27.59%, P2: + 0.12%) and reduced in one subject (P3: -5.2%). Step width decreased in two subjects (P1: -23.56%, P2: -0.98%) and increased in one subject (P3: +10.67%) **(Fig. 1)**.
Conclusion: Considering the limitations in this case study, the results show in agreement with the study of Baram & Miller (2007) that Biofeedback in the form of closed-loop visual feedback cues has a positive effect on cadence, step length and step width in pwMS who suffer from gait disturbances. We suggest that Biofeedback is a feasible option for physical therapy helping to increase the self-awareness and motor control. However, further investigations are needed to determine short-term and long-term effects using Biofeedback training in neurorehabilitation.



P193 Fig. 1

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P194

Neuropsychology in Argentina – intervention strategies with limited resources

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Objectives: this poster aims to show the possibilities of puppet building in neurorehabilitation as well as social skills stimulation and developing.
Methods: Information was gathered from current evidence, case reports and clinical experience
Results: Argentinian neuropsychologists often face important challenges in creating everyday practice strategies with limited resources, trying to meet the needs of an increasingly complex population of patients. Daily experience has raised an own theoretical development, which includes the use of puppets to rehabilitate and habilitate praxia, gnosia, and some executive functions. It extends not only to the stimulation of cognitive functions, but both to the puppet transitional perspective, halfway of external reality and psychic reality as an object that builds fantasy and reality altogether; as well as the consideration of the significance of the body in the construction and management of the puppet and the manipulation of different tools and materials. It is also of great profit in developing and rehearsing social skills, as well as a means of social inclusion for inpatients, as it allows them to relate to society through their creations. Besides that, it can be used to work with illiterate patients as well as Non Verbal Learning Disorders.
Conclusion: Conclusions are focused on the idiosyncratic characteristics of puppets as a help in our practice and include the items previously mentioned, such as the rehabilitation of cognitive functions and social skills of a wide range of patients, including for example illiterate ones, as well as the importance in social inclusion of inpatients through creative work.
Keywords: Puppets; neurorehabilitation; executive functions, gnosia, praxia, transitional object, social skills.

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Progressive full recovery from complete quadriplegia following a C3-C4 spinal cord injury – a case report

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We report the case of a 22-yo male who sustained a C3-C4 spinal cord injury after a traffic accident. Quadriplegia with anesthesia and multiple fractures resulted after the crash. At hospital admission the patient was conscious and spontaneously breathing. MRI showed a 8 x 6 mm T2-hyperintense area in the centre of the spinal cord at C3-C4 level and signs consistent with a neck hyperextension trauma. No neurosurgical intervention was required. Within the following few hours the patient was intubated, sedated and mechanically ventilated due to the worsening of his general status. Weaning from MV was complicated by respiratory tract infections, but after 12 days the patient was extubated, tracheostomized and 2 days later completely weaned from MV. Rehabilitation was initiated at day 11 in the general hospital. Somatosensory and motor evoked potentials were performed at day 14 and proved to be normal. 8 days later, the patient was transferred to an advanced neuro-rehabilitation unit. One month after the accident, severe tetraparesis subsisted, whereas breathing, swallowing and sensitivity were restored. During the following 3 months, the patient underwent an intensive program which consisted of multiple and progressive approaches including physiotherapy, ergotherapy, water therapy, Erigo®, Lokomat®, Hirob® and Lyra® devices, treadmill and leg press for an average time of 3 to 4 hours per day. Baclofen 10mg tab was administered per os. The patient was discharged from hospital in full recovery after 108 days. At discharge, he was fluidly walking showing a physiological gait pattern and had recovered dexterity to a normal level according to the Purdue Pegboard Test. After an additional year of outpatient physiotherapy, he almost restored his premorbid funcionality. Slight phasic muscle hypertonia/hyperreflexia of four limbs and a minimal impairment of the fine motor skills are still observed. Further MRIs at 3, 6 and 18 months from the accident, showed two gliotic lesions, about half the size of the original one overall, in the median and paramedian region bilaterally. Early aggressive rehabilitation has played a major role in determining the patient's outcome. We want to emphasize the high predictivity that evoked potentials have had in this case, whereas MRI poorly correlates with the functional recovery. Eventually, we hypothesize that early intensive rehabilitation may be useful in promoting spinal cord repair by means of neuronal sprouting or regeneration.

