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ABSTRACTS

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OP01

Scale for Retropulsion: A new scale to quantify postural imbalance in the sagittal plane

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Question: Retropulsion reflects a disturbed postural alignment in the sagittal plane, similar to lateropulsion in the frontal plane. It is characterized by a spontaneous posterior body tilt, active backward pushing, and resistance against passive correction. So far, research on this behavior is very limited, even though it seems quite frequent and relevant for neurorehabilitation. One major problem is that there is no established tool available to classify and quantify retropulsion. That's why we initiated an international, interdisciplinary Delphi study to develop a clinical scale for retropulsion. The final Scale for Retropulsion (SRP) is a bed side test and includes four subtests (static postural control, reactive postural control, resistance, dynamic postural control) which are assessed while sitting and standing. The SRP was translated into German following a standardized translation process. The aim of this study was to investigate the relationship of the SRP with established measures for postural control.

Methods: Patients with different neurological disorders (stroke, SHT, Parkinson's Disease, CIP/CIM) and postural imbalance were included in this study. Within one day, the SRP was performed by experimenter A and the Backward Disequilibrium Scale, the Berg Balance Scale, posturographic measures (static and limits of stability) were tested by experimenter B.

Results: We included 38 patients in this preliminary analysis (mean age 68 ± 13 years). The SRP showed high correlation with the Backward Disequilibrium scale ($r=0.77$, $p<0.001$). These scales assess a similar construct but the SRP includes components which are not determined by the Backward Disequilibrium Scale such as resistance or reactive postural control. The correlation of the SRP with the Berg Balance Scale was very high ($r=0.92$, $p<0.001$). By contrast, measures of the static posturography did not correlate with the SRP. Only the limit of stability in the forward

direction correlated with the SRP score ($r=-0.44$, $p=0.014$), i.e. patients with higher SRP scores had more problems in shifting their center of mass actively forward.

Conclusions: The SRP showed good correlation with established clinical measures for dynamic postural control. This supports the criterion validity of the scale. Even though retropulsion is specific for the sagittal plane it seems to be associated with a generally reduced postural control assessed with more generic measures.

OP02

A Nationwide Survey Regarding the Actual Life Situations of Patients with Thalidomide Embryopathy in Japan, 2018

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Introduction: Today, there are several thousands of thalidomiders over 50 years old living around the world and struggling with physical disabilities, secondary diseases and physical pain. However, clinical studies on the effects of the thalidomide-induced damage upon the thalidomide victims as they age have only recently started to be conducted. In Japan, a multicenter survey was previously conducted from 2011 to 2014, but it did not investigate socioeconomic factors such as gaps in health care and social status between thalidomiders and the general population in the same age cohort. Therefore, we newly carried out a nationwide survey focusing on the actual life situations of them.

Patients and Method: Questionnaires were sent to 274 thalidomiders living in Japan. Questionnaire items basically coincided with those of the Comprehensive Survey of Living Conditions (CSLC) in the general population

conducted by the Japanese Government. The results were compared with those of the CSLC for individuals aged 55–59 years, which was the cohort most similar in age to the average thalidomider in Japan. Moreover, we examined their persistent pain in details.

Results: More thalidomiders rated their health condition as relatively bad or bad compared with the general population (20.2% vs. 13.3%, respectively). A much higher percentage of thalidomiders reported having some health or physical problem caused by a disease or wound (68.8% vs. 32.6%, respectively), and thalidomiders more frequently visit medical and healthcare-related facilities. A higher proportion of thalidomiders (8.1%) were unemployed, and thalidomiders tended to feel higher levels of worry and stress, especially in terms of the future. As for pain, 54 thalidomiders out of 173 (31.2%) and 62 (35.8%) felt pain everyday and occasionally respectively. The most frequently found site of pain was shoulder, followed by neck, hands and fingers, upper arms, back, forearms and hip joint in order of frequency. Out of 119 thalidomiders with persistent pain, 21 (17.6%) of those felt much stronger pain and 50 (42.0%) of those slightly stronger pain than 5 years ago.

Conclusions: This nationwide survey of the actual life situations of thalidomiders in Japan clarified their actual health conditions and associations with socioeconomic status as well as increasing pain in thalidomiders, and can contribute to help improve health and medical care, welfare measures, and social support for thalidomiders in the near future.

OP03

Exercise therapy for fatigue in individuals with multiple sclerosis. A summary of current evidence based on the method Evidence Map

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Objective/Question: Exercise therapy is an evidence-based intervention to tackle fatigue in multiple sclerosis (MS).¹ However, due to e.g. time constraints of busy clinicians a research to practice gap exists. It has been suggested, that an evidence map can address this issue by providing evidence in a concise table.² Therefore, the object of this work was twofold: Summarizing current evidence in a table applying principles of an evidence map

and performing a survey among physiotherapists if this table is useful for clinicians.

Methods: Evidence from Heine et al¹ (2015, Cochrane Review) and from randomized controlled trials (RCTs, 2015-19), listed in the Cochrane Library, were summarized. Search strategy and eligibility criteria for searching the Cochrane Library was in line with Heine et al. Data was extracted in a pilot-tested table and peer-reviewed by the second author. An online-survey was distributed among the network of neuro-physiotherapists, registered within the Austrian physiotherapy association.

Results: Data from six RCTs, including 335 participants, and the Cochrane Review by Heine et al was included in the table. The RCTs confirmed the findings of Heine et al: Exercise therapy (e.g. endurance training or yoga) compared to non-exercise therapy reduces fatigue statistically significant.

The questionnaire was sent to 58 therapists: 8 therapists completed the questionnaire. They perceived detailed descriptions of the interventions and references of the studies as useful. Format of the table, font size, and amount of abbreviations should be changed. A link to the full-text of the studies would be helpful. Four therapists concluded that the information was useful for their clinical practice. One therapist reported that the information, provided in the table was not new to him/her.

Conclusion: Exercise therapy is effective in reducing fatigue in persons with MS. Additionally the used method to summarize evidence can be useful for clinicians. However, adaptations f.e. to the format of the table have to be applied and its usability has to be tested in a bigger population.

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1. Heine et al (2015) Exercise therapy for fatigue in multiple sclerosis. Cochrane Database of Systematic Reviews.
2. Schmucker et al (2013) Methoden des Evidence Mappings. Bundesgesundheitsblatt-Gesundheitsforschung-Gesundheitsschutz, 56, 1390–97.

OP04

Dalfampridine improves gait velocity but not mobility in daily life after a 6-month follow up in people with Multiple Sclerosis

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Question: Dalfampridine is a novel drug for symptomatic management of MS leading to increased gait velocity. Its effects on short and long term daily living outcomes are currently unknown. The goal of this pilot study was to evaluate effects of Dalfampridine on daily mobility and on performance of ADLs in people with MS. Moreover, the relationship between gait velocity and the daily living variables was evaluated.

Methods: 25 subjects were tested before and after a six-week and a six-month period of Dalfampridine intake. Following outcome measures were used to evaluate the effect of Dalfampridine on daily mobility and ADL performance: accelerometry over a 7-day period, the Timed 25-Foot Walk (T25-FW), the Canadian Occupational Performance Measure (COPM), the Fatigue Severity Scale (FSS) and the 12-Item Multiple Sclerosis Walking Scale (MSWS-12). Means and standard deviations are reported. Repeated measures ANOVA was used to the effects over time (pre-intake, at 6 weeks and 6 months intake). Moreover, the relationship between variables was evaluated using the Pearson correlations coefficient for interval variables and the Spearman's rank correlations coefficient for ordinal variables.

Results: ANOVA results show significant differences across pre-, 6-weeks and 6-months of intake for all variables. Specifically, the data reveal improvements of >20% after six weeks and six months of Dalfampridine intake in gait velocity, performance of daily living and subjective walking impairment. Improvements of 17% of mobility in daily life are seen after six weeks and of 5% after six months of Dalfampridine intake. Fatigue decreased of 20% (6 weeks) and 15% (6 months). Results of the correlation analysis at the three different measure points are: accelerometry and T25-FW ($r = 0,647$; $0,768$; $0,797$), MSWS-12 and T25-FW ($r = 0,686$; $0,726$; $0,431$), COPM and T25-FW ($r = 0,141$; $0,302$; $-0,036$).

Conclusion: Preliminary results show clinical relevant improvements of gait velocity and in some areas of ADL after Dalfampridine intake. Correlation analysis indicates that gait velocity correlates with mobility in daily life. Although persons with a higher gait velocity show a greater amount of daily mobility, there seems limited long term carry-over effect of improvements in gait tests on mobility of daily living. It is plausible that physical and occupational therapy are needed to induce a change in activity behavior and a lasting carry-over effect of improvements seen in clinical tests.

OP05

Modern gait training in spinal cord injuries using a novel powered exoskeleton

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Question: Spinal Cord Injury (SCI) is a traumatic event that results in a permanent deficit below the level of the lesion. Intervention to reintegrate patient into society is important to improve life satisfaction. Locomotor training using systems such as body-weight support treadmill training and/or exoskeletons has been shown to influence neuroplasticity and neural motor output. The purpose of this study is to evaluate the impact of overground gait training using the Indego powered exoskeleton in patients affected by SCI.

Methods: Patients affected by SCI admitted in our Neurorehabilitation Unit have been consecutively enrolled following inclusion and exclusion clinical criteria to fit the exoskeleton. Every patient underwent 8-week training protocol consisting of gait training 3 times per week, which utilized the Indego powered exoskeleton in indoor and outdoor conditions. Participants were also trained in donning/doffing the exoskeleton during each session. Safety measures were put in place and adverse events (AEs) were monitored and reported. Gait session length and number of steps were recorded for every patient. The Functional Independent Measure (FIM) was used to assess the effects of the exoskeleton on the rehabilitation activity.

Results: Twenty patients (12M/8F) mean age 44 (± 14.5) were consecutively enrolled. Patients were divided using the ASIA impairment scale and the level of lesion. Ten patients with ASIA A (complete) accomplished 15,296 steps in average time of walking of about 5 hours in 29 sessions, while the ASIA B and C (incomplete) made 18,451 and 6,787 steps respectively. When considering the level of the lesion, patients affected by cervical spine injury (n7) completed 20,265 steps compared to the 13,668 steps of thoracic (n7) and lumbar spine injury (n6). Using the Functional Independence Measure (FIM) to compare results at admission and at discharge, we found a statistical significance in terms of outcome scores (admission 98.10; discharge 101.05; $p < 0.01$). No adverse events were recorded.

Conclusions: Gait training with the new exoskeleton Indego has been found to be safe and easy to use for both high and low levels of lesions. Patients affected with cervical spine injury were able to complete a considerable amount of steps and showed good tolerability of overground gait training using the Indego device. Using the FIM patients had significant results in terms of recovery using a wearable robot.

OP06

Benefits of dynamic joint orthoses for regression of joint contractures in children and adolescents

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Introduction: Contractures are a common complication in neurological conditions such as cerebral palsy, resulting in a limited range of motion (ROM). Stretching plays an important role in treatment of the affected joints. Controlled dynamic stretching (CDS) orthotic joints represent promising new devices to enhance existing therapy, but there are no data on this therapeutic option in children and adolescents.

Objectives: To analyze whether CDS orthotics reduce or prevent contractures of various joints in children and adolescents with the primary

endpoint of clinically relevant improvement of passive ROM (PROM).

Patients and Methods: In this single-center, observational, intraindividually-controlled study, children and adolescents were recruited in 2018-2019 at the Charité Center for Chronically Sick Children. Patients received CDS orthotics in addition to their regular multidisciplinary treatment. CDS orthotics were used for knee flexion (KF) and extension (KE), elbow extension (EE), wrist dorsal extension (W) and ankle dorsal extension (DE). PROM and clinically relevant changes were assessed with neutral/zero-method and goal attainment scale (GAS) at baseline, after 6 (FU1) and 12 weeks (FU2), and 6 (FU3) and 12 months (FU4). Undesired events were monitored continuously.

Results: We treated 39 affected joints with CDS orthotics (13 KE, 10 W, 7 EE, 4 KF, 5 DE) in a total of 18 children (8 male, median age 9 years (range 5-15) with cerebral palsy, spina bifida or other genetic syndromes. In addition to contractures, most patients had increased muscular tone. Children received 1 to 4 (mean 2) orthotics. At FU2, PROM improved in 5/6 KE by $8 \pm 3^\circ$ ($p < 0.05$) and in 7/7 EE by $7 \pm 6^\circ$ ($p < 0.05$). We detected a trend towards PROM improvement in 4/6 W by $18 \pm 12^\circ$ ($p = 0.05$). Parents and therapists noted alleviation in care, positioning, transfers and increased activity in therapy. CDS were globally well tolerated, and no worsening of contractures was found. Until FU2, outcomes have improved, but not yet reached their pre-specified long-term goals (GAS). Whereas PROM was improved in 97% ($p < 0.05$) of tested joints, active usage of improved ROM as long-term goal still needs to be evaluated at FU4.

Conclusion: This is the first study showing improvements in PROM attributed to CDS orthotics in the majority of joints after a short treatment period with consecutive clinical improvements of individually set goals in children and adolescents with chronic neurological conditions.

OP07

Effects of Vestibular Rehabilitation After Severe Traumatic Brain Injury: A Preliminary Randomized Controlled Study

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Question: Gait and balance impairments after severe Traumatic Brain Injury (sTBI) are common and sometimes persist after the event. Chronic vestibular symptoms, such as vertigo, static and dynamic postural instabilities are among the most common causes of disability. These aspects are considered unfavorable prognostic factors, causing functional limitations and psychological distress, with a negative impact on quality of life and social reintegration.

The aim of this randomized controlled preliminary study, was to investigate the effects of vestibular rehabilitation on balance and gait, in subjects with sTBI and adequate cognitive functioning (Level Cognitive Functioning ³ 7).

Methods: Ten inpatients (6 males 32,5± 11,16 years) with a diagnosis of sTBI were enrolled in the study and randomized in two groups: a control group (CG), who performed a standard rehabilitation training, and a vestibular rehabilitation group (VRG), who completed a specific vestibular rehabilitation training (VR), which consisted in gaze stability and dynamic postural stability exercises, in addition to the standard one performed by the CG.

All patients were evaluated before and after 4 weeks of training sessions with the Berg Balance Scale (BBS), Dynamic Gait Index (DGI) and Community Balance & Mobility Scale (CB&M).

Results: As the Repeated Measures ANOVA showed, significant improvement was found in the experimental group, with respect to the control group, in DGI score ($p < 0,05$). Not significant improvement was found for BBS and CB&M scores in both groups.

Conclusion: Four weeks of VR training, in addition to standard rehabilitation, could improve balance and gait performances in patient with sTBI.

Although a larger sample size is needed to confirm the present results, the findings of this study suggest that the use of VR in patients with sTBI is promising when gait and balance disorders are addressed.

The results hence open the way for further discussions and assumptions about new rehabilitation strategies for patients with sTBI.

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OP08

Assessment of the balance and functional status in neurological patients: Reliability and validity of the Russian version of the Berg Balance Scale

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Question: Balance disorders are significant symptoms of many neurological diseases (Parkinson's disease, Multiple Sclerosis, Stroke, etc.). There is a need for the standardized objective clinical tool to predict fall risk in neurological patients (NP) in Russia and Russian-speaking countries as there is not a validated scale for this purpose. Meanwhile in Europe and USA Berg Balance Scale (BBS) is widely used for assessment of NP stability (Lima C. et al., 2018). The aim was to perform a validation study of the Russian version of BBS.

Methods: A randomized double-blind control study was designed to validate the Russian version of the Berg Balance Scale (BBS). Fifty-eight NP participated in the study had mild to moderate disability and could walk unassisted. The validation of BBS included translation by two independent medical translators and back translation by a native English speaker with fluent Russian, cultural adaptation and finally, assessment of psychometric parameters: Internal consistency (Cronbach's alpha

coefficient) and Test-retest consistency (two examinations by the same doctor with one-hour interval), Inter-rater reliability (two independent doctors' examinations with one-day interval) and concurrent validity. To test the concurrent validity of the scale, the Romberg Balance Test was performed on a stabilometric platform Stabilan-01-2 (JSC Rhythm, Russia).

Results: The average BBS score for all subjects before balance training on the stabilometric platform was 38.4 (CI 29.3–48.7). All the psychometric parameters of the BBS were higher than the critical threshold (0.70). Internal consistency assessed by Cronbach's alpha was 0.82 ($p < 0.001$). Inter-rater reliability of the scale evaluated by the Cohen's kappa was 0.91 ($p < 0.001$). Test-retest consistency calculated by the Pearson's correlation coefficient was $r = 0.94$ ($p < 0.0001$), indicating permanence of doctors' assessment during the observation period. The BBS scores correlated significantly ($r = 0.78$, $p < 0.05$) with the Romberg Balance Test, indicating acceptable concurrent validity. The average BBS score after balance training course was 43.8 (CI 34.1–51.9) that is significantly higher ($p = 0.047$) than before it.

Conclusion: Recovery of balance is a critical rehabilitation component for NP with motor impairment. This study has proven the reliability and validity of the Russian version of the BBS in the neurological patients and has shown feasibility for assessment of rehabilitation progress.

OP09

Influence of pusher behavior on starting position of the subjective postural vertical in the frontal plane

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Introduction: Pusher behavior (PB) is a severe postural disorder caused by stroke, and believed to arise from abnormal subjective postural vertical (SPV) perception in the frontal plane. Generally, SPV is calculated as the mean of the sum of the angles starting from the affected-side position and starting from the non-affected-side position. However, postural reaction when passively tilted to paretic side

toward non-paretic side is different in patients with PB (resistance to passive correction of tilted posture) and without PB (no resistance). Therefore, we hypothesize that SPV value on starting position is influenced by presence of PB. The purpose of this study was to clarify the difference in SPV due to the starting position for patients with PB and without PB.

Methods: Thirty-six right hemispheric stroke patients were enrolled. PB was assessed using the Scale for Contraversive Pushing (SCP). Based on SCP, 17 had PB (PB group) and 19 did not (non-PB group). SPV was measured using a vertical board (VB), with a semicircular rail attached to the bottom. Participants sat on the VB without their feet touching the floor, with eyes closed. The VB was manually rotated from a starting tilt position, either to the non-affected or affected side, at 15° or 20°, toward a vertical position at a rate of $< 1.5^\circ/\text{s}$. Participants told when they perceived themselves to be in a true vertical position, and the VB tilt was recorded using a digital inclinometer. To investigate the influence of the starting position on SPV, the mean value was calculated for the four trials that started from the affected side (SPV-A) and the four trials that started from the non-affected side (SPV-N). The tilt of 0° was considered the true vertical position, and the affected-side rightward tilt was assigned negative values. Differences in parameters between the two groups were evaluated using Student's t-test.

Results: In SPV-A, the mean value was a significant affected-side deviation for the PB group ($-6.3 \pm 1.5^\circ$) as compared to the non-PB group ($-2.1 \pm 1.9^\circ$; $p < 0.05$). In SPV-N, the mean value was not significantly different between the non-PB ($1.5 \pm 3.0^\circ$) and PB groups ($1.5 \pm 3.9^\circ$).

Conclusions: At the starting position on the affected side, the PB group showed a significant contralesional tilt on the SPV than the non-PB group. In PB, as the body recognizes that the verticality tilted to the affected side, it seems that it resists passively by correcting from the affected side to the non-affected side.

OP10

Physiotherapy in children and adolescents with trisomy 21

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Introduction: Trisomy 21 is the most common autosomal numerical chromosomal aberration

with a frequency of 1:800 new-borns. From birth on, the life of those patients is marked by the physical and mental impairments, which are associated with the genetic defect. The reduced strength and the reduced balance play a substantial role, as these are essential abilities to achieve effective and functional movements. In addition, there is a delay in motor development. The aim of this bachelor thesis is to clarify whether one of the investigated physiotherapeutic interventions can have an effect on the parameter strength and balance in children and adolescents with trisomy 21, by using evidence-based literature.

Methods: For the implementation of the work, a systematic literature search was carried out and implemented in the electronic databases "MEDLINE via PubMed", "Cinahl" and "PEDro". Six studies, which investigated the effects of physiotherapeutic interventions on strength and balance in children and adolescents with trisomy 21, were searched to answer the question of this thesis. Further, books from the fields of paediatrics and neurology were used to explain the clinical picture and increase knowledge.

Results: Three out of six studies investigated the effect of progressive resistance training. The other publications dealt with isokinetic training, whole-body vibration training in combination with conventional training and virtual-reality training in combination with treadmill training. With regard to the outcome parameter "strength", five out of six studies achieved a significant improvement within their intervention groups. Additionally, all included studies, which investigated the outcome parameter "balance", showed a significant improvement within the intervention group.

Discussion and Conclusion: Due to the different therapy contents, a direct comparison of the interventions and results was only possible to a limited extent. Moreover, various measurements methods were used to assess the outcome parameters "strength" and "balance". Nevertheless, six out of six studies confirm the hypothesis that physiotherapeutic interventions can improve the strength and balance of children and adolescents with trisomy 21.

Fig. 1

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OP11

To smell or not to smell – that is the question – Clostridium difficile-associated Diarrhea identified by odour?

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Introduction: There exists a long traditional myth that Clostridium difficile associated diarrhea (CDAD) can be diagnosed by a typical odour of stool – an odour often described reminding of horse apples.

Methods: We included patients with diarrhea of unknown origin in our rehabilitation unit (intermediate care unit). They mostly recovered from stroke or other neurological diseases justifying intermediate care treatment (so called "phase B" in Germany) Before taking samples of stool for testing for e.g. toxin proofing CDAD we asked our nursing staff caring hands on for the patients, if they would bet, if there is CDAD on the odour.

10 male, 10 female, mean age 82, range 61 – 89 were included. We found 4 groups according odour positive, toxine positive (PosPos), odour positive, toxine negative (PosNeg), odour negative, toxine positive (NegPos), odour negative, toxine negative (NegNeg).

Results: We found 4 in group .PosPos,8 in group PosNeg , 3 in Group NegPos, 5 in group NegNeg.

2 by 2 Table Toxine/Odour

	Toxine Pos	Toxine neg
ODOUR Pos	4	8
ODOUR neg	3	5

Conclusion: The results were totally random. The odour is not at all able to discriminate between CDAD and Diarrhea of other etiologies. But although the results were announced in our clinic very often, our staff was of the opinion, they could bet and win. Old myths die hard.

OP12

Disease-specific rehabilitation in women with epilepsy

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Purpose: to study specific aspects of neurorehabilitation in women with epilepsy

Methods: 155 women at the age of 16 – 45 were included in the prospective observational research of reproductive endocrine complications (REC) due to antiepileptic drugs (AEDs) into 3 groups: 1gr. - AEDs monotherapy, 2 gr. - polytherapy, 3 gr. - without AEDs. Family status, reproductive activities 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 the clinic weren't taped in groups. 47% of women were married. 31% of 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 was 53%, 75% of

them due to the side effects of AEDs. Comorbid REC was observed for 21 women (13%). In 61 (40%) cases REC due to the treatment of AEDs was identified. REC was 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 included social, mental, reproductive aspects. The fertility rate among women with epilepsy was lower optimal due to medical and social reasons. Reproductive endocrine complications were a frequent side effect of antiepileptic drugs above at polytherapy. It was necessary for monitoring reproductive health condition during treatment with antiepileptic drugs.

The reported study was funded by the Russian Foundation for Basic Research (RFBR) according to the research project № 18-013-00222.

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OP13

Hyperacute Rehabilitation - Benefits and Challenges

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Question: Can the benefits overcome the challenges of hyperacute rehabilitation?

Methods: Hyperacute rehabilitation refers to the very early stage of rehabilitation for persons

with disabilities from acute care settings. According to the World Health Organisation, nearly 200 million experience considerable difficulties in functioning. This prevalence will rise in coming years due to the ageing population with multiple co-morbidities which pose a major challenge to the Physical and Rehabilitation Medicine Specialty worldwide in delivering comprehensive goal-oriented multidisciplinary rehabilitation programme. The issue that involves hyperacute rehabilitation is about dealing not only with acute illnesses but also with de-conditioning, healthcare-associated infections, critical illness neuromyopathy and psychosocial elements. Needless to say, it involves the collaboration of PRM physicians with other specialty colleagues. Delivery of such rehabilitation programmes involves pathways such as functional restoration, disability management and neuro-palliative care. Models to deliver such efficient care ideally should be the establishment of PRM beds in the acute hospital along with the work-force planning of the mobile PRM team. For instance, in the UK, it is planned at the three levels: a) Tertiary Specialised Rehabilitation b) Supradistrict specialised services and c) Local non-specialised services. Benefits of such services include the reduction in length of stay in the hospital along with good functional outcomes. Outcomes measures to assess efficacy are numerous and depends on the familiarity and inter-observer reliability of each country and sub-specialty. Challenges of such rehabilitation provision involve not only of ethical aspects (resuscitation status, ceiling of care, mental capacity assessment, palliative end of life care etc.,) but also cost efficiency and savings.

Results: Study in the UK showed the average cost savings of such programme are roughly 700 Euros for each highly dependent patient with the cost recovery achieved in 14.2 months. This may be promising when planning the service internationally based on Disability-Adjusted Life Years (DALYs).

Conclusion: In summary, challenges of such rehabilitation programmes may overcome by good workforce planning as there are clear benefits in terms of preventing complications, reducing the hospital length of stay and successful community integration.

OP14

Feasibility of transauricular vagus nerve stimulation at improving

behavior in disorders of consciousness

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Introduction: Vagus nerve stimulation has been reported to modulate cortical excitability through enhancing neuronal thalamic activity. Two recent case studies including invasive and non-invasive vagus nerve stimulation after severe traumatic brain injury have shown promising results at increasing the level of consciousness. This study aimed to determine the effectiveness of non-invasive transauricular vagus nerve stimulation (taVNS) in a sample of individuals in VS/UWS or MCS after a cerebrovascular or traumatic incident.

Methods: Eleven subjects (n=6 female), aged 41±18 years, either in VS/UWS (n=4) or MCS (n=7) for more than 6 months after a traumatic (n=6) or non-traumatic (n=5) brain injury participated in the study. Experimental intervention consisted of 40 30-minute sessions, administered twice a day, with a minimum resting period of 5 hours between sessions. The Parasym (Parasym Ltd., London, UK) was used to administer the stimulation (Sinusoidal waveform; Pulse rate=20Hz, Pulse width=200µs, I=20mA). Participants were assessed by a blind experienced therapist with the Coma Recovery Scale-Revised (CRS-R) one month before the intervention, before the intervention (baseline), after 1, 2, 3, and 4 weeks after the beginning of the intervention, and one month after the intervention. During all the study, participants received multisensory stimulation that did not include other brain or nerve stimulation.

Results: Although clinical diagnosis (VS/UWS or MCS) remained unchanged during the study, a significant increase in the total CRS-R score was detected from baseline to 1-month follow-up (paired t test, 9.4±2.7 vs 10.2±3.3, p=0.04). None of the individuals in VS/UWS showed any change. In contrast, five of the seven individuals in MCS showed an improvement during the study (range: 1 to 3 points) (chi-square=5.2, p=0.02). Improvements in the CRS-R were detected during the last week of the intervention in only one responder, and at 1-month follow-up in all other cases, and were evidenced in only one subscale of the CRS-R in all responders (three individuals in the motor subscale and another in the visual subscale) but in one case,

who showed improvements in motor, visual and verbal subscales. All patients finished the study with no noticeable side-effects.

Conclusions: taVNS could be a safe and promising tool to improve recovery in severely brain injured patients. A delayed effect, primarily on motor responses, was the main positive response detected in our study.

OP15

Corticothalamic metabolism in severe traumatic brain injury with different neurological outcomes

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Introduction: The objective was to study the correlations and the differences in glucose metabolism between the thalamus and cortical structures in a sample of severe traumatic brain injury (TBI) patients with different neurological outcomes.

Methods: We studied 49 patients who had suffered a severe TBI and 10 healthy control subjects using 18Ffluorodeoxyglucose positron emission tomography (18F-FDG-PET). The patients were divided into three groups: a vegetative or minimally-conscious state (MCS&VS) group (n = 17), which included patients who were in a vegetative or a minimally conscious state; an in post-traumatic amnesia (In-PTA) group (n = 12), which included patients in PTA; and an Out-PTA group (n = 20), which included patients who had recovered from PTA. SPM5 software was used to determine the metabolic differences between the groups. FDG-PET images were normalized and four regions of interest were generated around the thalamus, precuneus, and the frontal and temporal lobes. The groups were parameterized using Student's t-test. Principal component analysis was used to obtain an intensity-estimated-value per subject to correlate the function between the structures.

Results and conclusions: Differences in glucose metabolism in all structures were related to the neurological outcome, and the most severe patients showed the most severe hypometabolism. We also found a significant

correlation between the cortico-thalamocortical metabolism in all groups. Voxel-based analysis suggests a functional correlation between these four areas, and decreased metabolism was associated with less favorable outcomes. Higher levels of activation of the cortico-cortical connections appear to be related to better neurological condition. Differences in the thalamocortical correlations between patients and controls may be related to traumatic dysfunction due to focal or diffuse lesions.

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OP16

Development and validation of the Cooperative Activity Stroke Assessment (CASA): Complementing evaluation of upper limb motor status in stroke survivors

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Introduction: Bilateral cooperative upper limb movements are frequently used in functionally meaningful tasks of daily living. Although being significant for stroke survivors, these movement tasks are barely considered in existing clinical assessments for upper limb function and impairment. The Cooperative Activity Stroke Assessment (CASA) was designed to be a valid, feasible, time and cost-efficient tool to assess bilateral upper limb function complementing current gold standard measures.

Objectives: The objective of this study was to develop and evaluate the Cooperative Activity Stroke Assessment (CASA).

Materials & Methods: The CASA consists of five bilateral cooperative tasks of daily living, scored on a qualitative (movement execution) and quantitative (execution time) scale. Inter- and intra-rater reliability and floor/ceiling effects were analyzed in a heterogeneous cohort of 55

stroke patients (34 subacute patients; 20 chronic patients). Validity was assessed by correlating CASA-scores to the Fugl-Meyer Assessment of the Upper Extremity (FM-UE) and the Box and Block Test (BBT).

Results: Inter-rater (Intra-class correlation coefficient (ICC): 0.99 (0.98-0.99 95%CI), intra-rater (ICC: 0.98 (0.96-0.98 95%CI) and test-retest ($r_s = 0.96$, $p < 0.001$) reliability of the CASA were excellent. Spearman correlations between the CASA and FM-UE ($r_s = 0.88$, $p < 0.001$) and the BBT ($r_s = 0.89$, $p < 0.001$) showed a strong concurrent validity. Only 2% of the patients showed ceiling effects while flooring effects occurred in 20% of the patients.

Conclusions: We suggest the CASA to be a simple, cost and time efficient and feasible assessment with excellent clinometric properties measuring functionally relevant bilateral upper limb function in both subacute and chronic stroke patients. Due to its time efficient and simple setup and implementation, CASA might be feasible to complement recommended assessments only evaluating unilateral or bilateral non-cooperative upper limb function and impairment for research and clinical routine.

OP17

Mapping of 1,633 Goals from the Tower Study Reveals a Higher Proportion of Activity and Participation-Related Goals in Spasticity Patients

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Objective: In order to gain insight into areas of interest from the spasticity patient's perspective, we mapped the goals within the TOWER study using the International Classification of Functioning, Disability, and Health (ICF) categories and the EQ-5D domains. Goal setting is a significant challenge for individualized toxin treatment in patients with movement disorders. The ICF identifies and structures patient goals and may provide the expanded framework for treatment impact on individual task performance.

Methods: A total of 1,633 individualized spasticity-related treatment goals collected according to the Goal Attainment Scale (GAS) during the TOWER study were mapped by following the ICF linking rules and the EQ-5D domains. Two researchers familiar with the ICF and ICF linking rules independently reviewed the goals. In the case of ambiguity, a third expert provided the final decision on the most appropriate linking. The degree of consensus and differences acts as a measure of comprehensibility of the goals. Goal categories are described according to the ICF framework.

Results: A high level of agreement in the main ICF concept (i.e., what the goal is about) was achieved (N=1570; 96.1%) and was dependent upon 3 factors: knowledge of ICF items, understandable goal statements, and appropriateness of linking rules. Eight hundred and ninety seven (54.9%) goals were task related (activity/participation). The main domains were problems with walking / mobility (N=318, 35.4%) undertaking single/multiple tasks (N=170; 18.9%) and dressing (N=112, 12.5%). Body functions were represented in 44% of patient goals: 21.4% related to pain and 44.7% related to muscle tone. Only 65% of goals were to be linked to the EQ-5D categories.

Conclusions: The results reveal a higher proportion of activity/participation-related goals including single/multiple tasks such as stretching, positioning and exercising. This analysis sheds new light on the patient need and also the perspectives of patient-centered goal-driven botulinum toxin treatment in spasticity. The ICF offers a broader framework for patient-centered goal setting and may increase comparability of clinical data. EQ-5D seems to miss more than 35% of goals that matter to patients with focal spasticity.

OP18

Epilepsy and Autism Spectrum Disorder: sequential plasmatic level and global quality of life assessment in antiepileptic drug treatment in Mali

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Introduction: Epilepsy and Autism Spectrum Disorder (ASD) are the two faces of a coin. We hypothesized that appropriate antiepileptic treatment will result in a better quality of life for epileptic patients with or without ASD.

Aim: To evaluate the quality of life of epileptics with/out ASD on antiepileptic drugs (AED) in Mali.

Methods: We followed 90 epileptics with/out ASD from October 2017 to May 2019. We recorded the duration, intensity, and the frequency of epileptic seizures before and during treatment (M1 at M3) and used the McGill to assess the global quality of life. Plasmatic AED levels were determined at first month (M1) and third month (M3) timepoints after treatment initiation.

Results: Comorbidity ASD/epilepsy was 8.9%. The age group 16-30 years represented 50%. Our study participants received phenobarbital (73.3%), valproic acid (7.8%) and carbamazepine (18.9%). Side effects occurred in 13.3% of participants. With 79% treatment adherence rate, the AED was under-dosed (42%), normo dosed (50%) or overdosed (8%). At M1, epileptic seizures occurred <1/ month in 26.7%, had minimal intensity in 94.4%, and lasted <1 minute in 16.7 %. The global quality

of life was better 94.5%. The plasmatic levels of AED were different from M1 to M3 $p < 0,000$.

Discussion: The non-observance rate of the AED treatment was non-negligible. Nevertheless, our data show that AED prescription and follow up based only on body weight does not guarantee adequate plasma levels to control seizures. Epileptics with/out ASD will benefit from sequential AED, Electroencephalogram (EEG) and quality of life assessment. The occurrence of side effects should prompt for screening for known polymorphisms (SNPs) in Cytochrome CYP450 genes. Altogether, our ultimate goal is to revolutionize the AED treatment for personalized medicine in Mali.

OP19

Using clinical data to develop a prognostic model for decannulation in patients with acquired brain injury

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Objective: The objective of the present study was to use routinely gathered clinical data to develop a prognostic model for decannulation, which can be directly implemented in clinical practice.

Methods: A large cohort study including 609 tracheostomised patients with acquired brain injury (ABI) admitted for neurorehabilitation. We analysed discrete failure-time with logit-link. In this model a reference hazard-function is analyzed using restricted cubic splines. The outcome was time to decannulation from either a cuffed or fenestrated tracheostomy tube.

Results: A total of 441 patients (72%) were decannulated during follow-up. The prognostic model for decannulation included age, sex, diagnosis, time from injury, living region, and Early Functional Assessment (EFA). In multiple adjusted models age and EFA scores were the strongest predictors related to decannulation.

Conclusion: A conservative prediction model for decannulation was developed, using clinical data which have been gathered routinely. Based on the model, an online tool was

developed, which may be directly applied in clinical practice to assist decision-making and information to relatives regarding prognosis for decannulation.

OP20

The role of neurosurgical complications and cognitive reserve in the outcome of patients with severe acquired brain injury

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Introduction: The efficacy of decompressive craniectomy (DC) to reduce the intractable intracranial hypertension and mortality, but with an increase of vegetative state (VS)/unresponsive wakefulness syndrome (UWS) has been previously reported.

Methods: As for the analysis of previous multicentric studies, the DECRA study leads to underline the significant differences of the neurological complications in the DC versus the medical group, with a percentage of hydrocephalus of 10% versus 1% respectively. Similarly, the long term RESCUE-ICP study results demonstrated an interesting curve of neurological recovery compatible with the possible role of the late neurosurgical complications and the time needed for their resolution.

Results: The point of view of the rehabilitation team may support an innovative interpretation of the DECRA and RESCUE-ICP results; that is, if the neurosurgical complications are treated in adequate timing, the outcome after DC could be better and reached earlier, i.e. in the first 6 months after DC. Delay of cranioplasty may lead to the development of the syndrome of trephined (SoT) or of the sinking skin flapping syndrome (SSFS), defined as a syndrome secondary to extensive craniectomy, progressive and sometimes severe neurological deterioration occurring at different time intervals after DoC, from several days to 7 years, due to the atmospheric pressure on the underlying brain tissue and to the in-and-out displacement of the brain through the skull defect. Several authors have noted that in cases of an extensive skull defect, usually sunken, clinical symptoms are improved by cranioplasty. In summary, the

recovery obtained between 6 and 12 months after DC seems to depend on the late resolution of the neurosurgical complications, such as hydrocephalus and the SoT/SSFS. In a group of patients with TBI, also the grey matter volume loss, measured by means of Voxel-Based Morphometry and the effect of the Cognitive Reserve seems to modulate the clinical outcome.

Conclusion: Early cranioplasty is desirable for the beneficial effects on the final outcome of the patients with severe brain injury, also with prolonged disorder of consciousness, to reduce the hospital stay, the relative costs and the linked risks of nosocomial infections, which is nowadays the first cause of mortality worldwide. The cognitive reserve may also play a role in the clinical outcome. *Acknowledgment: European Union's Horizon 2020 grant agreement No 778234.*

OP21

Mirror therapy to improve the motor function of the upper extremity of stroke patients

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Introduction: Stroke is the most common cause of disability and due to the aging society, the number of strokes is increasing. Patients who suffered an insult are considerably restricted in their ability to cope with everyday life, particularly due to an impairment of motor functions of the upper extremity. There are several different therapeutic measures that can be applied to improve arm motor function. Mirror therapy is a simple and inexpensive treatment that is much researched. The aim of this bachelor thesis is to prove the positive effect of mirror therapy on the motor ability of stroke patients. The question, "Can mirror therapy contribute to an improved use of the motor function of the upper extremity of stroke patients?" will be answered.

Methods: In November 2018, literature research was carried out in the medical and physiotherapeutic databases PubMed, PEDro and Cinahl.

Results: Six randomized controlled trials (RCTs) were selected, analyzed and discussed to answer the question. In all six studies, it was shown that the motor ability of the upper extremity could be significantly improved during the course of the study with the intervention of

mirror therapy. However, a significant group difference between the intervention group mirror therapy and the respective comparison groups could only be determined in one study.

Discussion and conclusion: Mirror therapy positively influences the motor regeneration of the upper extremity after a stroke. In most studies, mirror therapy is used as an additional therapy. Whether it is more effective compared to other therapies, however, could not be determined.

Keywords: mirror therapy, rehabilitation for stroke, motor ability

OP22

The effectiveness of various methods for the functional development of paretic hands after stroke

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Question: Is there any difference in the effectiveness of visual force feedback for improvement of muscle function of hand and fingers compared with task-oriented electromyogram (EMG)-triggered functional electrical stimulation (FES) and ergotherapy.

Methods: The randomised controlled pilot trial of four weeks was conducted in Rehabilitation Clinic of Debrecen University in Hungary. Twenty eligible subacute and chronic stroke patients (15 male and 5 female, age: 66,02 ± 9,81) were enrolled. The patients were randomised into three groups: the Group A got a task-oriented EMG-triggered FES treatment (20 minutes/day). The Group B had visual forced feedback training (20 minutes/day) and the Group C took part in a conventional ergotherapy treatment (30 minutes/day). All the patients attended the conventional physiotherapy (90 minutes/day). Action Research Arm Test (ARAT),- and Fugl-Meyer Assessment upper limb test (FMA) were measured before and after the study as global outcome measures. An electronic dynamometer (Biometrics Ltd E-LINK software) was used to assess the maximal grip force in 5 hand positions, the rate of force development and the sustainability of grip force. Similar assessments were performed to assess pinch strength, key 1-3, three jaw and tip to tip positions. Wilcoxon and Kruskal-Wallis tests

were used for intragroup and intergroup analysis of changes.

Results: There was a significant improvement in the ARAT and the FMA test in all groups ($p=0,017$, $p=0,027$ respectively). However, in the key 1-3 and three jaw positions tests the improvement was significant only in the Group B ($p=0,017$). In the intergroup, the analysis has shown that there were not significant differences in the changes of outcomes with the exception of three jaw test, where the Group B achieved a significantly better result. ($p=0,017$)

Conclusion: All of the interventions could improve the global hand functions but the data are suggested that the visual feedback training by Biometrics may be more effective on special parameters. Further studies involving more patients are needed to get more evidence.