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The usability test of mechanical and robot-assisted gait system in patient with spinal cord injury – a pilot study

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Introduction: Mechanical orthosis, such as the knee ankle foot orthosis (KAFO) and robot assisted gait training system (Rewalk) are both used for walking in spinal cord injury (SCI) patients. However, usability test of these systems has not been conducted for the users.
Objective: The purpose of this study was to compare the usability during gait training with KAFO compared with Rewalk in patients with SCI.
Patients and methods: A 32-year-old man with SCI (T_5/T_5 SCI, ASIA impairment) was recruited. The usability was tested using KAFO and Rewalk. The patient had 20 training sessions (60min/1 session) for each gait training system. The usability test was formed through consultations with experts on usability assessment. The content of the usability test was based on safety, effectiveness, efficiency, and satisfaction according to ISO standards. The usability test was evaluated by a questionnaire constructed by the investigator which included 4 categories of safety (6), effectiveness (6), efficiency (4), and satisfaction (7). The 5-point Likert scale was used for each (1-very dissatisfied, 2-somewhat dissatisfied, 3-neither satisfied nor dissatisfied, 4-somewhat satisfied, 5-very satisfied).
Results: For KAFO, mean saftey score was 3.5, effectiveness 3.3, efficiency 3.3, and satisfaction 3.8, while for Rewalk, mean saftey score was 3.5, effectiveness 3.3, efficiency 3.3, and satisfaction 3.9. The patient was satisfied with Rewalk more than KAFO system in overall satisfaction and did not report any adverse events when using the each gait training system.
Conclusion: In this pilot study, the patient was satisfied with the safety, effectiveness, efficiency and satisfaction of the each gait training system. The patient suggested that the each system was better than others in terms of effectiveness and efficiency. Through the usability test, we found that each gait training

Table 1. Usability test for KAFO and Rewalk

Category	Contents	KAFO	Rewalk
Safety (6)	Easley wearable	3	3
	Safe equipment	3	3
	Stable attachment of trunk part	4	4
	Physical adverse response during training	4	4
	No danger to the body	4	4
	Contingency body	3	3
	Mean	3.5	3.5
Effectiveness(6)	Strengthened muscle power	3	3
	Increased range of motion	3	3
	Improved gait function	4	4
	Reduced pain	3	3
	Improved bowel function	3	3
	Psychological improvement	4	4
	Mean	3.3	3.3
Efficiency(7)	Similarity to actual walking	3	4
	Getting used the equipment	3	3
	Getting overly tense	4	3
	No difficulty of equipment use	3	3
	Mean	3.3	3.3
Satisfaction(5)	No feeling fatigue	2	4
	body fitting	4	4
	Conformability of straps, buckles and pads	4	3
	Increased motivation for rehabilitation	4	4
	Desire for continued robot assisted training	4	4
	Wanting to recommend to other people with similar disability	4	4
	Overall satisfaction with robot assisted rehabilitation	4	4
	mean	3.8	3.9

P196 **Fig. 1**

P196 **Fig. 2:** The KAFO and Rewalk gait training system

system had its own advantages. Further research should be conducted with a larger sample sizes to explore the generalizability of our finding.

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Exploring prevention and treatment strategy for critical illness associated neuromuscular weakness