OP23

Paired associative stimulation delivered by pairing movement-related cortical potentials with peripheral electrical stimulation improves voluntary activation in people with stroke

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Question: Novel paired associative stimulation (novel-PAS), is a neuromodulatory intervention that involves pairing an endogenous electroencephalography signal, the movement-related cortical potential (MRCP), with peripheral electrical stimulation. Novel-PAS can increase corticomotor excitability and has potential to aid stroke recovery [1]. Previous studies have used transcranial magnetic stimulation (TMS) to assess the immediate effects of novel-PAS; however, the use of TMS as a measure in stroke research is limited by safety precautions, discomfort, and the inability to generate a measurable response in some individuals. Thus, we were interested in evaluating the effect of novel-PAS on more feasible measures in people with stroke. This study asks whether novel-PAS can produce an immediate improvement in the primary outcome of maximal voluntary contraction (MVC) of the dorsiflexor muscles, and in the secondary outcomes of rate of force development of the dorsiflexor muscles, voluntary activation (VA) of

the tibialis anterior and electromyography amplitude.

Method: In this repeated-measures cross-over study, fifteen participants with chronic stroke completed two interventions, novel-PAS and sham, in a randomised order. During novel-PAS, 50 repetitions of visually-cued dorsiflexion were completed, while single pulses of electrical stimulation were delivered to the deep peroneal nerve. Each somatosensory volley was timed to arrive in the motor cortex at the peak negativity of the MRCP. Univariate and multivariate linear mixed models were used to analyse the primary and secondary data respectively.

Results: There was no significant effect of novel-PAS on the primary outcome (MVC) ($p=0.64$) or on the combined primary and secondary outcomes (MVC, rate of force development, VA and electromyography amplitude) ($p=0.14$). However, the multivariate analysis revealed a significant effect of novel-PAS on VA, such that novel-PAS increased VA by 7% (95% confidence interval 1.3-12.7%).

Conclusion: Novel-PAS can significantly increase VA of the tibialis anterior in people with chronic stroke. This finding confirms that novel-PAS has a central neuromodulatory mechanism and offers an alternative, feasible measure for future research.

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OP24

Pelvis biomechanics in post-stroke patients measured by instrumental gait analysis

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Introduction: Impairment of gait is common in post-stroke patients, with a significant impact on patient's autonomy, increasing the energy cost. The pelvis, as a connecting element between the lower limbs and the trunk plays a key role in weight transfer between limbs during gait.

The aim of this study was to describe the relation between the kinematics of the pelvis and type of gait in post-stroke patients.

Methods: Post-stroke spastic hemiplegic patients with gait impairment were referred between 2012-2019 to the gait Laboratory (GL) of a neuro-rehabilitation center. Data of kinematics, kinetics and video were collected from 182 patients.

Pelvis tilt, rotation (Rot) and obliquity (Ob), maximum and minimum values were registered and their variation ranges were calculated. We performed a comparative analysis and statistical significance for correlations with cadence, speed and stride length using Pearson test - significance levels p

Results: 100/182 were male, mean age was 54 years, 50 had hemorrhagic and 109 ischemic strokes, 105 had right and 77 left hemiparesis. Spatio-temporal parameters: cadence 66.02 step/min (3/4xnorm), stride length 0.62m (2/5xnorm), velocity 0.36m/s (1/3xnorm).

Average pelvis excursion, in the three planes was: Tilt 10.92° (3xnorm), Rot 17.02 (2xnorm), Ob 7.27 (as norm).

There was statistical significance ($p<0.01$) between cadence and pelvis excursion with negative moderate correlation (Tilt -0.421, Rot -0.411, Ob -0.279).

No statistical significance or poor correlation, between stride length and pelvis excursion (Tilt $p>0.05$), (Rot -0.168, Ob -0.172 with $p<0.05$).

There was poor negative correlation between speed and pelvis excursion (Tilt -2.12, Rot -0.283, Ob -0.245) ($p<0.01$).

Conclusions: Our findings confirm the expected, in walking hemiplegic stroke patients, as described in reference scientific publications. In our cohort: higher excursion of pelvis correlated with lower cadence; pelvis excursion demonstrated little impact in walking speed, probably due to the influence of other compensatory strategies, focused on other limb segments and/or assistive devices; pelvis tilt and rotation demonstrated greater influence than obliquity in the different parameters.

Keywords: Stroke; Gait; Gait analysis; Pelvis; Kinematics; Kinetics

OP25

The effect of continuous passive movement for paretic ankle-foot and brain activity in early stroke rehabilitation

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Introduction: Post-stroke muscular weakness, spasticity and pathological posture of the paretic lower limb may cause ankle and foot deformity and disharmony of the gait. After a stroke commonly applied therapy is passive movement with the aim of preventing complications (such as spasticity, deformities, deep vein thrombosis) and sending stimuli towards the cerebral cortex.

Objectives: to investigate the short-term efficacy of the continuous passive motion (CPM) device developed for the therapy of ankle-foot paresis and to investigate by fMRI the evoked flow changes in the cerebral cortex during passive movement.

Patients and methods: Sixty-four patients with an acute first ever ischemic or hemorrhagic stroke were investigated. Patients were randomly assigned into 2 groups: forty-nine stroke patients received both manual and

device therapy (M+D), while the other group (15 patients) received only manual therapy (M). In addition, a third group of ischemic stroke patients (12 patients) was investigated by fMRI before and immediately after 30 minutes CPM device therapy. All patients were assessed using the Modified Ashworth Scale (MAS) and a goniometer.

Results: Mean MAS score significantly decreased, and the ankle's mean plantar flexion and dorsiflexion passive range of motion significantly increased in the M+D group. The mean equinovalgus improved significantly in the M+D group. In the fMRI group the passive movement of the paretic ankle increased blood oxygen level-dependent responses (BOLD) in the contralateral pre- and postcentral gyrus, superior temporal gyrus, central opercular cortex, and in the ipsilateral postcentral gyrus, frontal operculum cortex, and cerebellum.

Conclusion: Manual therapy combined with CPM device therapy improved the clinical parameters of the paretic ankle-foot and the ankle passive movement increased contralateral and ipsilateral cortical activation.

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OP26

Instrumental assessment of the impacts of assistive walking devices on gait of hemiplegic post stroke spastic patients

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Introduction: Post stroke gait is frequently spastic, asymmetrical, slower and energetically costly. Assistive walking devices (AWD) can be used to capacitate post stroke patients, promoting their mobility when adequate.

One way to determine how a patient performs with AWD is through a Gait Laboratory (GL) evaluation. Besides other parameters assessed during gait analysis, force plates are used to provide information about vertical ground

reaction forces (GRF), which allow to estimate magnitude (1Fz) as well as time of weight bearing (%1Fz).

Objectives: To assess the impact of AWD on gait of post stroke patients, regarding 1Fz, cadence and walking speed.

Materials & methods: Retrospective cross-sectional study of post stroke patients, referred to the GL for spastic gait evaluation, between 2012-2019: kinematics, kinetics and video.

For the descriptive analysis, categorical variable frequencies were described as a percentage (%) and the mean, median, standard deviation (SD), maximum and minimum values for the continuous variables were computed. Comparative analysis and their statistical significance, in function of AWD (none, walking pole (WP), cane and cane with pyramid base (CPB)) were tested with the Kruskal-Wallis and Mann-Whitney tests. A statistical significance level of $p \leq 0.05$ was used.

Results: Of 192 cases, 127 were included as there was full data and walked independently barefoot.

Patients characteristics were: 59% male, age 53 years (SD 11.7), 70% ischemic stroke, 58% right hemiparesis, 87% with ≥ 12 months post stroke, AWD (51% none, 20% WP, 22% cane, 7% CPB), cadence 53 steps/min (SD 20.3), velocity 0.39 m/s (SD 0.20), %1Fz 26.7% and 1Fz 96.4% (SD 10,48).

Findings indicate statistical significant differences for age, cadence, velocity and 1Fz: with higher mean ranks for no-AWDs, and lower mean ranks for CPB, regarding other AWDs for the variables cadence, velocity and 1Fz; patients using cane were older than those using no AWD and tended to be older than those using WP; WP had higher mean rank than cane for 1Fz.

Conclusion: This study displays the impact of different AWDs in post stroke gait, namely on weight bearing, velocity and cadence. These factors are important for reducing falls, disability and burden of care. Thus, it allows rehabilitation professionals to use evidence-based knowledge when prescribing AWD.

OP27

Effect of Different Types of Inputs Combined with Contralateral Force Irradiation on Hand Function and Strength in Hemiplegia: (A Pilot study)

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Introduction: The contralateral force irradiation is based on fact that the stimulation of strong and preserved muscles produces activation of contralateral injured/weak muscles. Recent studies presented that somatosensorial inputs such as electrical stimulation or visual input increase the effect of force irradiation.

Objectives: The aim of the study is to determine the effect of single-session only unilateral exercise training, pressure splint with unilateral exercise training and visual feedback with unilateral exercise training on hand function and strength in hemiplegia.

Patients & methods: Hemiplegic patients (N=15) who applied to our clinic and whose mean age was 55.3 ± 9.1 years, were randomly assigned to three groups (mirror (M), splint (S) and control (C) groups). All patients asked to squeeze the exercise ball 300 times with the unaffected hand. The affected limbs are into the mirror box in M group; into the Johnstone Splint in S group; on the table in C group without moving. Box-block test (BBT), hand grip strength (HGS (with a dynamometer) and pinch strength (PS) (with pinchmeter) were evaluated bilaterally before and after treatment. Wilcoxon Signed Ranks Test were performed for statistical analysis by using SPSS (Version 16.0; SPSS; Chicago, IL, USA).

Results: The comparison between pre and post-treatment values showed that statistical significance was determined only in the mirror group of the affected hand on the BBT and PS scores ($p=0.041$, $p=0.047$, respectively). However, there was no significant difference in favor of a group in the pre and post-treatment changes of affected and unaffected hand ($p>0.05$).

Conclusion: The studies showed that somatosensorial inputs promote contralateral force irradiation. We used mirror treatment as a visual input and Johnstone Splint as a proprioceptive input. The results of our study suggest that the kind of somatosensorial inputs altered the amount of contralateral force irradiation.

OP28

Is isokinetic training useful in stroke patients?

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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.

Question: 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 180o/sec and 120o/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 180o/sec and 120o/sec, using a Gymnax 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.

OP29

Influence of etiology, hemiparetic side and chronicity on spatiotemporal gait parameters in post-stroke patients

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Question: Gait limitations after stroke can result in difficulties performing activities of daily living and increased risk of falls. Understanding factors associated with gait impairment may improve rehabilitation strategies and functional outcomes in stroke patients. The objective of this study was to investigate the influence of stroke type, hemiparetic side and lesion chronicity on spatiotemporal gait parameters.

Methods: Retrospective study of hemiparetic stroke patients that performed a laboratory gait analysis in a rehabilitation unit between January 2012 - January 2019. Age, gender, type of stroke, hemiparetic side, use of gait devices and time since stroke were retrieved from the medical records. Data regarding gait speed, cadence, step length, step time, single support, double support, stride length, stride time, step width, limp index, step length ratio, and single support ratio were collected from laboratory gait analysis reports. A stratified statistical analysis for the spatiotemporal parameters was performed according to: stroke type (ischemic/hemorrhagic); hemiparesis side (left/right) and lesion chronicity (<12 months /12 - 36 months/ >36 months). We ran a multiple linear regression – adjusting for age, gender and use of gait device – for selected spatiotemporal parameters, namely: gait velocity, cadence, limp index, step length ratio and single support ratio. Significance level used was $p<0,05$.

Results: 109 patients were included. There was a statistically significant difference for step time non-paretic side and limp index non paretic side between patients with ischemic and hemorrhagic stroke. There were no statistically significant differences in spatiotemporal parameters between patients with left and right hemiparesis. There were statistically significant differences for speed, step length, step width, stride length and double support between patients stratified by lesion chronicity. After adjusting for age, gender and gait device, time since stroke (>36 months vs <12 months), but not type of stroke or hemiparetic side, was a significant negative predictor of gait velocity.

Conclusions: Gait velocity has been described as a factor for disability, falls and mortality. This study shows lesion chronicity may be associated with gait impairment after stroke independently of age. It also stresses the importance of implementing rehabilitation strategies including gait velocity as one of the goals in this group of patients.

OP30

Morbus Fabry and Morbus Gaucher: Which Incidence Rates can be Expected in the Setting of a Neurorehabilitation Clinic - Results of a Genetic Screening Study

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Question: Fabry disease (FD) and Gaucher disease (GD) are rare lysosomal storage diseases, which can lead to severe organ manifestations due to a genetic defect with special involvement of the nervous system. The availability of a specific enzyme replacement therapy has elevated the profile of this conditions. Their rare occurrence makes it difficult to accurately determine their incidence rates in the setting of a neurologic rehabilitation center. Epidemiological data suggest a prevalence for FD between 1: 476,000 and 1: 40,000 for Western Europe and 1: 160,000 for GD (homozygous patients) in the general population. There are currently estimated to be 120 diagnosed FD patients in Austria and approximately 20 GD patients. The prevalence of these diseases is estimated to be around 1% in patients with highly suggestive symptoms, as they can be found in neurological departments,

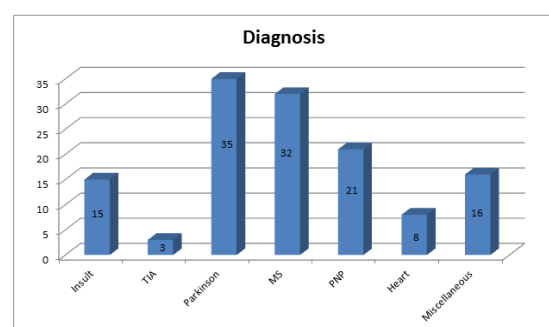
but there are no valid data confirming these estimates.

Methods: Over a period of 18 months we screened 102 consecutive patients admitted to our clinic with a high index of symptoms and signs for FD/GD. Patients who were previously screened for either condition before admitted to our clinic were excluded from the study. After a detailed medical education and given written informed consent, blood samples were obtained. We used a dry-blood-spot kit (DBS, CentoCard®, Gentogene, Rostock, Germany). We also analyzed the relationship regarding the patients presenting clinical symptoms and the referring-diagnosis to our clinic (Table 1).

Results: A total of 102 patients were screened, 55 women and 47 men with an age range from 27 to 76 years, so that the typical age-profiles of both diseases were well covered. The diagnostic testings failed to confirm any positive screening results for either Fabry disease or Gaucher disease.

Discussion: Patients with FD or GD are at high risk to develop chronic and multiple organ manifestations including severe neurological deficits. In the light of available and effective therapy those conditions should be detected at an early disease-stage. The incidence rates of both diseases in the setting of a neurological rehabilitation center are still unknown. As the clinical symptoms are mostly nonspecific and even a high index of suspicion doesn't necessarily lead to higher detection rates, there is urgent need for developing more effective screening methods.

Fig. 1



OP31

Flail-arm and flail-leg syndromes: survival impact with non-invasive ventilation

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Introduction: Flail-arm (FA) och flail-leg (FL) syndromes are rare forms of motor neuron disease (MND), probably part of a continuous spectrum including progressive muscle atrophy (PMA) and amyotrophic lateral sclerosis (ALS). Bilateral, symmetric involvement of the upper and lower limbs, respectively for FA and FL, is seen. Survival is longer as compared to other MND forms but the impact of non-invasive ventilation (NIV) is not well-clarified.

Methods: Consecutive patients with FA and FL followed in our Unit in Lisbon between 1995 and 2015 were included. All patients had progressive weakness and wasting confined for more than 12 months at the upper (UL) and lower (LL) limbs for FA and FL respectively, symmetric and without hipertonia or vivid reflexes. Initial symptoms were proximal for FA and distal for FL. Demographic characteristics as well as scores in revised ALS functional rating scale (ALSFRS-R), forced vital capacity (FVC) and mean bilateral diaphragmatic motor responses by phrenic nerve stimulation (meanPhrenAmpl) were compared between the two groups using Mann-Whitney U test. Kaplan-Meier and Cox analyses identified the independent predictors for NIV adaptation. *p*

Results: We included 17 FA (age at onset 67.4  9.5yrs, 16men, disease duration 19.9  13.3mo, total survival 91.8  48mo) and 16 FL (age at onset 57.1  10.1yrs, 10men, disease duration 21.5  13.8mo, total survival 72.4  37.7mo). Total survival from disease onset was non-significantly longer in patients with FA (91.5  48.4mo) than FL (72.4  37.7mo), who had non-significant lower time until NIV adaptation but after had a significant longer survival after NIV (59.3  41.2mo vs 24.5  15.6mo, respectively, *p*=0.015). Significant differences were seen regarding age (*p*=0.011), gender (*p*=0.026), FVC (*P*=0.012) and the upper (*p*<0.001) and lower (*p*=0.037) ALSFRS-R subscores. Independent

predictores of survival were disease duration, ALSFRS-R, FVC and having or not NIV for FA and ALSFRS-R for FL.

Discussion: Significant longer survival period is seen in patients with FA as compared to FL, more dependent on respiratory factors in the first case. NIV adaptation seems to have a significant positive impact only in FA patients.

OP32

Robot-assisted gait training vs. conventional therapy in caregiver burden after stroke: a randomized study of an in-patient rehabilitation clinic

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Background: Stroke survivors often dependent to a caregiver and the burden may affect the rehabilitation process of the survivor. During in-patient rehabilitation of the survivor, how caregivers' burden changes is a subject not yet investigated.

Objectives: The purpose of this study was to evaluate caregiver burden of the stroke survivors during in-patient rehabilitation period and to compare the effects of robot-assisted gait training and conventional therapy on burden of the caregivers.

Methods: This was a randomised, crossover prospective design study. Sixty-three stroke survivors and their caregivers enrolled to the study and the stroke survivors randomly assigned into two groups. The patients in the first group had robot assisted gait training for 2 weeks then conventional therapy for the following 2 weeks, the patients in the second group treated with conventional and then robot assisted gait training for the same period. Caregiver burden inventory (CBI), Beck Depression Index, Beck Hopelessness Scale was administered to the caregivers at baseline (0.day), switch day (15.day) and end of the rehabilitation (30.day).

Results: Before in-patient rehabilitation 18 (35%) of the caregivers were above normal scores of CBI, however at the end of rehabilitation 42 (66.6%) of the caregivers were in high burden and needed respite or other

services. CBI scores changed significantly at the end of rehabilitation in both groups.

Conclusion: Caregiver burden of the stroke survivors increase during in-patient rehabilitation period. Robot-assisted gait training seems to increase the burden slightly lower compared to the conventional therapy.

OP33

Cerebral oximetry is a predictor of safety and efficacy in early robot-assisted stroke rehabilitation

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Question: Stroke is one of the leading causes of invalidity and lethality. Furthermore, long-term bed rest after stroke may cause secondary complications and reduction in the effectiveness of rehabilitation. The paradigm of very early mobilization (VEM) based on evidence from clinical trials claimed, that early initiation of rehabilitation influences recovery from stroke (Bernhardt J, Churilov L, 2013). However, recent studies have shown the ambiguousness of VEM results of the patients (Luft et al., 2016). We aimed to estimate safety and efficacy in early stroke rehabilitation.

Methods: By way of this purpose we used verticalization in "Erigo" and a robot-assisted gait training "Lokomat". 14 healthy volunteers (group 1, age 47.9±5.2) and 62 patients with period after stroke from 5 to 14 days (groups 2 and 3, age 61.3±6.7 and 63.5±5.9, respectively) took part in the study. Participants mainly received 10 (8-12) sessions of the verticalization and 8 (7-10) of walking training in Lokomat. We estimated cerebral blood supply by cerebral oximetry (CO). CO was evaluated in all groups except the third one. Also, we assessed mean arterial pressure (MAP) and oxygen saturation (SpO₂). We mostly began rehabilitation on 5th day from the date of stroke (n=46) however, 16 patients started the training on the 10th-14th day.

Results: In the horizontal position CO, as well as SpO₂ values, did not differ in all groups (p=0.16). During verticalization, CO and SpO₂ were decreasing in all groups (p=0.026). CO and MAP had a correlation coefficient of 0.88 in group 1 and 0.85 in group 2. Left and right hemispheres differed by 1.3% in horizontal position and by 1.8% in an upright position in group 1 while differed by 2.6±4% and 6.2±7% in

the second group respectively. CO asymmetry had an inverse relationship with both MAP stability (r=-0.71) and duration of being in the upright position (r=-0.68). Duration of the Lokomat sessions was the longest in the group 2 (p=0.042) and had an inverse relationship with the asymmetry of CO (r=-0.76).

Conclusion: Hemodynamic control in early stroke rehabilitation provided its safety and increased effectiveness of both verticalization and Lokomat.

OP34

Physiological responses and perceived exertion during robot-assisted overground walking in non-ambulatory stroke survivors

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Introduction: A large gap remains regarding how persons with severe disability could engage in aerobic exercise programs. One potential solution for this subset of stroke survivors is the use of robotic exoskeletons during walking.

Objectives: The aims of this study were to investigate the physiological responses and perceived exertion during 20-minute robot-assisted overground walking (RAOW) in persons with subacute stroke, and compare the exercise intensity of RAOW to aerobic exercise guidelines for stroke survivors.

Patients and methods: Ten stroke survivors (50% male, 71±9 years-old, 50±42 days post-stroke, functional ambulation category 0-2) walked 20 minutes overground wearing a lower limb exoskeleton (Ekso GTTM, Ekso Bionics) with full bilateral assistance. Breath-by-breath gas exchange and heart rate were monitored continuously. Rating of perceived exertion (6-20 Borg scale) was assessed at the end of a 5-minute seated resting period and every 5 minutes during walking. Net values were obtained by subtracting gross values minus resting values.

Results: Net heart rate and net rating of perceived exertion significantly increased between minute 5 (median=8 beats/min, interquartile range (IQR)=10 beats/min; median=2, IQR=5) and minute 20 (median=17 beats/min, IQR=17 beats/min; median=6, IQR=5). Other net physiological responses did not significantly change over time. Percentage of predicted maximum heart rate and gross rating of perceived exertion reached the minimum aerobic threshold at respectively minute 5 (median=60%, IQR=15%) and minute 10 (median=11, IQR=6). Percentage of predicted heart rate reserve was significantly below the 40% threshold at minute 5 (median=14%, IQR=9%) and minute 10 (median=18%, IQR=10%), but did not significantly differ at minute 15 (median=14%, IQR=9%) and minute 20 (median=14%, IQR=9%).

Conclusions: Fully assisted RAOW seems a rather low-intensity exercise for non-ambulatory stroke survivors, overall complying with aerobic exercise guidelines (2 out of 3 criteria fulfilled). Future studies should examine how the level of robotic assistance impacts the exercise intensity and whether RAOW training increases the cardiorespiratory fitness of these patients.

OP35

Comparing the Effects Between Condensed and Distributed Robotic Therapy in Subjects with Spastic Stroke Post Botulinum Toxin Injection: A Randomized Controlled Trial

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Question: Robot-assisted therapy (RT) has been prove to be feasible and effective for patients with spastic stroke post Botulinum Toxin A (BoNT-A) injection. The key element leading to effective intervention for RT is the high-intensity. As well as treatment intensity, the scheduling of training is also shown to influence skills acquisition. It is unknown about the optimal schedule of RT as an adjunct therapy with BoNT-A injection, which has time-limited effect. The aims of this study were to determine and compare the effects between condensed and distributed training programs of

RT following BoNT-A injection in subjects with spastic stroke.

Methods: Patients with chronic spastic hemiplegic stroke post BoNT-A injection were randomly assigned to receive RT (InMotion 2.0) either 4 sessions per week for 6 weeks or 2 sessions per week for 12 weeks. During each session, participants received 45 minutes of RT followed by 30 minutes of task practice.

Outcome measures included the Fugl-Meyer Assessment for the upper extremity (FMA), Wolf Motor Function Test (WMFT), and Stroke Self-Efficacy Questionnaire (SSEQ). All participants received pre-intervention, mid-intervention, and post-intervention assessments. We used mixed ANOVA to test the time, group and interaction effects between time and group. Pairwise comparisons with Bonferroni adjustments were used to examine the differences between 2 measurement time points.

Results: We recruited 36 patients, 18 were assigned to the condensed group. There was no significant main effect of group and interaction effects between time and group in all outcome measures. There were significant time effects in FMA and SSEQ scores (both $p < .001$), the pairwise comparisons revealed significant differences between pre and mid tests (both outcomes $p < .05$), pre vs post test (both $p < .001$), but not mid vs post test. For WMFT, there was no time effect in time score, but a significant time effect in function score ($p = .008$). The pairwise comparisons revealed significant differences between pre and post test ($p = .019$), but not pre vs mid test ($p = .55$), nor mid vs pos test ($p = .09$).

Conclusion: No matter delivered in a distributed or intensive schedule, the RT had positive effects on the upper extremity functions of patients with spastic stroke post BoNT-A injection. The RT effects in the impairment and self-efficacy judgment domains might precede the activity domain.

OP36

Clinical effectiveness of a combined transcranial direct current stimulation and virtual reality-based program on chronic individuals post-stroke with persistent severe hemiparesis

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Introduction: The absence of voluntary movements after stroke may limit effective neural reorganization that supports functional improvement, and poses a major challenge for rehabilitation. Only a few interventions (motor imagery, mirror therapy, virtual reality) can trigger cortical neural networks of arm movements, which, in turn, can be facilitated by applying transcranial direct current stimulation (tDCS).

This study presents the effectiveness of a combined intervention based on virtual reality-based reaching exercises with concurrent tDCS and conventional physical therapy, in comparison to conventional physical therapy alone.

Methods: Thirty chronic individuals with persistent severe hemiparesis post-stroke were randomly assigned either to an experimental or a control group, and underwent 24 one-hour sessions, 3-5 times a week. Participants in the experimental group combined 30 minutes of VR and tDCS (Anode: C3/C4; Cathode: Fp2/Fp1; I=2 mA) (Figure 1), with 30 minutes of conventional physical therapy. Participants in the control group completed 60 minutes of conventional physical therapy. Assessment included the Fugl-Meyer Motor Assessment-Upper Extremity, the Wolf-Motor Function Test, and the Nottingham Sensory Assessment before and after the intervention.

Results: Significant improvements were detected after the experimental intervention not only in the Fugl-Meyer Motor Assessment (5.1 ± 3.9), but also in time (-105.9 ± 139.3 s) and ability subscales (2.2 ± 2.6) of the Wolf-Motor Function Test in comparison to the control group, who presented limited improvement (0.2 ± 1.0 , -22.6 ± 43.1 s, 0.7 ± 0.9 , respectively). Improvement in the motor function exceeded the minimally clinically importance of both

scales. Similar improvements in both groups were detected in the Nottingham Sensory Assessment.

Conclusions: Motor improvements in global arm function, speed and ability, in spite of the chronicity, persistence, and severity of the hemiparesis support the effectiveness of the intervention. This, together with similar effects on the sensory function to conventional physical therapy, could support its use as a feasible alternative to the scant therapeutic options for this population.

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Fig. 1



OP37

Brain connectivity index to follow neurorehabilitation processes: evidence from EEG network analysis

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Question: EEG rhythms are linked to any kind of cognitive performance including motor tasks and memory. The brain is a complex network consisting of spatially distributed networks dedicated to different functions including cognitive domains where dynamic interactions

of several brain areas play a pivotal role. Brain connectome could be a useful approach not only to mechanisms underlying brain cognitive functions, but also to those supporting different mental states.

Methods: Tens of studies were conducted in order to find the best brain index to follow cognitive performance. Here we revise our experience of brain index based on connectome analysis. Small World (SW) parameter was evaluated on brain networks, since it measures the balance between the local connectedness and the global integration of a network, representing the brain network organization. Small-world organization is intermediate between that of random networks, the short overall path length of which is associated with a low level of local clustering, and that of regular networks or lattices, the high-level of clustering of which is accompanied by a long path length.

Results: We found Small world index correlated to learning processes, memory performance, disease progression (in stroke, Alzheimer, epilepsy), but also age, motor performance.

Conclusion: These results suggest that, by means of an innovative analysis applied to a low-cost and widely available techniques (Small World applied to EEG), the functional connectome approach as well as conventional biomarkers would be effective methods for monitoring neurorehabilitation.

OP38

Back to Base: How Robotic Support Affects Treadmill Walking and the Underlying Brain Activation in Healthy People

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Question: Gait and balance disorders are major features of neurological diseases that affect the quality of life. Previous studies demonstrated the usefulness of robot-assisted gait training (RAGT) devices in rehabilitation because of the intensive, repetitive and variable motor practice. However, the science-based

evidence for improved gait recovery is mixed due to heterogeneous study designs and methods, coupled with a lack of knowledge regarding the underlying neurophysiological mechanisms of RAGT. Therefore, we explored the biomechanical and neurophysiological mechanisms related to RAGT and questioned how locomotor control is characterized in brain signals if robotic devices interact with their users.

Methods: Twelve healthy, right-handed volunteers (9 females; $M = 25 \pm 4$ years) performed trials of unassisted treadmill walking (TW) as well as RAGT on a treadmill at 2.8 km/h in a randomized within-subject design. Prior to the experiment, participants familiarized with TW and RAGT for four minutes. Individual gait patterns were determined by ground reaction forces (GRF) whereas cerebral hemodynamic changes in primary somatosensory cortex (S1), primary motor cortex (M1), premotor cortex (PMC) and supplementary motor area (SMA) associated with cortical locomotor network areas were examined with functional near-infrared spectroscopy (fNIRS).

Results: In both TW and RAGT, results of the vertical GRF demonstrate a classical double bump throughout the stance phase which is accompanied by significantly increased brain activity in S1 compared to PMC and SMA [$F(2,22) = 8.001$, $p = 0.002$, $\eta^2_p = 0.421$]. However, individual analysis of GRF shows significantly high inter-subject variabilities during RAGT compared to TW ($p < 0.05$) which is not represented in different brain activity patterns.

Conclusion: Restricted gait through robotic devices lead to modulated locomotion in healthy people which did not affect brain activity in motor cortical areas. Either robotic support might be subliminal that it does not manifest itself in changes in metabolic activity or it could have led to increased brain activation in further areas within the cortical locomotor network (e.g. prefrontal areas). Advanced neurophysiological studies are required to evaluate RAGT based on neural correlates to optimize the outcome and efficiency of robotic rehabilitation.

OP39

Electroacupuncture as a therapeutic method in the treatment of peripheral nerve pareses

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Introduction: Conventional stimulation of paretic muscles according to the I/t curve is being still used in conventional rehabilitation of peripheral nerve paresis. In our workplace, we newly use electroacupuncture (further EA) for electrostimulation which, as we presume, speeds up the regeneration of damaged structure of peripheral nerve pareses.

Aim of the study: To assess the effect of EA to improve limbs mobility in case of peripheral nerve paresis.

Patients and methods: Peripheral pareses with the different level of damage to the peripheral nerve have been indicated for treatment with EA. Overall, 59 patients have been treated with this method so far. EA application was started after 4 weeks from nerve injury. Aetiology of injury was mostly traumatic, less frequently iatrogenic damage. With peripheral pareses, at least 2 acupoints were stimulated by EA (one proximally and one distally from the place of nerve lesion). The selection of acupoints is given by the type of particular paresis. We use the measurement of dermal resistance, neuromuscular irritation and palpation method for searching.

Results: In the past 3 years, using EA, we have noticed the clinical improvement in mobility of 51 from 59 patients with pareses of peripheral aetiology immediately after the first application and subsequently a long-term improvement in mobility as well; it was measured in the interval of one month from the beginning of EA application. We made video documentation of 24 patients. Improvement in mobility was confirmed in most cases by the control EMG examination.

Conclusion: Current research of the clinical effect of EA in case of the pareses of peripheral aetiology shows very good clinical results; our method is absolutely unique in this indication and form of application. To make the results objective we use video documentation, surface polyEMG, the assessment of muscle reaction by an accelerometer and gyroscope, gait

analysis and muscle test. Neurological EMG examination is performed in different workplaces. EA appears as a suitable therapy to facilitate active mobility after damage to the central nervous structures mainly due to immediate stimulation effect.

OP40

Analysis of the balance function state under the influence of polymodal afferentation in virtual reality

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Question: Maintaining the balance function (BF) is a complex process in which the important information coming from the visual, vestibular, proprioceptive, somatosensory analyzers. However, the role of the participation in one of the sensory systems is different and depends on many factors. In diseases of the nervous system, the mechanisms of afferent information in different combinations and degrees are violated. In this regard, an important part of neurorehabilitation are differentiated approaches to interaction with the sensory link of balance. The aim is to assess the state of BF in healthy subjects under the influence of training with polymodal afferentation in virtual reality.

Methods: 35 healthy subjects (age 21,1±7,9) were examined. The training was conducted using the environment for creating virtual games and unity3d applications on the equipment of the VR "HTC Vive". Games, implemented in the researching assumed the displacement of the human body in the planes (dynamic balance), as well as maintaining a certain posture for some time (static balance). The balance function in the "Romberg test" (closed and open eyes) was evaluated by stabilography (Stabilan 01-2, Russia). Used parameters: the area of the ellipse (EA), m2, the quality of the balance function (GBF)%, the average movement speed of the center of pressure (AMSCP) mm/s.

Results: Training included 8 sessions up to 10 minutes. Before training: QBF 79,8±9,8%, EA 146,94±71,4 mm², AMSCP 9,9±3,05 mm/s. After the training significantly increased the QBF 82,72±6,2 (p<0.05). In the test with closed

eyes before the training QBF $65,5 \pm 15,4\%$, EA $232,2 \pm 138,1 \text{ mm}^2$, AMSCP $13,8 \pm 4,6 \text{ mm/s}$. There are a tendency to improve the indices after the training: QBF $74,5 \pm 13,0\%$ ($p=0.1$) due to significant changes in the indices of EA $198,4 \pm 92,5 \text{ mm}^2$, AMSCP $16,63 \pm 4,7 \text{ mm/s}$ ($p<0.05$).

Conclusion: The high indicators of the BF state in healthy subjects after using the training in virtual reality are revealed. Visual and auditory stimulus implemented with virtual games, allow a person to adjust them in real time, repeat all the movements, train and restore the modify components of the BF. Training in virtual reality with polymodal afferentation creates the necessary working space for motor skill training, provides interactive feedback and high intensity training and rehabilitation.

OP41

AVANT: Stroke-Rehabilitation Program in Vietnam. Report of Progress after 3 Years of Implementation

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Question: Stroke is major health concern in low-and middle income countries and the leading cause of death in Vietnam, with 230,000 cases annually accounting for 110,000 deaths. There is lack of a well-structured neurorehabilitation system unable to provide comprehensive rehabilitation services.

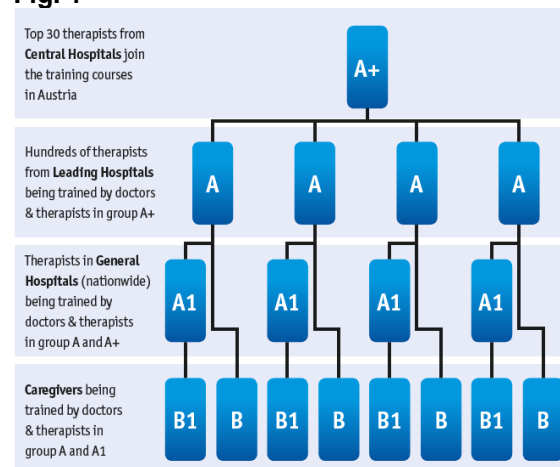
Method: The AVANT-Program is designed as a 3 year cooperative educational program to standardize and systemize basic rehabilitation and mobilization practice in Vietnam using a "train the trainer" system. Being endorsed by the World Stroke Society and in Association with the Vietnamese Medical Association, the Vietnamese Ministry of Health, the Vietnamese Society for Stroke Rehabilitation, and several leading hospitals from different regions of the country and funded by an educational grant by EVER-Pharma, important know-how and rehabilitation skills are trained. These trainings focus on skills in basic mobilization and transfer techniques as well as instructions on the prevention of spasticity, swallowing disorders and other maladaptive compensatory mechanism after stroke. A comprehensive rehab-booklet and a teaching DVD have been produced by Austrian rehab-professionals and

distributed on a large scale to the trainees and caregivers (available also in Vietnamese language via YouTube).

Results: By March 2019, 31 core trainers (A+) have completed a three week teaching course in Austria (Clinic Pirawarth, Vienna and the Christian Doppler Clinic, Salzburg). On the A and A1 level, 34 courses were performed in major Vietnamese cities. In total, 2370 participants certified with CME tests, including 1210 doctors and 1160 therapists. On the B level, a total number of 26 courses have taken place, training approximately 982 caregivers.

Perspective: By the end of 2019 3000 doctors and therapist and 4000 caregivers will have been attending the AVANT-program across 58 out of 64 provinces in Vietnam. As by today the program is on schedule and all training courses have been successfully completed. A further important step will be the evaluation of the program using an electronically based registry. The Programm was supported by an unrestricted educational grant by EVER Neuro-Pharma GmbH.

Fig. 1



OP43

Applying the Dual-Task in the Rehabilitation of Central Nervous Diseases

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The dual task is the favored method in rehabilitation. Every task is the combination of attention, decision and motor response. All together the learning process can be detected after a few occasions, and repetition of tasks improves achievement of mental and motor

disability. However, it is not known how the learning process is changed in different diseases with patients of different ages

The goal of our study was to discover the learning process in different diseases (Parkinson's disease, and post-stroke state) and compared them with aged matched healthy controls.

Method: Every person did 5 tasks with Dividat Senso. Each of the tasks lasted for one and a half minutes. We selected simple tasks and tasks for encouraging more thinking. The reaction time of four plays and the hits and misses of a task were detected. Every task was repeated for 5 days.

Patients: Patients with PD (N = 30) and post-stroke (N = 28) were compared with 42 aged matched healthy controls. They were divided into two groups according to their ages (<65> years).

Results: The control persons both <65 years and > 65 years presented a decreased reaction time in every task and improved number of hits until the end of the 5th day. Patients with PD < 65 years had the same results as the controls, but patients > 65 years showed a significantly delayed reaction time in different tasks compared to the controls. The worst results were from patients in post-stroke state. They did not show any improvement in their learning process independently of their ages.

Conclusion: Dual task is a proper task for detecting the learning process in people with different ages. There was an aged matched decrease in learning, but for the learning process in PD > 65 years and in post-stroke patients, independently of their ages, in which parts of the brain were affected, the results were significantly worse compared to the controls. PD plus higher age exaggerates the severity of the state. The stroke affects not only the motor parts of the brain, but the whole brain.

OP44

Cortical connectivity and memory performance in cognitive decline through EEG data

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Question: Functional brain abnormalities including memory loss are found to be associated with pathological changes in connectivity and network neural structures. Alzheimer's disease (AD) interferes with memory formation from the molecular level, to synaptic functions and neural networks organization

Methods: Here, we determined whether brain connectivity of resting-state networks correlate with memory in patients affected by AD and in subjects with mild cognitive impairment (MCI). One hundred and forty-four subjects were recruited: 70 AD (MMSE Mini Mental State Evaluation 21.4), 50 MCI (MMSE 25.2) and 24 healthy subjects (MMSE 29.8). Undirected and weighted cortical brain network was built to evaluate graph core measures to obtain Small World parameters. eLORETA lagged linear connectivity as extracted by electroencephalogram (EEG) signals was used to weight the network

Results: A high statistical correlation between Small World and memory performance was found. Namely, higher Small World characteristic in EEG gamma frequency band during the resting state, better performance in short-term memory as evaluated by the digit span tests.

Conclusions: Such Small World pattern might represent a biomarker of working memory impairment in older people both in physiological and pathological conditions.

OP45

Distribution of attention while observing ecologically valid environment

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In daily living, the environment is complex and dynamical. It includes various visual information about static and moving objects, people and their actions, social interaction and emotions. Studying of attention distribution while observing the model of natural environment is of interest from a number of perspectives – in normal and pathological context.

We developed new method of studying visual attention while observing natural scene - videofilm, showing the room with three actors inside it. Each actor occupied a separate part of the scene (scene was conditionally divided into left, central and right parts). Actors performed simple daily activities. The structure of videofilm was as follows: static scene (5 s) - action observation (center-left-right, 15 s) – emotions (center-right-left, 15 s) – motion and social interaction (25 s). After watching the movie, the subjects were interviewed about the film, actors and events they could remember. For registration of gaze data we used Mangold VT3mini eyetracker (sample rate-200 Hz, accuracy-0.5°). 27 healthy volunteers and 16 patients with focal brain lesions were participated in the study.

In norm, the objects of scene had different valence for the gaze depending on the semantic meaning of current events. Accurate depiction and understanding of events were observed, when gaze was directed «at the right time in the right place» - on the face of an actor while emotional reactions, in the direction of the actor's gaze while his interaction with environment, on the hands while manipulating objects.

The adaptive strategies of visual perception, characteristic of healthy subjects, were disturbed after brain lesions. A decrease in visual attention to the side contralateral to the affected hemisphere was observed. Defects in the attention distribution led to distortions in the reflection and memorization of events. Decrease of spontaneity in some clinical cases

accompanied by the replacement of semantically significant rapid gaze translations by random gaze translations and delays on objects, not connected with current events.