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Introduction: Critical illness associated neuromuscular weakness is very common in patient population those who are admitted in intensive care unit and mechanically ventilated. It has been evident in various research studies that patients mechanically ventilated for more than 7 days develops electrophysiological abnormalities and about 25–33% patients acquires neuromuscular weakness that may prolong post intensive care rehabilitation.
Objectives: This study was designed to investigate and explore the effects of electrical muscle stimulation (EMS) on as preventive or therapeutic option in critically ill patients.
Materials and methods: Subjects were recruited among the patient admitted in multidisciplinary intensive care units during the study period. The study employed a randomized single blind controlled experimental study design consisting of two group experimental group (Electrical stimulation group) and control group. The MRC score was used for clinical assessment of muscle strength and barthel index were used to assess the level of independence.
Results: EMS group patients achieved higher muscle strength grading scores than controls in knee extensors (left P≤0.01), (right P≤0.01) and ankle dorsiflexors (left P≤0.02), (right P≤0.02).
Conclusions: EMS has shown beneficial effects on the preserving strength of critically ill patients mainly affecting muscle groups stimulated therefore it can be considered as a potential effective means of preventive or therapeutic option for critical illness associated neuromuscular weakness.

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The upper extremity after stroke during early mobilisation: A Comparison of guidelines

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Background and Purpose: Early mobilisation after stroke is thought to contribute to the effects of stroke-unit care. The intervention is poorly defined and not underpinned by strong evidence. The author aimed to examine the early mobilisation and its impact oft he shouldergirdle and the affected arm.
Method: The author started a search in stroke Guidelines of the words affected arm during early mobilisation and veryfied them with the AGREE II instrument to score the quality. Followed by an analysis of the guidelines sources and a systematic review, to show the current state of research between 2007–2017, which have not be named in the Guidelines.
Results: 15 Guidelines from 11 countries between Februray and April 2017 with 19 sources were found. Three Guidelines recommend early mobilisation within 24 h and three between 24 h and 48 h. One Guideline recommend to assisst the affected arm during change of positioning. Five trials had been found during the systematic search. None of them showed advantages of starting mobilization within 24 h or 48 h. Not even one study could have been found which compares the impact of early mobilization on the hemiplegic or hemiparetic shoulder.
Conclusion: There is varyfing evidence when early mobilization should start. We also could not found evidence that early mobilization has any impact on the shouldergirdle or affected arm. Further investigations will be needed.
Keywords: Guideline, stroke, early mobilization, affected arm, shouldergirdle

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EEG paradigms as a supplemental tool to behavioral assessments of DOC

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Introduction: Diagnosis and prediction of recovery in the acute phase of disorders of consciousness (DOC) are critical for subsequent medical decisions. However, reliable assessment remains elusive due to the inability of current validated clinical scales to take into account motor and drive deficits. Recently, the Motor Behaviour Tool (MBT), a novel clinical scale, has been developed to address this caveat (1). In this context, neuroimaging and brain-computer interface (BCI) have also been proposed to improve the diagnosis and prognosis of these patients. (2).
Objectives: This pilot study aims to investigate the diagnostic and prognostic value of two electroencephalography (EEG)-based paradigms in patients with DOC, i.e., coma, Unresponsive Awareness Syndrome (UWS) or Minimally Conscious State (MCS). As a second step, we will employ them as evidence to further establish the added value of the MBT (i.e., assessment of minimal responses suggesting remaining conscious processing) combined with the Coma Recovery Scale-Revised (CRS-R), a standardized validated scale commonly used to assess consciousness in this population (3).
Patients and methods: Acute DOC patients undergo CRS-R and MBT assessment prior to two EEG paradigms. Firstly, a motor attempt EEG-BCI coupled with Functional Electrical Stimulation (FES) is used (4). We hypothesize that replacing the need for overt movements with motor attempt can alleviate the tendency of CRS-R to underestimate the level of awareness in case of cognitive-motor dissociation (CMD) (5). In addition, a second EEG protocol presents patients with FES-tactile (T), auditory (A), and audio-tactile (AT) stimuli both in actionable and non-actionable space. EEG evoked potentials observed in the actionable space are expected to show a non-linear addition of sensory stimuli (i.e., A+T≠AT) indicating multisensory integration and the capacity of conscious processing (6).
Results: Pending elaborate analysis, preliminary findings show **(Fig. 1)** that BCI accuracy is significantly above chance only for a patient who was diagnosed as UWS by the CRS-R evaluation, but exhibited a motor behavior classified as CMD confirmed by the MBT tool, and not for one in real UWS (same diagnosis based on CRS-R and MBT), implying the presence of the hypothesized relation between motor EEG correlates and awareness (7). Average EEG evoked potentials of 8 patients during the second EEG paradigm highlight a difference between within (solid line) vs. outside (dashed line) the actionable space **(Fig. 2)**, suggesting awareness-dependent modulation. Future analyses will explore correlations of such EEG descriptors with the clinical outcomes. **Conclusion:** EEG correlates extracted from these EEG paradigms are promising tools for diagnosis of DOC and may supplement current clinical scales to help the validation of new tools like the MBT.