Eyetracking is perspective technology for assessment of brain function, visual attention and memory. Inclusion of eyetracking into daily clinical practice and neurorehabilitation programs, combining it with another modern technologies, can significantly improve the effectiveness of these programs.

This research was supported by Russian Foundation for Basic Research grant №16-29-08255.

OP46

Neuropsychiatric and Cognitive Disorder in Cerebellar Stroke Patients: The Cerebellar Cognitive Affective Syndrome (CCAS)

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Question: Cerebellar cognitive affective syndrome (CCAS; Schmahmann's syndrome) is characterized by deficits in executive function, linguistic abilities, spatial cognition and affect regulation. This syndrome is prevalent in patients with bilateral posterior cerebellar injury and/or cerebellar vermis injury, which causes attention deficit impairments. Our aim was to test the Schmahmann syndrome scale (CCAS-scale) to patient affected by cerebellar stroke.

Methods: Consecutive patients been diagnosed with cerebellar stroke have been evaluated using the CCAS scale. CCAS-scale is a specific tests to evaluate the different functions involved in CCAS Syndrome, especially focused on: executive function, visuospatial abilities, visuo-spatial memory and affect symptoms. We used the Mini-Mental State Examination (MMSE) and Montreal Cognitive Assessment (MoCA) to focus on cognitive deficits: the main exclusion criteria was dementia. The Neuropsychiatric Inventory test was used to implement the affect disorders study.

Results: Eight patients (mean age 62 ±7) (5M/3F) affected by cerebellar stroke have been consecutively studied in our Neurorehabilitation unit. The CCAS test found deficits in category switching, digit span backward, go no-go test and phonemic fluency (M: 5.4/10; cut off: ≥3 \10). At the same time using the NPI we showed that all the patients had neuropsychiatric symptoms (M aXb: 55/144) including dysphoria (M: 8), agitation (M: 8), motor activities (M: 8), disinhibition (M: 8), irritability (M: 12) and eating disorders (M: 6). The MMSE and MoCA didn't show any cognitive disorders.

Conclusion: the cerebellar stroke is a complex syndrome that is related with behavioural and cognitive disorders. The cognitive functions typically resulted preserved are: semantic and retrograde memory, linguistic functions, agnosia and apraxia. The CCAS test is a valid scale to assess the Schmahmann Syndrome although we found a lack of focusing on affect symptoms. Future research should involve a larger sample of cerebellar stroke patients evaluated with a combination of CCAS syndrome scale with NPI to implement a new assessment tool for the affective and cognitive components of CCAS.

OP47

Sensory stimulation in Acquired Brain Injury: a review of intervention programs

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Introduction: Acquired Brain Injury (ABI) can lead to sensory deficits and compromise functionality and quality of life. However, the sensory stimulation as a rehabilitation technique in Stroke and mild and moderate Traumatic Brain Injury have received reduced interest in the literature.

Objectives: This study aims to determine the methodological characteristics and the effects of sensory-perception stimulation programs in ABI.

Materials & methods: In order to assess the characteristics and efficacy of those programs, we conducted a systematic review at multiple literature databases at EBSCOhost, Pubmed

and OTseeker. A total of 23 studies were analyzed according to recommendations from PRISMA-P and Cochrane Collaboration Guidelines.

Results: In most studies, sensory stimulation was initiated within 12 months after injury. There is no consensus regarding frequency, duration and number of sessions, or duration of the intervention. Instruments used to assess outcomes are also very variable. Most programs involved unisensory stimulation, and vision was the predominant target. Compensatory therapy and somatosensorial discrimination training were the most used interventions. Studies used mostly a pre-post design, with few studies comprising follow-up assessment. Considering the studies revised, the interventions with positive outcomes in ABI are: compensatory therapy, cognitive training, vestibular intervention, somatosensory discrimination training, proprioceptive stimulation with muscle vibration, and sustained attention training with olfactory stimulation.

Conclusion: Sensory stimulation has positive results with immediate and long-term improvements in sensory functioning. This review provides useful information to rehabilitation practitioners and researchers.

Key words: sensory stimulation; cognitive stimulation; acquired brain injury; systematic review

OP48

Extraction of Clinically Relevant Kinematic Parameters from IMU-based Motion Capture System in Stroke Patients

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Question: Despite many studies on accelerometers and gyroscopes were performed regarding movements of upper extremity in stroke, yet there exist no standardized evaluating methods especially in

terms of significant clinical relevance. In this study, we aimed to determine potential parameters and appropriate tasks that may serve as clinical outcome measures or an index, which can be measured with a single sensor on the wrist.

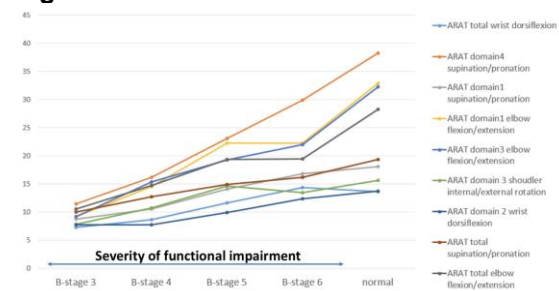
Methods: Ten healthy volunteers and nine patients with hemiplegic stroke were recruited to perform Action Research Arm Test (ARAT) and a series of tasks representing activities of daily living (ADL). They were equipped with multiple IMU sensor based upper body motion capture system during the tasks. Acceleration values of the wrist and hand sensors in three global orthogonal directions and Euler angles of sensors in each segment of the upper limb with reference to their proximal segment sensors were measured. ARAT score and Brunnstrom stage were evaluated for all patients. Average amplitude and maximum amplitude of the movement segments, logsum and logsum per time was extracted and analyzed.

Results: Of the parameters that showed significant differences in values between healthy subjects and patients and also significant correlation with clinical measures, average amplitude of forearm supination/pronation angle during ARAT domain 4 tasks demonstrated most decline of the value in severely impaired patients compared to normal subjects (29.83%) and also largest difference between severely and mildly impaired patients (48.46%). During ADL tasks, logsum per time for supination/pronation showed profound difference between severity levels (38.33%). Average amplitude of acceleration in x-axis (left-right) and z-axis (up-down) of hand and wrist sensors during ARAT tasks demonstrated a range of 45 to 60% value compared to healthy subjects, with 21.6 to 37.8% difference along the severity spectrum.

Conclusions: Although accurate measurement of upper extremity movements with single wrist sensor may not be feasible, specific parameters may play a significant role in simple or serial functional evaluation as an important predictor of clinical outcome measures.

Figure 1. Average amplitude angles of joint movement segments during ARAT tasks by Brunnstrom stage are shown.

Fig. 1



OP49

IMPULSE Trial - study protocol, rationale and design of a prospective, multi-center, randomized, double-blind study on the stimulation of brain plasticity to improve upper limb recovery after stroke

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Question: Following stroke, the initial recovery process follows the resolution of reversible pathophysiological events and later on functional improvement occurs as the neural networks within the brain undergo changes in response to various stimuli. Up to 85% of motor improvement in patients with mild to moderate impairment is seen within the first 8 weeks after stroke. This decline of functional gain in the more subacute and chronic phase after stroke is attributed to an early but relatively short "sensitive period" post-stroke, which represents an environment of heightened plasticity. Animal studies suggest that both, recurrent stroke and pharmacological interventions can induce or extend this sensitive period, which correlates with the levels of the neurotrophin BDNF that has been implicated in the modulation of synaptic function and plasticity. We hypothesize that the combination of the neuropeptide preparation Cerebrolysin® and neurostimulation (atDCS) re-induces a milieu of heightened neuroplasticity in subacute and chronic stroke patients who have an unexploited potential for functional recovery.

Methods: The study population of IMPULSE-I is represented by a total of 90 patients of 18-80 years of age who suffer from upper extremity

paresis (defined by an ARAT score of 13-50) due to a first-ever hemispheric subcortical ischemic stroke eight weeks to 12 months before study enrolment, and who have an unexploited potential for functional recovery according to a SAFE (shoulder abduction and finger extension) score of ≥ 5 . The primary objective is to show a significantly higher proportional recovery rate in the Action Research Arm Test (ARAT) at day 21 post-baseline in the verum group as compared to the control group (Table1).

Results: The study will be performed at six Austrian stroke centres, the first patient will be recruited in early autumn 2019, 90 patients are planned to take part in the first phase of the trial (IMPULSE I; Table 2).

Conclusion: The IMPULSE-trial will add important evidence to answer questions on how to enhance training effects in motor-rehabilitation and if there will be cumulative effects of tDCS and Cerebrolysin® on top of conventional arm-rehab-training.

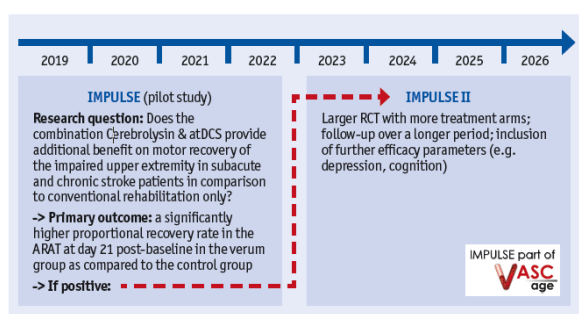
Fig. 1

Interventions

	Verum		Control	
	Pharmacological intervention	Non-invasive brain stimulation	Pharmacological intervention	Non-invasive brain stimulation
Study medication	Cerebrolysin	atDCS	0.9% saline	Sham stimulation
Dose	30 ml once daily (+70ml 0.9% saline)	2mA/35cm ² for 20 minutes, once daily*	100 ml	0mA/35cm ² for 20 minutes, once daily*
Mode of administration	Intravenous infusion	Cutaneous	Intravenous infusion	Cutaneous
Duration of treatment	21 consecutive days	2 x 5 days (Monday to Friday)	21 consecutive days	2 x 5 days (Monday to Friday)
Basic therapy	<ul style="list-style-type: none"> Conventional rehabilitation therapy for 2-3 hours (Monday to Friday), including: Task-specific motor training for 30 minutes, 2 x 5 days (Monday to Friday) 			

*plus ramp-up and ramp-down (a 30 seconds)

Fig. 2



OP50

Electroacupuncture as a therapeutic method in the treatment of central nerve pareses

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Introduction: Electroacupuncture (EA) has been used in Western medicine since the second half of the 20 th century. With central nerve pareses, the issue discussed so far is the effect of EA on the functional change of the mobility of affected limbs.

Aim of the study: To assess the effect of EA (electrical stimulation of inserted acupuncture needles) for improving functional mobility of limbs with central paresis.

Patients and methods: For the treatment with EA, we indicated central nerve pareses with different level of damage to the central nervous system. They were patients with spinal lesion and patients after cerebrovascular accidents of different aetiology with different functional damage to the central nervous system. Overall, 89 patients have been treated with this method so far. EA application was performed using the stimulation of at least 2 acupoints from corporal acupuncture and at least 2 points in the area of cranial acupuncture lasting 5-10 minutes according to the type of damage. Currents with the frequency of 200 Hz were used. Then EA was applied to the points of corporal acupuncture only with the use of medium-frequency currents with the frequency modulation of current on the frequency of 50 Hz. The selection of acupoints is given by the type of paresis; to find them, we use the skin resistance measurement, neuromuscular irritability measurement and palpation methods.

Results: In the past 3 years, using EA, we have noticed the clinical improvement in mobility of 78 from 89 patients with pareses of central aetiology immediately after the first application and subsequently a long-term improvement in mobility as well; it was measured in the interval of one month from the beginning of EA application. Video documentation of 21 patients has been made.

Conclusion: Our form of EA application is unique in case of these indications and shows a very good clinical effect, in most cases already after the first application. To make the results objective we use video documentation, surface polyelectromyography, the assessment of muscle reaction by an accelerometer and gyroscope, gait analysis and muscle test. EA appears as a suitable therapy to facilitate active mobility after damage to the central nervous structures, mainly due to immediate stimulation effect. Current clinical results show a significant improvement in functional mobility in patients with central nerve pareses even on the basis of a long-term observation. (see Fig. 1,2)

Acknowledgement: Supported by MH CZ – DRO (FNOI, 00098892)

Fig. 1

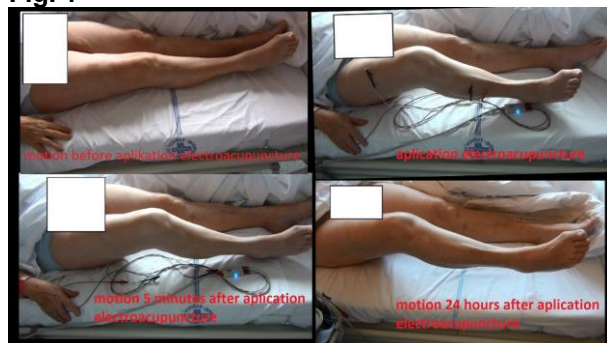


Fig. 2



S5.1

Leukoaraiosis, an invisible factor contributes to balance and gait disorders after stroke

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Objective: Leukoaraiosis is associated with balance and gait disorders in elderly persons, but its effect on these disorders after stroke remains to be clarified. The purpose of this study is to investigate whether leukoaraiosis affects balance and gait capacities after stroke.

Methods: Cohort study of consecutive participants admitted to neurorehabilitation ward after first-ever hemisphere stroke from 2012 to 2018. Leukoaraiosis was diagnosed on MRI (Flair sequence) performed within the 3 first months after stroke, using 4-grade Fazekas scale. Individuals were then classified in 2 groups (G1: absent or mild vs G2: moderate or severe leukoaraiosis). Clinical data systematically collected at day 30±3 (D30) post-stroke and at discharge were retrospectively analyzed. Balance disorders were assessed with the Postural Assessment Scale for Stroke (PASS), gait disorders with the modified Fugl-Meyer Gait Assessment, lateropulsion with the Scale for Contraversive Pushing (SCP) and independence with the Functional Independence Measure (FIM). Kaplan-Meier survival curves and Cox regression were applied to analyze the recovery between two groups.

Results: 184 persons met inclusion criteria: age 67.1(IQR,57-72.7) years, 63 females, 157 with infarction. A total of 143 (78%) persons presented leukoaraiosis with following median score (1[1-2]) and distribution: Grade 0: 41[22%]; 1:75[41%]; 2:55[30%]; and Grade 3:13[7%]. Moderate to severe leukoaraiosis (G2) was present in 68 (37%). Among initial assessments (D30), G2 had greater balance disorders (31[18-34] vs 33[26.5-36],p=0.003), gait disorders (3[0-6] vs 5[3-6],p=0.009), but didn't present greater lateropulsion; their

independence in daily life was lower (80[48.5-107] vs 100[65-116.5], $p=0.004$). Log rank tests showed that time to recovery from monopodal stance ($p=0.002$) and independent gait ($p=0.005$) differed from two groups. Moderate or severe leukoaraiosis was an independent factor associated with worse recovery, with adjusted hazard ratio 0.64 (95% CI, 0.43-0.95; $p=0.026$) and 0.66 (95% CI, 0.45-0.98; $p=0.039$) for balance and gait disorder respectively.

Conclusion: Leukoaraiosis is a cause of balance and gait disorders after stroke, as well as an independent cause worsening their recovery. This suggests that stroke consequences might be limited by early detecting and treating risk factors of leukoaraiosis.

Fig. 1

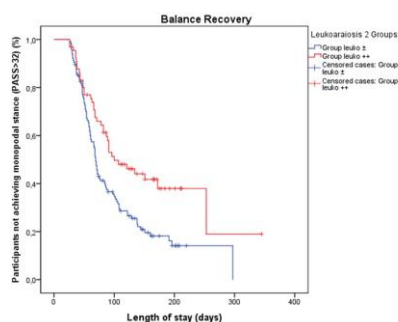
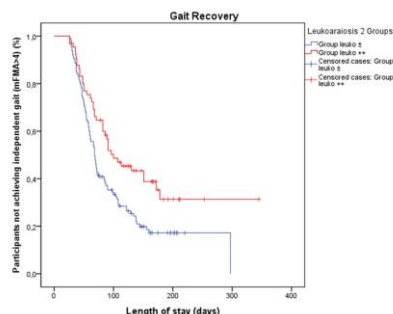


Fig. 2



S5.2

An innovative scenario for robot-assisted upper limb neurorehabilitation based on motor and cognitive functions

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Question: In the last decades, the interest in robotic devices used for rehabilitation of central neurological diseases has gathered a growing importance. However, the majority of these robotic devices is focused on motor task-specific training, whereas the cognitive recovery is still left to conventional methodologies.

It has been demonstrated that cognitive efforts contribute to motor recovery, making the rehabilitation process more effective. The aim of this study is to present an innovative scenario for upper limb motor and cognitive rehabilitation based on a planar end-effector robotic device for elbow and shoulder rehabilitation (Motore, Humanware s.r.l., Pisa, Italy) (Figure 1).

Methods: The main features of the proposed scenario are (i) strong integration between cognitive and motor effort, (ii) high versatility of proposed exercises and (iii) high patient engagement.

A human-centered approach was used to identify the rehabilitation exercises. A close cooperation with an experienced physiatrist and four speech therapists at the Rehabilitation Dept., Versilia hospital, Camaiore, Italy was carried out in order to identify the functional requirements of the innovative scenario.

Results: The proposed scenario (Figure 2) is based on a living room where the patient can access to three different exercises characterised by both motor practise, in a free mode or constrained movement, and cognitive functions such as visuospatial association, short term memory and working memory.

Two different types of assistance are provided to the patient: cognitive, where a visual feedback is shown on the screen, and motor, where the patient upper limb is mobilised to the target only when needed.

Conclusions: The innovations of this study are represented by (i) integration between cognitive and motor functions, (ii) novel performance evaluation metrics (i.e., Motor Performance Index and Cognitive Performance Index), that provide a quantitative description of motor and cognitive functions of each patient and the (iii) automatization of the difficulty level of the scenario (i.e, low, medium and high) based on the current performances of the patient. Such innovative aspects may be also useful for home-based training with advantages in terms of continuity of care.

Fig. 1



Fig. 2



S6.1

Long-term outcomes and predictors of recovery of consciousness in children with disorders of consciousness after a brain injury with the Coma Recovery Scale-Revised

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Objective: The objective of this study is twofold: first, to determine the long-term outcome of a pediatric sample with disorders of consciousness due to a severe acquired brain injury with the Coma Recovery Scale-Revised; and second, to describe the most frequent items of this scale that determine recovery of consciousness.

Methods: 21 children from two to sixteen years old who were admitted to the inpatient or outpatient program of the Neurorehabilitation Unit of Vithas Hospitals participated in the study. Participants had a mean age of 9.4 ± 4.7 years old. Seven of them had suffered a traumatic brain injury and 14 a non-traumatic brain injury. All subjects were included in a personalized multidisciplinary rehabilitation program. Participants were assessed using the CRS-R scale at admission and weekly during, at least, the first year after the injury or until recovery of consciousness. Descriptive statistics and logistic regression statistics analysis were used.

Results: According to the admission CRS-R scoring, eight children (42.9%) were in an Unresponsive Wakefulness Syndrome (UWS) state, nine children (38.1%) in a Minimally Conscious State minus (MCS-), and four children (19%) in a Minimally Conscious State plus (MCS+). One participant diagnosed as UWS, and ten participants diagnosed as MCS+ or - at admission, regained consciousness. The most frequent feature that determined recovery of consciousness was functional communication, alone ($n=5$) or associated with functional object use ($n=4$). Most participants (72.7%) regained consciousness during the first six months after the injury. Time since injury and initial CRS-R scores were found to be predictors of outcome.

Conclusion: Most frequent feature of recovery of consciousness was functional communication. Best predictors of recovery included time since injury and CRS-R score at baseline.

Acknowledgements: This study was partially funded by the European Union's Horizon 2020 research and innovation programme Marie Skłodowska-Curie (Grant agreement No 778234) and by Universitat Politècnica de València (Grant PAID-06-18).

S8.1

VR-based multisensory peer-peer therapy fosters learning and retention in nonfluent aphasia

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Aphasia is the most frequent cognitive disorder in stroke population worldwide. The majority of the affected individuals remain chronic experiencing serious communication failures which affect the quality of life. Recent studies yield that the rehabilitation can be effective if it consists of socially-embedded, intensive training of behaviorally-relevant tasks[1]. In addition, evidence shows that semantic representations in the brain involve activity in sensorimotor areas suggesting that multimodal cues may facilitate word retrieval[2]. Resources of the standard care system, however, are often very limited and cannot offer such therapy. Thus, the need for evidence-based and cost-effective strategies for the recovery of language increases. Here, we designed and clinically validated a principle-based, embodied, virtual reality (VR) rehabilitation system which enables multisensory peer-peer training of speech and language disorders after stroke: Rehabilitation Gaming System for aphasia (RGSa)[3]. 17 patients with persistent non-fluent aphasia underwent intensive treatment in a randomized, controlled, parallel-group design. Patients were allocated to the experimental group (EG) receiving therapy with RGSa or to the control group (CG) receiving standard language

therapy. Both groups were matched for materials and intensity undergoing treatment 5 days/week for 8 weeks. Our results showed that both groups significantly improved on the primary outcome measure (EG:p=0.01; CG:p=0.04), and the secondary outcome measure (EG:p=0.007; CG:p=0.01) after the therapy. Interestingly however only the RGSa group showed improvements in the communicative frequency (p=0.01). Moreover, the follow-up evaluation, administered 8 weeks after the end of the trial, demonstrated that both groups retained changes related to the expression of the trained vocabulary (EG:p>0.01; CG:p=0.01), however, only the RGSa group retained therapy-induced improvements in communication (p=0.05) and language (p=0.01). Finally, our results yielded beneficial effects of the multisensory cueing on naming suggesting that the proposed strategy can indeed foster verbal-production skills even at the chronic stage. Together, these findings reveal the effectiveness of RGSa for improving and retention of language function in patients with aphasia suggesting that principle-based VR-methods may be integrated into the healthcare system to intensify the rehabilitation of post-stroke disorders.

1.Difrancesco et al. 2012*Aphasiology*

2.Kiefer & Pulvermuller 2012*Cortex*

3.Grechuta et al 2019*Stroke*

S9.1

Motor Cortex Modulation by Rhythmic Auditory Stimulation

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Objective: Persisting deficits in motor function are a prevalent consequence of brain injury for example caused by stroke and affected patients depend on efficient neurorehabilitation. Auditory rhythms can induce movements in listeners as one can observe by watching people tap or nod in synchrony with the beat of musical pieces. Obviously, there are excitatory links between

the auditory and the motor system. High-groove is a musical quality that entrains easily.

On this background, the following study aimed to investigate if passive listening to high-groove rhythms can increase motor cortical excitability and if possible, changes last for one hour.

Methods: In thirteen healthy subjects, parameters of cortical neuromodulation (resting motor threshold, motor evoked potentials, short intracortical inhibition and intracortical facilitation) were examined using transcranial magnetic stimulation before (T0), directly after (T1) and one hour after (T2) a fifteen-minute high-groove rhythmic auditory stimulation.

Results: Motor thresholds significantly decreased directly after high-groove stimulation (T1) but this effect was no longer present after one hour (T2). No impact on the remaining parameters was found.

Conclusions: This study showed that passive listening to high-groove rhythms for fifteen minutes led to an increased excitability of the motor cortex. However, the effect did only persist less than one hour.

Regarding significance of these findings for neurorehabilitation, more research on this topic is needed. In the course of further studies, one should investigate if a sustained modulation of motor cortex excitability and facilitation of movement can be evoked by improving rhythmic stimulation concerning stimuli selection and duration.

S17.1

Vibro-tactile P300 brain-computer interface as a mean to evaluate command following skills and communication in patients with unresponsive wakefulness syndrome

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We present results from a vibrotactile brain-computer interface (BCI) assessment aiming at detecting command-following and communication in 12 unresponsive wakefulness syndrome (UWS) patients. Two different paradigms were administered at least once for

every patient: (i) VT2 with two vibro-tactile stimulators fixed on the patient's left and right wrists and (ii) VT3 with three vibro-tactile stimulators fixed on both wrists and on the back. The patients were instructed to mentally count either the stimuli on the left or right wrist, which elicits a robust P300 for the target wrist only. The EEG data around each stimulus was extracted and subdivided into 8 averages. This data was classified with linear discriminant analysis and used to calibrate a brain-computer interface to test YES/NO communication abilities.

The grand average VT2 accuracy was 38.3 % and the VT3 accuracy 26.3 %. Two patients achieved a VT3 accuracy $\geq 80\%$ and went through communication testing (one answered 4 out of 5 questions correctly in session 1, whereas the other could answer 6/10 and 7/10 questions correctly in sessions 2 and 4). In 6 other patients, the VT2 or VT3 accuracy was above the significance threshold of 23% for at least one run, while in 4 patients the accuracy was always below this threshold.

The study shows the importance of repeating EEG assessments to increase the chance of detecting command-following in patients with severe brain injury. Furthermore, the study shows that BCI technology can be useful to test command following in chronic UWS patients and can allow patients to answer YES/NO questions. Besides UWS patients, the principle can be used in locked-in/completely locked in and minimal consciousness patients for assessment and communication.

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S17.2

Rehabilitation of Post Stroke Patients with and without new onset epileptic seizures, analysis of outcome in 16 neurorehabilitation clinics

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The risk of appearance of epileptic seizures after suffering a stroke is well established in literature.

However, the effect of an epileptic seizure on the outcome of neurorehabilitation is yet to be

established. We analyzed a total of 23511 patients with initial diagnosis of Stroke who where treated between January 2015 and March 2019 in 16 Neurorehabilitation Clinics throughout Germany. A total of 459 patients suffered epileptic seizures during the hospitalization. The most common initial diagnosis of patients later on suffering a seizure was ischemic embolic stroke (ICD 63.4). The cases analysed where divided in groups according to the stage of rehabilitation. Those stages are: Phase B early neurorehabilitation with a Barthel Index (BI) <35 points, Phase C (BI 35-75 points) and Phase D (BI > 75 points). The rate of new onset epileptic seizures was significantly higher in patients in the early stages of neurorehabilitation, a rate of 6,3% in early neurorehabilitation and 7,5% in patients needing assisted respiration, compared to a rate of 0,08% of patients in the late stages of rehabilitation (D Phase). The most common form of epileptic seizures were partial focal symptomatic epileptic syndromes, with a significant percent of unclassified seizures.

Conclusion: New onset epileptic seizures are common complication of stroke and occur predominantly in the early stages of rehabilitation. With this study we want to remark the importance of early detection, correct treatment and adapted rehabilitation program for this group of patients, which is important for the global outcome of hospital rehabilitation and long term prognosis.

S17.3

Brain connectivity and learning processes in a cognitive-motor task in neurodegeneration: evidence from EEG network analysis

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Question: EEG rhythms are linked to any kind of learning and cognitive performance including motor tasks. The brain is a complex network consisting of spatially distributed networks dedicated to different functions including cognitive domains where dynamic interactions of several brain areas play a pivotal role. Brain connectome could be a useful approach not

only to mechanisms underlying brain cognitive functions, but also to those supporting different mental states. This goal was approached via a learning task providing the possibility to predict performance and learning along physiological and pathological brain aging.

Methods: Eighty-six subjects (22 healthy, 47 amnesic Mild Cognitive Impairment, 17 Alzheimer Disease) were recruited reflecting the whole spectrum of normal and abnormal brain connectivity scenarios. EEG recordings were performed at rest, with closed eyes, both before and after the task (Sensory Motor Learning –SmoL- task consisting of a visual rotation paradigm). Brain network properties were described by Small World index (SW), representing a combination of segregation and integration properties.

Results: Correlation analyses showed that alpha 2 SW in pre-task significantly predict learning ($r=-0.2592$, $p<0.0342$): lower alpha 2 SW (higher possibility to increase during task and better the learning of this task), higher the learning as measured by the number of reached targets.

Conclusion: These results suggest that, by means of an innovative analysis applied to a low-cost and widely available techniques (Small World applied to EEG), the functional connectome approach as well as conventional biomarkers would be effective methods for monitoring learning progress during training both in normal and abnormal conditions.

S18.1

Is post-stroke lateropulsion a kind of graviceptive neglect?

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Objective: Lateropulsion after hemisphere stroke is interpreted as a bias in verticality representation. Lateropulsion is puzzlingly associated with spatial neglect, interpreted as a bias in the sided representation of space. Disentangling how the neural bases of these 2

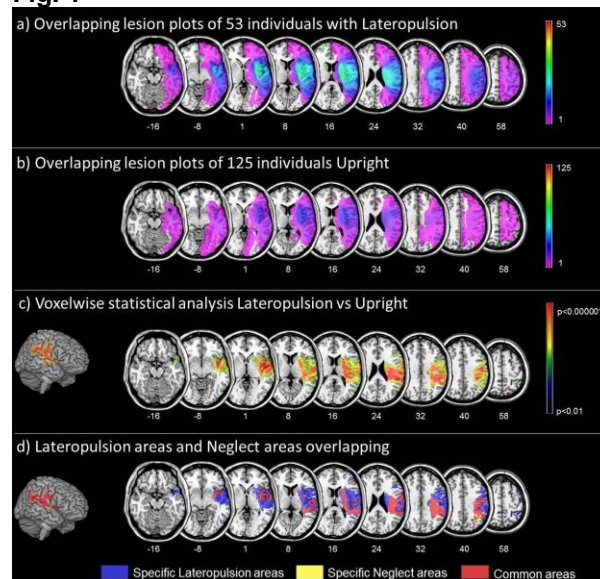
behaviors overlap might help understanding their association.

Methods: Cross-sectional study of individuals consecutively admitted to neurorehabilitation ward after a first-ever uni-lateral hemisphere stroke (Cohort DOBRAS 2012-2018, clinicaltrial.gov: NCT03203109), with clinical data systematically collected one month post-stroke. Participants were classified as showing lateropulsion (Scale for Contraversive Pushing, SCP>0.5) or not, and as showing spatial neglect (at least 2/6 abnormal body or non-body neglect tests) or not. MRI with anatomical sequences performed at 2 months, were analyzed in correspondence with behaviors, using Voxel-based lesion-symptom mapping (VLSM).

Results: We investigated 178 individuals, 79 with right and 99 with left hemisphere stroke, among whom 53 (30%) had lateropulsion and 81 (46%) spatial neglect. Lateropulsion and spatial neglect were strongly associated ($X^2=90.4$, $p<0.001$): all with lateropulsion showed spatial neglect whereas in those upright spatial neglect was found only in 22%. Interestingly, a strong overlap was also found regarding neural bases. These common areas were expanded, represented 34% of the total areas involved in either of these two disorders in spatial cognition that are lateropulsion or spatial neglect, encroaching both cortical (centered on the parieto-insular cortex) and subcortical (posterolateral thalamus and putamen) structures with a very high degree of significance ($p<10^{-6}$).

Conclusion: This study identifies a common lesion of the vestibular cortex and subcortical connections involve in lateropulsion and spatial neglect. Two behaviors representing different spatial dimensions, one referred to straight above (lateropulsion, body orientation with respect to gravity) and the other referred to straight ahead (spatial neglect)? Would it mean that lateropulsion and spatial neglect result from a same mechanism, lateropulsion being possibly caused by a kind of graviceptive neglect?

Fig. 1



S19.1

Brain Computer Interface training for patients with severe upper limb paresis in the subacute phase after stroke – Study protocol for a pilot RCT

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Introduction: Brain Computer Interfaces (BCI) pair brain activity with visual and / or motor feedback. They may provide sorely needed training alternatives for patients with severely impaired upper limb after stroke, where treatment choices are limited and unsatisfactory. Studies where the effectiveness of BCI training with patients in the subacute phase after stroke is examined are scarce.

Objectives: We want to examine if BCI based training is more effective in improving upper limb (UL) motor function than conventional therapy in the subacute phase after stroke. Furthermore, we want to explore which patients benefit, and how patients and therapists experience this type of training.

Patients and methods: This is a pilot RCT. Forty patients with stroke and severe UL paresis (< 13 on Action Research Arm Test) will be included and randomized to either BCI training as part of their rehabilitation or standard UL rehabilitation. BCI training will be conducted with the RecoveriX system (g.tec, Austria). The RecoveriX system comprises EEG, functional

electrical stimulation and visual feedback from virtual hands on a screen. The system is calibrated according to patients' brain activity. Only when a defined accuracy in imaging wrist and hand movements is reached, functional electrical stimulation is initiated to move the hands. The patients will undergo targeted 10 treatment sessions during the course of 3 weeks.

Outcome measures: UL motor function will be assessed with Action Research Arm Test (ARAT) and Fugl Meyer Motor Assessment. Interviews will be conducted with patients and therapists to explore their experience with regard to effect and user-friendliness. Data on cortico-spinal tract integrity derived from TMS, and patient-related data will be used as predictors in a regression analysis.

Results: The study is ongoing, no results available yet.

Discussion: In the subacute phase, most plasticity and potential for recovery can be expected. Stimulating task-oriented training with many repetitions can improve motor function. However, it is very challenging to provide suitable active training for patients who hardly can move their affected upper limb. A system that creates a closed loop between intention, output and feedback may represent a promising treatment option for patients with severe upper limb paresis after stroke.

S19.2

Brain-computer interfaces as a tool for upper extremity motor rehabilitation for chronic patients suffering from stroke

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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. In this current study, a BCI controlled an avatar and functional electrical stimulation (FES) to provide the visual and

proprioceptive feedback respectively. The given task was to imagine either left or right wrist dorsiflexion according to the instructions in randomized sequences. Then, the linear discriminant analysis and common spatial filter classified the brain activity acquired by the EEG system. 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 (240 trials of either left or right motor imagery) of BCI feedback sessions over 13 weeks. Two days before and two days after the BCI training intervention, clinical measures were used to observe any motor improvement. The primary measure was upper extremity Fugl Meyer assessment (UE-FMA) which evaluates the motor impairment. Four secondary measures were also performed to exam the spasm (modified Ashworth scale, MAS), tremor (Fahn tremor rating scale, FTRS) and level of daily activity (Barthel index, BI). In 27 chronic stroke patients the study showed an average improvement of the UE-FMA of 8 points ($p < 0.0001$). Furthermore spasticity and tremor were significantly reduced and the Barthel index increase significantly. Therefore, the BCI based motor rehabilitation is a very effective way of treatment in chronic stroke patients. In future the protocol will be extended to treat lower limb movements with the BCI system.

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CS01

The importance of brain plasticity in stroke rehabilitation

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Stroke is the leading cause of disability-adjusted life years lost in the world. Two thirds of stroke survivors suffer from disabilities affecting the motor and sensory system, cognition and communication. Stroke represents enormous burden for the patients as well as for society, therefore there is increasing demand for better acute stroke care and early rehabilitation.

Based on evidence from available studies, multidisciplinary rehabilitation is an effective

treatment in terms of reducing impairments and enhancing functional recovery.

The functional outcome, the reorganization of the brain is individually highly variable and can be determined by post-ischemic time, type and location of the brain lesion, pattern of gene expression, growth factors, neurotransmitters, endogen neurogenesis and environmental effects.

Stroke induces a whole remapping of the adjacent cortical areas. Cortical reorganization is a long process that takes place on several levels. It includes the activation of inactive cortical connections, the developments of new pathways. Ischemic lesions produce specific signals that induce axonal collateral sprouting and proliferation of dendritic arborization and synaptic spines of neurons. Synaptic plasticity and synaptogenesis also play an important role in the reorganization processes. Newly-formed horizontal and vertical cortico-cortical dendritic connections allow for re-learning skills.

Ischemia is a strong enhancer of the brain-derived neurotrophic factor (BDNF) gene expression. BDNF has a role in creating new synapses, in promoting neuronal survival, dendritic arborization and remyelination.

Another possible mechanism of recovery after stroke is the process of endogen neurogenesis. Neuronal progenitor cells could be differentiated into neurons. These cells' differentiation, proliferation and migration are stimulated by neurotrophic factors, hormones, medications, as well as physical activity, motor, sensory and cognitive rehabilitation training.

The reorganization processes of the brain after stroke are greatly enhanced by environmental stimuli. Repetitive, intensive, task-oriented learning and rehabilitation training are therefore of great significance. This activity-dependent neuroplasticity is the key element of neurorehabilitation.

The complete understanding of brain plasticity enables new therapeutic strategies for rehabilitation in order to improve the functional status of stroke patients.

CS02

Complicated rehabilitation of a patient with hypertrophic olivary degeneration (Case presentation)

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Introduction: Hypertrophic olivary degeneration (HOD) is a rare MR phenomenon caused by disruption of the dentato-rubro-olivary pathway, well known as the Guillain-Mollaret triangle. According to the literature, palatal tremor, dentato-rubral tremor (Holmes tremor), ocular myoclonus and ataxia are the most frequent symptoms of HOD. Recently, there is no specific treatment. Occurring of symptomatic HOD complicates the rehabilitation process of a patient with brainstem lesion.

Case: Our 27 year-old female presented to an outside hospital with acute onset of headache, right extremities weakness and decreased conscious level. CT/CTA revealed mesencephalic haemorrhage caused by arteriovenous malformation. Two months later AVM was solved interventionally. Patient was transferred to our rehabilitation clinic 2.5 months after the first admission. Initial neurological state was severe including diplopia, dysarthria, dysphagia, ocular opsoclonus, Holmes tremor, ataxia. Performed MRI revealed bilateral HOD, which is the least common pattern of it. Neurological symptoms made mobilisation impossible. So that we focused on Holmes tremor, one of the treatable symptoms. Following the literature, we built up combined oral drug therapy to ameliorate tremor (i.e. clonazepam, levodopa/benserazide, topiramate). It improved the symptom, however, patient's disability had not changed. According to the international guidelines, patient with severe tremor was referred to neurosurgeon for DBS. Neurosurgeon suggested two targets: GPi and Vim. After electrodes implantation patient took parts our rehabilitation program again. Recently she is able to stand up, walk in the room with walker, and performed the ADL.

Conclusion: Lesion of the Guillain-Mollaret triangle sometimes causes symptomatic HOD. These severe symptoms made rehabilitation impossible, however, our case presentation shows DBS implantation is worth performing to improve tremor and so patient could be involved in rehabilitation program again.

CS03

The use of transcranial direct current stimulation in stroke rehabilitation: effects on mood and cognition

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Background: Stroke is a high prevalence disorder causing a variety of motor, cognitive and affective symptoms, with a tremendous effect on quality of life [1]. Despite the various stroke localizations, a similar pattern of cognitive deficit typically occurs, involving verbal memory, visuospatial skills and executive functioning [2]. Growing evidence suggests, that non-invasive neuromodulation techniques serve as promising tools to enhance post-stroke cognitive rehabilitation [3].

Objectives: We assessed the effect of transcranial direct current stimulation (tDCS) combined with a targeted cognitive training program on overall cognitive functioning in stroke patients, independently of stroke localization.

Methods: Thirty-two stroke patients have been enrolled in the study so far. Measures of global cognitive function (Addenbrooke's Cognitive Examination Test, ACE) and affective symptoms (Beck's Depression Inventory, BDI) have been addressed at baseline and at the end of the 10-day program. Patients were randomly assigned to one of three groups: active tDCS with cognitive training (A-T), active tDCS without training (A), and sham tDCS with cognitive training (T). Cognitive training included a flanker task involving emotional stimuli, visuospatial processing and executive function. We expected active tDCS to improve cognitive and affective symptoms, whereas the specific cognitive training to be beneficial for global cognition. We also expected active tDCS to enhance the effects of the cognitive training.

Results: Comparing the effects of treatment conditions on cognitive performance, no difference was found after the 10-day program ($F(2,28) = 1.293$, $p = 0.290$). However, affective symptoms improved significantly on the BDI in the AT group ($F(2,28) = 7.174$, $p = 0.003$).

Conclusion: Results do not indicate positive effects of targeted cognitive training on overall cognitive function in stroke patients with different lesion sites; however, tDCS combined with cognitive training appears to be beneficial for the treatment of post-stroke depressive symptoms.

CS04

Use of PSSCogrehab in cognitive rehabilitation – case studies

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Introduction: Cognitive functioning - including perception, orientation, attention, memory, language and executive functions - is affected in several forms of neurological diseases, as well as traumatic brain events. These deficits may significantly impair the patients' quality of life during daily functioning, causing severe problems at work and in social relations. The impairment can also create an obstacle to other aspects of recovery, such as physiotherapy or ergotherapy. Therefore, it is crucial to also address and train cognitive functions during the rehabilitation process. Numerous paper-pencil tests are available for cognitive training purposes. However, there is growing evidence for increased effectiveness of computerized cognitive training programs, developed primarily for cognitive rehabilitation.

Objectives: Our purpose is to introduce and discuss the use of PSSCogRehab, a computerized program specifically designed to train affected cognitive functions. On the Neurorehabilitation unit of the Neurology Department, University of Szeged, the program is used in the cognitive rehabilitation process of stroke or traumatic brain injury patients.

Materials & Methods: We aim to discuss the beneficial effects and disadvantages of the program through the cognitive rehabilitation process of two patients. The two cases involve a 44-year-old female patient with a former anoxic condition, and a 66-year-old female patient with a history of an ischemic stroke. After

a thorough neuropsychological evaluation, they participated in a daily cognitive training program involving the affected cognitive domains. At the end of the training program, a retest session has been performed.