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Cisternostomy – a new border in treatment of refractory intracanial hypertension?

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Background: Decompressive craniectomy is the gold standard to decrease ICP in patient with refractory intracranial hypertension after severe tramatic brain injury (TBI) [3]. Despite efficacity in reducing ICP its effect on improving outcome is stil in debate. [1–4]
Case report: A 50 year-old man underwent a severe TBI (Glasgow coma scale 6) and was admitted to the emergency unit. CT scan revealed multiple bilateral brain contusions and a small acute subdural hematoma **(Fig. 1A)**. We decided to set up a brain monitoring with ICP, Pbto2, and microdyalisis [5]. The ICP became refractory despite maximal medical management. A new cerebral CT showed unilateral mass effect with oedema around the parenchymal contusions **(Fig. 2.)** A surgical treatment was planned. A left frontotemporoparietal craniotomy was performed. The acute subdural hematoma was removed without any effect on the ICP. We decided to perfom a cisternostomy obtaining an immediate relaxation of the brain and a dramatic lowering of ICP (1mmHg). A cisternal drain was left in place **(Fig. 2)**. ICP was under control and brain metabolism improved improved: Pbo2 and CMD-Glucose increased, Lactate/Pyruvate ratio decreased **(Fig. 3, 4)** (short video of the surgical procedure). The patient could be extubated 6 days after surgery, the GCS score was 14/15 and the patient was transferred to neuro-rehabilitation.
Discussion: This case suggested the efficacy of cisternotomy in the treatment of refractory intracranial hypertension and also showed some promising effect on improvement of brain metabolism. However this technique has some limitations [2]: there is limited clinical experience reported in the literature and it requires a skull base neurosurgeon.
Conclusion: The collation of data from multicentric center should allow us to have reliable conclusions confirming the role of cisternostomy in treatment of severe TBI.

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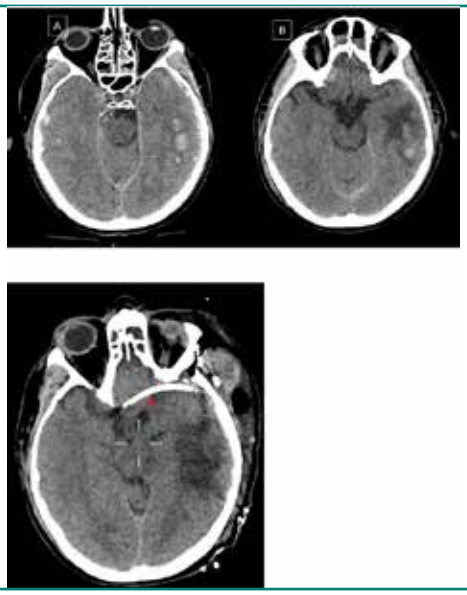
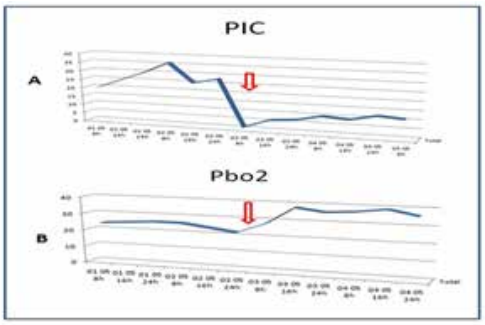
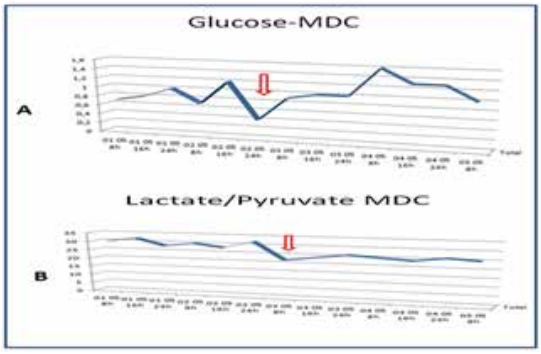