Results: The 44-year-old female patient recovering from an anoxic condition improved significantly in her global cognitive functioning, especially on tasks involving visual perception, anterograde memory, working memory, attention and executive functioning. The 66-year-old female patient's neglect symptoms also showed improvement by the end of the training, along her global cognitive status.

Conclusions: PSSCogRehab can be an effective tool during cognitive rehabilitation, especially if tailored individually to the patient. However, limitations should be taken into consideration, and combining the program with traditional tests could elevate the level of efficiency through maintaining the motivation of the patient.

CS05

Intake difficulties of macro- and micronutrients and related pathobiochemical disturbances in stroke associated dysphagia

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It was shown that the vast majority of stroke patients with initial nonoral feeding recommendation are discharged with oral intake restrictions indicating a continued need for swallowing assessments and treatment discharge. Lesion locations associated with motivation, reward, and drive to consume food as well as swallowing impairment, higher age, and more comorbidities were related to less oral intake improvement (1). Furthermore, during the use of oral hydration protocols for dysphagic patients following stroke it is important to evaluate the association of liquid consistency modification and six levels of augmented hydration orders interventions with functional outcomes and need for intravenous fluids (2). Recent findings suggest that regular use of natural capsaicin could promote the recovery of swallow function in stroke patients with dysphagia (3). Hypercatabolism is frequent in acute stroke, and nitrogen balance tends to be negative. However, in the subacute and chronic phases of stroke, it was confirmed that hypercatabolism had resolved and that

intensive rehabilitation is possible in the convalescent period (4). In tube-fed patients serum trace elements concentration was influenced by malnutrition and inflammation. Serum trace elements concentration might not be normalized if malnutrition and inflammation are not treated. It was recommended periodical monitoring of trace elements for long-term tube-fed patients with neurological dysphagia (5). Furthermore, it appears that, once stroke patients develop nonthyroid illness syndrome, it is difficult to achieve function improvement. Therefore, during the recovery period after stroke, it is important to determine whether this syndrome is present and ensure proper intensive rehabilitation and nutritional management (6).

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CS08

tDCS - Transcranial direct current stimulation in neuro-rehabilitation of post stroke patients with depression or aphasia

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Introduction: In recent years, neuroscience has succeeded in gaining more interest. Proof of this interest, does the number of studies is a growing, especially in the last 15-20 years. This spectacular evolution in the medical world is closely connected with the invention of various methods of investigation (eg. EEG, fMRI, NIRS), since it was possible objectification of different ideas and / or therapies.

It is known that brain function can be modified by applying a low frequency current, using the contact electrodes placed on the scalp, this type of stimulation is called Transcranial Direct Current Stimulation (tDCS). It is applied in order to explore the physiological mechanisms of cognitive functions and behavior, but also is used as a treatment, with the aim to diminish

clinical symptoms in neurological and psychiatric disorders, being extremely useful in the neuro-rehabilitation program of patients who suffered a stroke.

Material and Method: The tDCS therapy will be used in the rehabilitation of patients with cognitive disorders (depression, aphasia) suffered after a stroke. Patients enrolled in this study, first, will be evaluated psychologically. They will then enter into the treatment protocol, which will consist of 2 phases: Phase I, consisting of 10 sessions / 2weeks and Phase II (maintenance) 1 session / 2weeks, 3 months' time. By means of the TCS, the patient will be given the AtDCS (anodal tDCS), CtDCS (cathodal tDCS) or sham (placebo control method), with a current intensity between 1-2mA for max 20 min. Depending on the type of disease will have different types of assembling the electrodes on the scalp. If the depression is known that DLPFC (dorsolateral prefrontal cortex) of the left hemisphere, the cortical area of the brain function is altered. And in patients with aphasia, Wernicke or Broca areas are known to be responsible for various disorders, and these are of major interest to stimulate.

Discussions: The purpose of stimulation in depression, is to increase neuronal activity in the left DLPFC accordingly to treat specific symptoms. There are numerous studies that tDCS is now reporting that a therapeutic alternative to the drug administration.

Conclusions: TDCS therapy is a revolutionary therapy that shows an interest in growing in the medical world and beyond, being a non-invasive brain stimulation therapy. This therapy is well tolerated by patients and is not associated with serious side effects or withdrawal effects type.



BP01

The influence of a self-regulated exercise training in people with multiple sclerosis

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Introduction: Numerous studies indicate that exercise training has a positive effect on various symptoms in multiple sclerosis (MS). The aim of this study was to find out what impact a self-regulated sportive training has on gait, self-efficacy and sport-related self-efficacy in people with MS (pwMS) and how it affects the different types of disease.

Methods: Initially, the participants complete an evidence-based education program within two weekends to be prepared for a self-regulated training phase. After the first weekend they were encouraged to train self-regulated for twelve weeks. Out of 108 participants 77 (67 women, 10 men; mean age 51.37 ± 8.89 years; mean years of disease 17.47 ± 9.81) were included in further statistical analyses on motoric data and 72 (64 women, 8 men; mean age 51.03 ± 8.65 years; mean years of disease 18.19 ± 9.75) for the statistical analyses on psychometric data. For further subanalyses concerning the different forms of MS, the data of 28 participants with relapsing-remitting

(RRMS), 20 with secondary progressive (SPMS) and 10 with primary progressive MS (PPMS) were included. The Functional Gait Assessment (FGA), the Multiple Sclerosis Self-efficacy Scale (MSSES) and the Self-efficacy towards physical exercise Scale (SSA) were used as measurements before (T_0) and after (T_1) the intervention period.

Results: The results of the FGA presenting a significant difference between T_0 and T_1 and a large effect size in the total sample ($p < 0.001$; $d = -1.96$) and in the groups with RRMS ($p < 0.001$; $d = -2.43$) and SPMS ($p < 0.001$; $d = -1.02$). The results of the participants with PPMS showed no differences, but a trend to significance ($p = 0.066$) and also a large effect size ($d = -1.43$). There could not be recognized any significant changes in the MSSES and the SSA-Scale. Only the results of the group with RRMS showed a trend to significance ($p = 0.054$) and a large effect size ($d = -0.78$) in the MSSES.

Conclusion: A self-regulated exercise training is an option to improve walking ability in pwMS. Future studies should seize up the approach of self-regulated training to reveal further positive effects. It is very important to show pwMS ways to influence their health status without being depended on therapists, physician and given schedules. Only well-educated and empowered pwMS are able to exercise self-confidently and set training and rest periods, meaningfully.

BP02

Effects of High Frequency Repetitive Transcranial Magnetic Stimulation on Cognitive Functions, Behavioral Status, Quality of Life and Functional Brain Connectivity in Alzheimers Disease

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Question: Alzheimer's Disease (AD) is a progressive neurodegenerative disease with gradual decline in cognitive functions. Transcranial Magnetic Stimulation (TMS) is a neuromodulation treatment method that is used in neurodegenerative diseases such as AD. The purpose of this study is to investigate the effect of the repeated TMS (rTMS) in comparison to pharmacological treatment on cognitive

functions, Behavioral Status, Quality of Life and functional brain connectivity in AD.

Methods: Eighteen patients with AD aged 60 years and older were included in the study and were separated to 2 groups. rTMS group ($n = 10$) received 20 Hz rTMS intervention in the Dorsolateral Prefrontal Cortex bilaterally, 5 days consecutively in weekdays over 2 weeks. Subjects in the control group ($n = 8$) received no other intervention. Subjects in both groups continued to their pharmacological treatment prescribed by a neurologist. Cognitive functions were evaluated by Neuropsychological Test Battery (NPT), behavioral status was evaluated by Neuropsychiatric Inventory (NPI) and Frontal Behavior Inventory (FBI), quality of life was evaluated by Quality of Life in Alzheimer's Disease Questionnaire (QoL-AD) and functional changes in brain connectivity were evaluated by the resting state-functional Magnetic Resonance Imaging (rs-fMRI) before and after the study protocol.

Results: Statistically significant differences were found in attention (NPT-Mental Control) and executive functions (NPT-Clock drawing) in the TMS group; in memory (NPT-Visual Instant Memory) and behavioral status (NPI) in the control group ($p < 0.05$). Between groups, statistically significant differences were found in executive functions (NPT-Clock drawing) and behavioral status (NPI) in favor of rTMS group ($p < 0.05$). It was found that rTMS treatment was significantly effective on Default Mode Network, Executive Control Network and Dorsal Attention Network in rs-fMRI ($p < 0.05$).

Conclusion: Our findings showed that therapeutic methods that appear to be an alternative in AD are in fact influencing different areas of the cognitive and behavioral profile of the brain. Additionally, high frequency rTMS treatment can be an effective alternative treatment in addition to pharmacological treatment methods in AD. Further studies comparing different intervention methods and also different protocols of rTMS are needed to better understanding the therapeutic effects of rTMS on cognitive functions and functional brain changes in AD.

BP03

Is dorsiflexor muscle activation enough to ensure plantigrade or heel-first initial contact in post-stroke gait?

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Question: Since falls in post-stroke patients (PSP) occur mainly during gait, improving walking safety and efficacy is a major goal in neurorehabilitation. In normal gait, the activation of tibialis anterior (TA) and extensor hallucis longus (EHL) during swing phase (SP) is important for foot clearance and heel strike at initial contact (IC). Thus increasing step length and walking speed, simultaneously saving energy. The gait laboratory (GL), enhances understanding of gait patterns, which influence treatment strategies. Aim: to evaluate the activation of TA/EHL during swing phase in PSP and, measure its implication in: ankle sagittal kinematics at IC; step and stride lengths; cadence; walking speed.

Methods: Retrospective cross-sectional study of PSP evaluated in the GL of a neurorehabilitation center (01/2015 - 12/2018). Only patients with dynamic electromyography of TA were included. Most patients were referred to the GL in context of poor response to treatment with botulinum toxin, for assessment of target muscles and/or eventual orientation for surgical treatment. Statistical analysis with: Statistical Package for Social Sciences Software (SPSS), version 24 (independent samples T-test; statistical significance level of 0.05).

Results: 68 patients were included, 56% male, mean age 53 years, 62% with right hemiparesis. TA was activated during SP in 72% patients, EHL in 56% and both were simultaneously activated in 50%. Nevertheless, equinus foot (EF) was present in 60%. In EF cases, TA was activated in 68%, EHL in 56% and both in 56%. The TA and/or EHL activation during SP didn't correlate with the sagittal angle of the ankle (SAA) at IC, step length, stride length, cadence

or walking speed, neither in all sample analysis, nor in just EF cases analysis. However, the mean SAA at IC was 0.1° dorsiflexion, in the group with dorsiflexors activated in swing, while it was 1.6° plantar flexion in the group without.

Conclusions: In this group of patients, the lack of effect of TA activation in the measured gait parameters could be due to concomitant over-activity and/or shortening of plantar flexor muscles. Thus being the reason why IC was made with the fore-foot and in ankle plantar flexion, in spite of TA and/or EHL activation during SP. In these patients, instrumental gait analysis was crucial to determine the need for a medical or neuro-orthopedic intervention, with target at the plantar flexor muscles.

BP04

Combining tDCS and computerized mirror therapy in upper limb rehabilitation in stroke patients: a feasibility study

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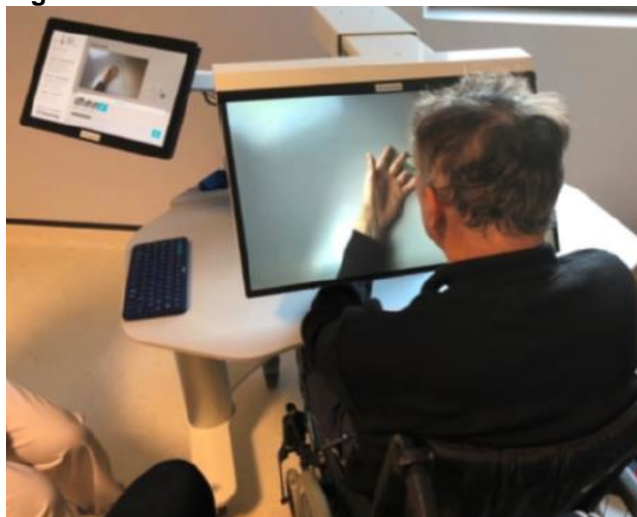
Introduction: Mirror therapy (MT) relies on a mirror and movements of the healthy limb to generate visual illusions of movement of the paralyzed limb. MT has proven to be effective for the motor rehabilitation of the upper limb of stroke patients, but suffers several limitations for patients. To overcome these difficulties, a computerized mirror therapy device was developed (IVS3TM, Dessintey). This device allows to record a video of the healthy arm in motion, then to reverse the image. The motor recovery effects could also be enhanced by applying simultaneous neuromodulation with tDCS. This small sample trial was conducted to evaluate the feasibility and tolerance of an IVS3 motor training combined with simultaneous bi-hemispheric tDCS.

Methods: Eleven patients with right or left hemiparesis following stroke were included in this trial. They received 20 sessions of computerized MT (IVS3TM, Dessintey; 5 sessions/week; 1 hour and 200 movements/session) combined with bi-hemispheric tDCS over the hand motor cortex (2mA, 20 minutes). The primary endpoint was adherence to the therapeutic program. The secondary judgment criteria were the safety assessment and the evolution of the tolerance of repeated tDCS stimulation coupled with IVS3.

Results: The synergy of these two therapies is well tolerated by patients with a compliance rate of $98,6\% \pm 0.025$. 51% of patients found the sessions encouraging, 46% pleasant, 12% easy and 5% fun. There have been no serious adverse reactions or unknown side effects with tDCS: 26% of patients reported tingling, 25% itching, and 8% had redness in the electrodes. Regarding the tolerance of computerized mirror therapy: 29% of patients report light fatigue following the session, 14% difficulties to remain focused on the screen, 6% tingling in the arm, 3% visual discomfort. The upper-limb motor function of the eleven patients improved.

Conclusion: In this feasibility small sample study, the eleven patients well tolerated and perfectly complied with the computerized mirror therapy associated with bi-hemispheric tDCS. This finding calls for clinical controlled study to evaluate the efficacy of this combined IVS3-tDCS program in stroke patients

Fig. 1



BP05

Intravenous amantadine sulfate (PK-Merz) decreases delta and increases alpha power in patients with disorders of consciousness: a preliminary EEG study

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Question: Oral amantadine hydrochloride is commonly prescribed for promoting functional recovery in patients with disorders of consciousness (DOC). Much is still unknown regarding the efficacy of intravenous amantadine sulfate. Here, we investigated whether intravenous amantadine sulfate induces changes in oscillatory brain activity in patients with DOC.

Methods: We recruited ten DOC patients (4 females, mean age 55.2) with brain injury of different aetiologies. The mean time from acute event was 228 days (min 44, max 1118). Four patients were diagnosed in a vegetative state (VS) and six patients in a minimally conscious state (MCS), according to behavioural assessments with the Coma Recovery Scale-Revised (CRS-R). Patients underwent a double-blind within-subject a-B-A-B clinical trial, which lasted 22 consecutive days. On day 1, patients received an intravenous infusion of placebo (a). From day 2 onward, they received a daily intravenous infusion of amantadine sulfate (PK-Merz 200 mg) for one week (B). Then, they received placebo for another week (A) and, finally, amantadine sulfate during the last week (B). Patients were assessed with the CRS-R and their brain activity was recorded using a 64-channel EEG system at the end of each study phase.

Results: Three patients (2 in MCS) did not complete the clinical trial and were excluded from the analysis. We estimated the power spectral density (PSD) from the filtered and artefact-free EEG datasets. Figure 1 plots the log PSD of each channel, averaged over 7 patients. Across the spectra in the 4 recording sessions, there was a noticeable drop-off in delta power following the drug administration, with a corresponding increase in alpha power. To quantify this, we expressed the power over delta, theta, alpha, beta and gamma bands as percentage contributions with respect to the total power over all bands (Figure 2). Amantadine sulfate produced significantly more power in the alpha band and less power in the delta band. Across sessions, three patients in MCS (out of four) presented clear on-off behavioural responses assessed with the CRS-R.

Conclusion: Our results clearly show that amantadine sulfate is effective in "speeding up" the typical slow-wave brain activity of DOC patients. Interestingly, these effects may remain behaviourally latent, thus emphasizing the importance of functional brain imaging

techniques. Unfortunately, the positive effects tend to disappear rapidly after drug discontinuation.

Fig. 1

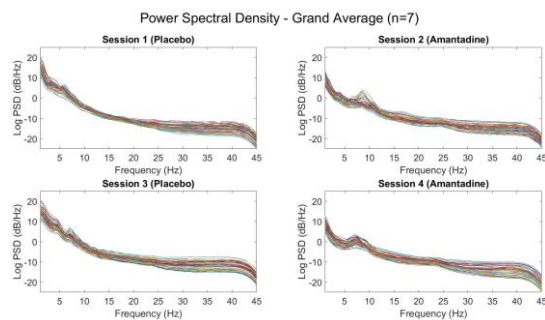
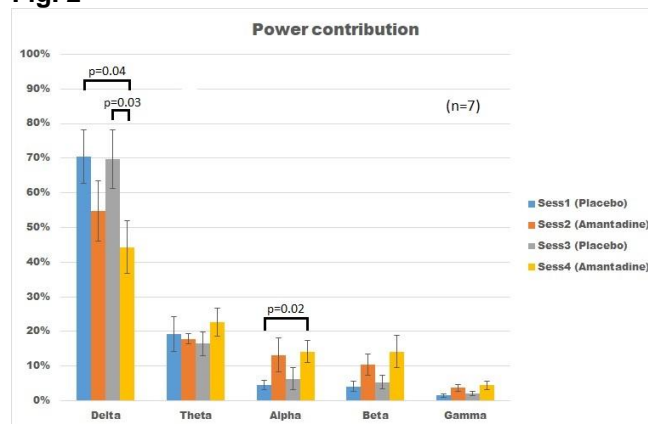


Fig. 2



Question: Peripheral nerves provide a promising source for neuroprosthetic control given their ease of access and functional selectivity. However, current interface methods, such as penetrating electrodes, are limited either by low signal amplitude or interface instability. By contrast, Regenerative Peripheral Nerve Interfaces (RPNI) are constructed by suturing a graft of de-vascularized, denervated muscle to the residual end of a transected nerve. The graft regenerates, revascularizes, and is reinnervated by the nerve, creating a stable bio-amplifier that transduces high amplitude electromyography (EMG) signals. Additionally, nerves can be surgically divided into fascicles to construct multiple independent RPNI. Here, we demonstrate the extraction of hand level prosthetic control signals from RPNI. We also demonstrate for the first time control of the DEKA Luke Prosthetic Arm from RPNI with indwelling wires.

Methods: We implanted RPNI in two individuals with upper limb amputations. P1 had a proximal transradial amputation and underwent implantation of 9 RPNI, with the median, ulnar, and radial nerves subdivided into four, three, and two branches, respectively. P2 had a distal transradial amputation and was implanted with a single RPNI on each of the median, ulnar, and radial nerves (3 total RPNI). During acute recording sessions, ultrasound was used to locate and visualize RPNI motor contractions, and implant percutaneous fine-wire bipolar electrodes into each RPNI. P1 and P2 were subsequently implanted with 8 and 3 indwelling electrodes, respectively.

BP06

Real-time Dexterous Fine Motor Control of an Advanced Prosthetic Arm Using Regenerative Peripheral Nerve Signals

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Results: P1's ulnar RPNI produced signals with an average maximum voluntary contraction (MVC) of 211 μ V and signal-to-noise ratio (SNR) of 3.48. P2's ulnar RPNI produced EMG signals with an average MVC of 49.2 μ V and SNR 7.45. Likewise, the median RPNI produced signals with an average MVC of 145 μ V and SNR 16.8. Using a combination of RPNI and available residual muscle signals, subjects successfully controlled a virtual prosthesis in real-time. Using a position/velocity Kalman filter, P1 obtained 98.2% motion accuracy over 56 trials; P2's motion accuracy was 80.6% spanning 108 trials. Implanted electrodes in P1 enabled real-time control of the DEKA Luke prosthetic arm.

Conclusions: Overall, we have demonstrated that RPNs produce motor specific contractions and high amplitude signals. Implanted electrodes enable an amputee to achieve real-time independent degree of freedom control of a prosthetic arm.