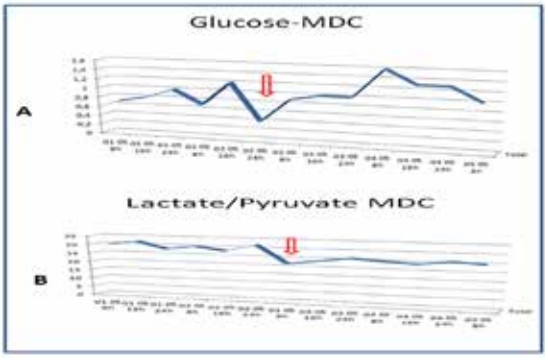
P201 **Fig. 1:** Initial (A) brain CT showing multiple bilateral brain contusions and a small acute subdural hematoma. Cerebral CT performed after one week (B) while the patient had refractory ICP despite maximal neuro-resiscitation revealing unilateral mass effect with oedema around the parenchymal contusions

P201 **Fig. 2:** Post operative cerebral CT showing decreasing of brain oedema and the cisternal drain (A) in the inter optic space





P201 **Fig. 3:** Brain monitoring with ICP (A) and Pbo2 (B). The red arrow represents the cisternostomy. ICP values before surgery shows a refractory intracranial hypertension despite maximal medical treatment. ICP dramatically lowered after cisternostomy, being normalized around 10-15mmHg. Pbo2 progressively increased and stabilized after cisternotomy reaching a level around 35mmHg



P201 **Fig. 4:** Brain monitoring with Glucose MDC (A) and Lactate/Pyruvate ratio (B). The red arrow represents the cisternostomy timing. Glucose MDC, globally inferior to 1mmol/L in the 24 hours before surgery, increased and stabilized to values above 1mmol/L. Lactate/Pyruvate ratio normalized after cisternostomy decreasing to values around 25

P202

ChinMotion rapidly enables 3D computer interaction after tetraplegia

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Individuals with severe paralysis require hands-free interfaces to interact with technology that can improve their communication abilities, independent living and neurorehabilitation treatments. However, current systems either require extensive training or deliver low-dimensional input signals. We sought to investigate whether preserved orofacial sensorimotor pathways could be harnessed to enable fast and intuitive multi-dimensional prosthetic control after tetraplegia. We developed and tested ChinMotion[1], a wearable open source interface that noninvasively translates chin, lip and tongue motion into intuitive 3D control commands. We evaluated ChinMotion effectiveness for controlling a computer cursor and a virtual robotic arm in eight uninjured controls and eight individuals with cervical spinal cord injury (SCI). Participants were instructed to perform

a centre-out-centre point-and-click task which adapted the ISO9241-9 standard recommendations for pointing device evaluation. The ISO9241-9 framework allowed to compare computer cursor control using ChinMotion, mainstream hand-operated pointing devices, and state-of-the-art hands-free interfaces. Within the same session, participants were also instructed to move the endpoint of a virtual robotic arm to perform a centre-out-centre reach-and-hold task in a 3D Cartesian space; trial completion times were used as performance metric. ChinMotion enabled superior point-and-click performance over existing hands-free interfaces and provided intuitive 3D control of a virtual robotic arm after ~2h of practice. Our results suggest that harnessing preserved orofacial sensorimotor pathways after injury offers a promising alternative towards facilitating safe, intuitive and accessible multi-dimensional prosthetic control to individuals with severe paralysis.

[1] F Galán, SN Baker and MA Perez. ChinMotion Rapidly Enables 3D Computer Interaction after Tetraplegia. arXiv e-Print archive: arXiv: 1606.02711.

P203

Increased alpha-rhythm dynamic range promotes recovery from visuospatial neglect: A neurofeedback study

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Objective: Despite recent attempts to use electroencephalogram (EEG) neurofeedback (NFB) as a tool for rehabilitation of motor stroke, its potential for improving neurological impairments of attention -such as visuospatial neglect- remains underexplored. It is also unclear to what extent changes in cortical oscillations contribute to the pathophysiology of neglect, or its recovery.

Methods: Utilizing EEG-NFB, we sought to causally manipulate alpha oscillations in 5 right-hemisphere stroke patients in order to explore their role in visuospatial neglect. Patients trained to reduce alpha oscillations from their right parietal cortex (rPPC) for 20 minutes daily, over 6 days.

Results: Patients demonstrated successful NFB learning between training sessions, denoted by improved regulation of alpha oscillations from rPPC. We observed a significant negative correlation between visuospatial search deficits (i.e. cancellation test) and re-establishment of spontaneous alpha-rhythm dynamic range (i.e. its amplitude variability).

Conclusions: Our findings support the use of NFB as a tool for investigating neuroplastic recovery after stroke and suggest reinstatement of intact parietal alpha oscillations as a promising target for reversing attentional deficits.

Significance: We demonstrate for the first time the feasibility of EEG-NFB in neglect patients, and provide evidence that targeting alpha amplitude variability might constitute a valuable marker for clinical symptoms and self-regulation.

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Neuroprostheses based on intracortical recordings of neural activity for restoration of movement and communication of people with paralysis

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Paralysis has a severe impact on a patient's quality of life and entails a high emotional burden and life-long social and financial costs. Restoring movement and independence for the paralyzed remains a challenging clinical problem, currently with no viable solution. Recent demonstrations of intracortical brain-computer interfaces, neuroprosthetic devices that create a link between a person and a computer based on a person's brain activity, have brought hope for their potential to restore movement and communication. While the intracortical brain-computer interfaces have steadily improved over the last decade, our recent success in linking brain activity with the newly developed techniques for spinal cord stimulation look to revolutionize locomotor rehabilitation. Specifically, our brain-spine interface restored weight-bearing locomotion of the paralyzed leg as early as six days post-injury in macaques1. New approaches in identifying neural features and designing decoding algorithms, which transform neural signals into computer commands, aim to deliver both stable and accurate control over clinically relevant periods of several months. To this end, we developed signal processing and decoder calibration approaches that enabled a person with long-stable tetraplegia to control a communication brain-computer interface for 138 days with an unchanged decoder2. Preliminary clinical studies suggest that these concepts and technologies are directly translatable to therapeutic strategies for people with paralysis.

[1] M. Capogrosso*, T. Milekovic*, D. Borton*, et al., A brain–spine interface alleviating gait deficits after spinal cord injury in primates. Nature 539, 284-288 (2016).
[2] T. Milekovic, et al., Stable asynchronous BCIs based on field potentials for communication, BCCN Conference

CONTRIBUTORS

[1] no abstract

NEUROLOGIE & REHABILITATION

Zielsetzung der Zeitschrift

Die Neurorehabilitation hat in den letzten zwei Jahrzehnten eine rasante Entwicklung durchlaufen. Fortschritte in der Neurologie, die zunehmende Evidenzbasierung und Validierung sensomotorischer, logopädischer, neuropsychologischer und weiterer therapeutischer Verfahren sowie die expandierende Rehatechnologie sind dafür ebenso verantwortlich wie die demographisch bedingt zunehmende Anzahl von Patienten. Die Zeitschrift **NEUROLOGIE & REHABILITATION** soll die Leser über zentrale Entwicklungen aus allen Bereichen der Neurorehabilitation informieren. Ergebnisse neurowissenschaftlicher und neurorehabilitativer Forschung und daraus abgeleitete Therapieansätze und -konzepte werden in Originalarbeiten publiziert, nicht nur von Medizinern und Grundlagenforschern, sondern im Zuge der Akademisierung der Therapieberufe zunehmend auch von Therapeuten.

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