Fig. 1

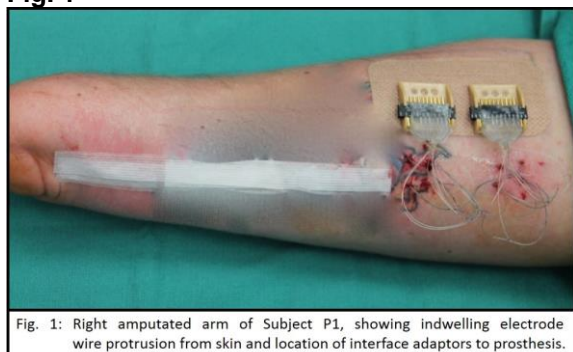
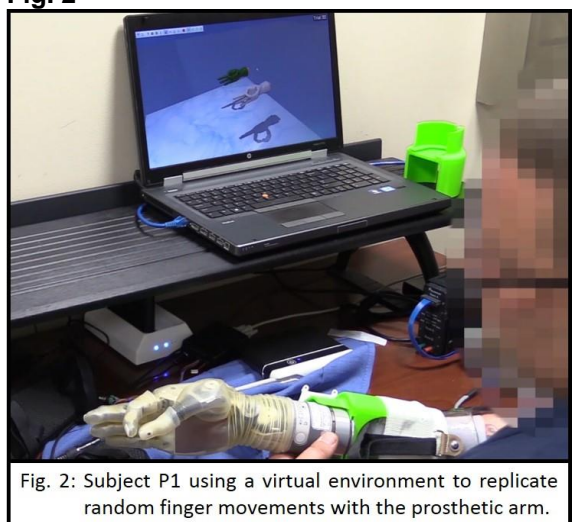


Fig. 2



BP07

Influence of the maximum flexion and extension of the hip, on spatio-temporal parameters in post stroke patients, as measured by instrumented gait analysis

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Question: Stroke is a leading cause of long-term disability. More than 80% of stroke survivors have a walking dysfunction. One kinematic alteration is the range of motion of the hip in sagittal plane. It is common that the affected lower limb appears stiff-legged, with extension, adduction and internal rotation of the hip. In normal gait, the deficits in flexion/extension of the hip produce changes of the spatio-temporal parameters (STP). The aim of this study was to assess if and how the angles of flexion/extension at the hip in post stroke patients influence spatio-temporal parameters through gait analysis (GA).

Methods: Retrospective cross-sectional study including post-stroke patients evaluated between 2015 and 2018 in the Gait Lab (GL) of a neuro-rehabilitation center, only patients with full GA. We calculated the average of the maximum angles of hip flexion (HF) and extension (HE), and retrieved the SPT from the GL report (cadence, velocity, step length, stride length). Statistical analysis was done using Statistical Package for Social Sciences Software (SPSS), version 24. Comparative analysis and their statistical significance were tested through independent samples T-test. A statistical significance level of 0.05 was assumed.

Results: 68 patients were included, 56% male, mean age of 53 years, 62% with right hemiparesis. Average STP in this group were: velocity - 0.37m/sec (0.03 to 0.99); cadence - 66 sep/min (20 to 113); stride length - 0.63m (0.19 to 1.16) and step length AL- 0.35m (0.12 to 0.63); step length CL - 0.30m (0.04 to 0.58). Average maximum HF of affected limb (AL) was 26.06° (1.94° to 55.52°) and of contra-lateral limb (CL) was 35.88° (17.65° to 61.61°). For extension the values were: HEAL = 2.80° (-37.36° to 39.55°) and HECL = 6.43° (-14.47° to 25.78°). Correlation tests showed a positive correlation for HEAL and HECL regarding: stride length and velocity. HECL showed additional statistically significant correlation for: cadence and step length. HFAL and HFCL had no statistically significant correlation with either of the STP measured.

Conclusions: The findings of our study are in accordance with the available literature. The GL allowed us to collect objective data that otherwise would be difficult to obtain. We confirmed that contralateral hip extension is crucial to allow a larger step on the affected side and, hence a higher and more useful velocity for everyday life after stroke.

BP08

Ipsilateral Motor Impairment in Post-Stroke Patients and the Specificities of the Cerebral Hemispheres

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Question: Regarding Stroke sequels, it is known that the ability to control and coordinate upper limb muscles depend on the brain hemisphere affected. Left hemisphere is commonly related to the planning and dynamic control of the movement trajectory, while right hemisphere is related to the control of the member position. However, due to neural structural changes caused by Stroke, upper limb ipsilesional extremity may present sensory alterations that lead to reduction in the capacity to perform movements. Thus, the impact in patients' functionality may also be resulted from deficits in ipsilateral hemibody, even if in a minor proportion. Thus, the objective of this study was to analyze ipsilateral and contralateral upper limb motor impairment in post stroke patients, correlating it to the affected brain hemisphere.

Methods: This studied was conducted in the Faculty of Health Sciences of Trairi, Santa Cruz, Brazil. It's a cross-sectional, analytical study in which 14 chronic post-stroke patients (left brain lesion = 6 and right = 8) were assessed by the following instruments: Fugl-Meyer, Box and block test (BBT), Reach Performance Scale - close target (RPS-CT) and distant target (RPS-DT), Handgrip Dynamometer Strength (HDS) and Mini Mental State Exam (MMSE). Mann-Whitney test was used for inter-group data; Wilcoxon for intra-group and Spearman correlation to assess motor impairment regarding brain lesion side.

Results: The group with right hemisphere lesion (RHL) presented significant difference for BBT ($p = 0.011$), and RPS-DT ($p = 0.027$); the group with left hemisphere lesion (LHL) showed difference for RPS-DT ($p = 0.027$) and HDS ($p = 0.027$). For inter-group analyses, expected results were observed related to the higher impairment of contralesional hemibody. Correlation data showed a strong correlation between BBT and HDS ($r = 0.82$; $p = 0.041$); HDS and RPS-DT ($r = 0.83$; $p = 0.039$) for the LHL group. In the RHL group, it was observed strong to moderate correlation between HDS and RPS-DT ($r = 0.82$; $p = 0.011$) and RPS-CT ($r = 0.75$; $p = 0.029$).

Conclusion: Handgrip manual strength seems to be more associated with manual dexterity in individuals with left brain injury and with RPS-CT in right hemisphere lesion. For RPS-DT, better manual strength benefits such task regardless the injured hemisphere side. However, we suggest further studies to complement our data and verify the relationship between the commitments and the hemispheric specialization.

YE01

Estimation of Balance Status in Hemiparetics: An Artificial Neural Network Implementation

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Question: The aim of this study was to compare manual Balance Evaluation Systems Test (BESTest) results and artificial neural network predictive results and to determine the highest contributions of BESTest subsets in order to find artificial neural network predictive results of BESTest subsets.

Methods: 66 hemiparetic individuals aged between 35-65 years were included in the study (M:43, F:23). The mean age of the participants was 53.70 ± 8.19 years and the mean duration of disease was 47.70 ± 62.72 months. Balance status was evaluated by BESTest. 70% ($n=46$) of the data set was used for learning, 15% ($n=10$) for evaluation, and 15% ($n=10$) for testing purposes in order to model artificial neural networks (ANN). Multiple linear regression model (MLR) was used to compare with ANN.

Results: The results of the study showed that ANN (root mean square error-RMSE: 4.993) was better than MLR (RMSE: 7.031) to estimate balance status of hemiparetics. The lowest contribution of subtest to BESTest total score was Stability Limits/Verticality and the highest contribution of subtest was Stability in Gait. It can be seen that as the most and the lowest contribution of subtest items were investigated, RMSE values were low and too close.

Conclusions: The results obtained from this study showed that RMSE values of ANN were better than the literature. Yet, since these values are very close to each other, you should

need to be careful in making an inference. BESTest cut off values showing severe of the balance problem are needed to make accurate inferences. To interpret our results could be more significant after determining cut off values of BESTest. We think that our study can lead to constitute a shorter, more sensitive, more practical and a helpful mini subset of BESTest for physiotherapists used for differentiate balance problems while it was proper for BESTest theory (1,2).

Key Words: Hemiparesis, Balance, Neural Networks, Artificial Intelligence.

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YE02

Ground reaction force patterns in post-stroke patients – the effect on spatiotemporal parameters

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Introduction: Impairment of gait is a common problem in post-stroke patients and there is a main concern for improving walking speed as it is associated with better quality of life. The aim of this study was to assess the relation between ground reaction forces (GRF) and gait characteristics in post-stroke patients, namely spatiotemporal parameters.

Methods: 166 post-stroke spastic hemiplegic patients with gait impairment were referred for evaluation at the Gait Lab of a Neurorehabilitation center between 2012-2019. All performed gait analysis at self-determined speed and data were obtained for the time to 1stpeak of vertical GRF (vGRF) (T1fZ)),

1stpeak (1fZ) of vGRF and 2ndpeak (2fX) ant-post GRF (apGRF) and ankle power as propulsive force (PF), as well as spatiotemporal parameters. We performed a comparative analysis and statistical significance was determined for $p < 0,05$.

Results: 93/166 were male, average age was 53 years, 43 hemorrhagic and 103 ischemic stroke, 96 presented right and 70 left hemiparesis. Spatiotemporal determinants: cadence 69,26 step/min (normal range (NR) 82-137), stride length 0,65m (NR 1.04-1.82), walking speed 0,39m/s (NR 0.91-1.68). 84% of patients presented a significant reduction of walking speed ($< 0,60$ m/s). Average time to 1stpeak vGRF 26,57% of gait cycle, 1stpeak vGRF 95,10N and PF 0,54W/Kg. There was a positive strong correlation between walking speed and 1fZ (r 0,523), moderate to PF (r 0,44) and a negative strong correlation with T1fZ (r -0,640). There was a positive moderate correlation between stride length, 1fZ (r 0,523) and PF (r 0,451); and a negative strong correlation with T1fZ (r -0,616). There was a positive moderate correlation between cadence and 1fZ (r 0,424), weak to PF (r 0,196) and a negative weak correlation with T1fZ (r -0,377). When walking speed was predicted it was found that T1fZ (Beta -0,10 $p < 0,05$) and PF (Beta 0,105 $p < 0,05$) were significant predictors. The strongest predictor from GRF for self-selected walking speed was PF (R20,489), as well as for stride length (R20,490).

Conclusions: GRF patterns correlated with walking speed and stride length. The main determinants are PF given by ankle power at foot off and time to accept weight given by T1fZ. Strategies to improve this GRF patterns may have positive repercussions both in stride length and walking speed, therefore GRF analysis is paramount to understand and improve gait after stroke

YE03

Efficacy of Transcranial Direct Current Stimulation in Patients with Developmental Dyscalculia in School Going Children: Double-blinded, Randomized Controlled Trial

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Question: Developmental dyscalculia (DD) is a condition that affects the numerical skills of individuals. If not treated in childhood than it can persist in adulthood. A most common problem among learning disorders. The need was to find the beneficial effect of neuromodulatory tool transcranial direct current stimulation (tDCS) along with conventional numeracy training programmed in treating with DD. Purpose to evaluate the efficacy of tDCS in improving numeracy problem that altered after developmental DD. We hypothesized that tDCS may or may not be an effective method in improving numeracy and performance in school going children affected with DD.

Methods: The protocol was registered under the Clinical Trials Registry- India, under World Health Organization International Clinical Trials Registry Platform (CTRI/2018/07/014834). Inclusion criteria were as follows: (1) Right-handed children, (2) Age 8-17 years both gender and (3) Diagnosed with DD as per LDDI. The exclusion criteria were any history of seizures, alcohol or drug abuse, CNS infection, any metallic implant near electrode placement site and cerebrovascular malformations. From this, we are obtaining the total sample size 30. Outcome measures Learning Disability Diagnostic Inventory (LDDI) used in this study. 30 school going children participated, informed consent were taken. Baseline assessment and outcome measures were assessed. The experimental group received active tDCS and control group sham-tDCS along with conventional treatment received for 3 days in a week up to 2 consecutive weeks. Post-intervention data were analysed. An active electrode placed at P3 and reference at P4 of the parietal cortex. 2mA current intensity for 30 min. in a day for 3 days in a week to 2 consecutive weeks. Conventionally numeracy training includes specific training of numeracy teaching by using specific games and activities according to their targeted level. Training

duration was 1 session per day for 20 min 3 days week, to 2 consecutive weeks.

Results: Both groups showed significant improvement in statistical analysis. But experimental group (p-value 0.001) shows more significant compared to control group (0.001).

Conclusions: Intervention was found to be quite effective in children affected by DD. It helps in improving their numeracy skills and school performance as well as in daily life numeracy related activities. Results showed a clinically and statistically significant improvement in the experimental group.

Fig. 1



YE04

Disability in Nekemte, Ethiopia: The Challenges and Opportunities in Rehabilitation

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Introduction: Ethiopia faces unique challenges in supporting disability. The 2011 WHO World Report on Disability estimated that 17.6% of the population was disabled, with 11.3 years of health lost due to disability per 100 people (160/194 reported countries). Rehabilitation is paramount in empowering those with disability and is key to enabling them to integrate back into their previous lives and support their families. The objective of our report is to highlight current strengths and shortcomings to improve opportunities for those affected.

Objectives:

- - To highlight strengths and shortcomings of public health and rehabilitation in Nekemte, Ethiopia
- - To highlight inequalities influencing access to care
- - To attract further funding from NGOs, government departments, and public health bodies to expand and enhance services

Materials & Methods: As students at the University of Exeter Medical School, we were able to take advantage of the ongoing relationship our university shares with the University of Wollega Nekemte. We gained a grassroots perspective on healthcare and conducted qualitative interviews with surgeons, public health officials, and local patients. The Ethiopian Red Cross enabled us to visit rural health posts, remote villages, the Nekemte Referral Hospital, and the Nekemte Rehabilitation Centre. We have utilised data from 863 patients of the Nekemte Rehabilitation Centre, gathered over the three years since it's opening.

Results: Our retrospective analysis of 863 patients from the Nekemte Rehabilitation Centre, provided us with a brief insight into care inequalities in Ethiopia. Patients accessing the centre had a mean age of 34 (CI95%: 30.84, 37.16), median 29. This was significantly different ($p < 0.0001$) to the published mean age of traumatic injury in Ethiopia (95% CI $\bar{X}1 - \bar{X}2$ 30.89, 31.11). Due to government-based funding, care was politically oriented and favoured those of working or school-going age. These data additionally revealed a highly significant male:female discrepancy in accessing the rehabilitation centre of 2.541:1 ($p < 0.0001$). Although the service is government-funded, patients are now expected to cover the cost of travel to the centre from throughout Oromia.

Conclusion: Infrastructure such as this has the potential to deliver real socioeconomic benefit, however the centre is currently limited to 12 inpatients a week, with a potential catchment area of over 10million people. Further funding and service development is vital.

YE05

Interhemispheric inhibition: its interhemispheric asymmetry and trial-to-trial variability

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Question: Interhemispheric interaction plays an important role in stroke recovery, especially in the field of neuromodulation where it is becoming clear that "one-size-fits-all" inhibitory stimulation of the unaffected primary motor cortex is not always working (Harvey et al., 2018). One of the promising ways to probe how unaffected hemisphere influences the affected one is transcranial magnetic stimulation phenomenon (TMS) of interhemispheric inhibition (IHI) (Bertolucci et al., 2018). However, IHI strength between dominant and non-dominant hemispheres is not well studied even in healthy subjects. Our aim was to assess IHI hemispheric asymmetry, its variability and its link with the corpus callosum (CC) structure in healthy subjects.

Methods: 20 healthy right-handed volunteers were enrolled (9 females, 21-34 y.o.). Four TMS sessions, each included 70 stimuli, were performed (single-pulse TMS and IHI paradigm for each hemisphere). Coefficient of quartile variation (CQV) was calculated for motor evoked potentials (MEPs) amplitudes for every TMS session. All participants underwent DWI MRI, fractional anisotropy (FA) in the motor zones of CC was calculated (Domin and Lotze, 2019).

Results: Inhibitory effect during IHI paradigm from the dominant (L→R) and non-dominant (R→L) hemispheres were shown in 18/20 and in 16/20 subjects, respectively. No significant IHI difference between hemispheres was found. A strong correlation between CQV of MEPs to single-pulse TMS from both hemispheres ($r = 0.632$, $p = 0.004$), but not for responses to IHI was demonstrated. A site-specific correlation

between the variability of the responses during single-pulse TMS and IHI was found for the dominant hemisphere ($r=0,524$, $p=0,021$). IHI from the dominant but not from the non-dominant hemisphere correlated positively with FA in both hand and leg CC regions ($r=0,550$, $p=0,015$, $r=0,552$, $p=0,014$).

Conclusion: We demonstrate that IHI interhemispheric asymmetry may exist but not at the single-subject level. At the same time, a correlation with CC structure was found only for IHI from the dominant hemisphere. Our preliminary results highlight the importance of IHI interhemispheric asymmetry and its trial-to-trial variability. We believe that such side-dependence and trial-to-trial variability of IHI should be considered for the evaluation of the interhemispheric interactions after stroke where the understanding of its nature is crucial for neuromodulatory intervention planning.

YE06

Unreliability of single case patients studies

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Background and objective: Single case patient studies are essential when rare impairments are investigated. However, the reliability of the single case data are rarely examined. The present work originally investigated numerical abilities of stroke patients. The analogue magnitude representation (AMR) is an evolutionary ancient system which is supposed to underlie the number understanding. According to the classic view this system is responsible for both symbolic and non symbolic numerical processing, because in both cases the same ratio effect had been found (*Dehaene*, 1992; *Nieder*, 2005; *Piazza*, 2010). Numerical distance (quicker reaction times for long distances relative to short ones) and size effect (reaction times increase when the two comparable numbers are larger) the consequence of the activation of the AMR (*Moyer and Landauer*, 1967; *Verguts and Opstal*, 2005). Recently some studies have reported dissociation between these two notation (*Holloway és Ansari*, 2009; *Schneider*, 2017; *Damarla and Just*, 2013). For this reason two partly distinct systems may underlie the symbolic and non symbolic numerical

processing. We propose an alternative model for symbolic numerical processing, the discrete semantic system (DSS), which can be an explanation for this dissociative pattern. The aim of our study was to investigate the dissociation of distance and size effects in symbolic and non symbolic numerical processing in the case of ischemic stroke patients, while the reliability of the patient data are examined with bootstrapping confidence intervals.

Methods: Healthy participants" data support the assumption that the DSS is an appropriate explanation for symbolic number processing (*Krajcsi*, 2016; *Krajcsi and Kojouharova*, 2017; *Kojouharova and Krajcsi*, 2018; *Krajcsi, Lengyel and Kojouharova*, 2018). In the present study 14 ischemic stroke patients" symbolic and non symbolic processing mechanism were tested by using comparison tasks. Reliability of the individual data are examined with bootstrapping confidence intervals.

Results: Dissociation were found when patients" data were analyzed with classical statistical methods. However, bootstrapping confidence intervals showed extremely wide interval for the patients data, which intervals included the whole control group intervals as well. these results indicate reliability problems in the patients data. These statistical properties should be considered when working with any brain lesion patients" data.

YE07

ARCO: A promising approach for accessible and effective home-based therapy post-stroke

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Introduction: Limited access to intensive and effective training especially after hospitalization complicates optimal stroke rehabilitation. Recently, we have developed COoperative Arm Rehabilitation (ARCO) therapy as an unsupervised home-based training approach focusing on cooperative hand movements. The ARCO device allows training of such movements (e.g. opening a bottle, winding up a blind, Fig. 1) while interacting with exergames. The simple design allows for training of intensive, repetitive and functional meaningful

tasks in a domestic environment to promote upper limb recovery.

Objectives: We investigated ARCO's feasibility for the application in an unsupervised home-based setting in mildly to severely affected chronic stroke patients and its effectiveness to induce improvements in upper limb function and impairment.

Materials & Methods: Seven chronic stroke patients (9-22 years range since stroke) completed a 6-week training with ARCO, i.e. 2 weeks of supervised training at the research centre followed by 4 weeks of training at the participants' homes without supervision. Feasibility was evaluated with the Intrinsic Motivation Inventory (IMI). Training efficacy was assessed with Fugl-Meyer upper extremity score (FM-UE), Box and Block-Test (BBT) and maximal voluntary contraction (MVC) of the wrist.

Results: Significant improvements were shown for FM-UE-score ($p = 0.017$) and wrist extension MVC of the more affected limb ($p = 0.032$). BBT tended to increase ($p = 0.057$). IMI score was high (median > 5.5 , max score: 7) throughout the whole therapy period. Participant P5 (chronicity 17 years) had no voluntary wrist function prior to study onset (FM-UE wrist: 0, MVC wrist extension: 0 [Nm], BBT-score: 0) and regained some of it by the end (FM-UE wrist: 4, MVC wrist extension: 0.44Nm, BBT: 2)

Conclusions: ARCO is feasible for unsupervised home-based training and enhances upper limb function in chronic stroke patients. Notably, one participant regained some voluntary wrist movements during therapy despite being chronic for 17 years. Thus, ARCO might be a promising and easily accessible therapy approach in stroke rehabilitation for a broad range of stroke phenotypes.

Figure 1: A) ARCO device. B) The device and exergames are presented in front of the patients. C) Example of an exergame where wrist flexion and extension induces movement of a basket to catch fruits falling from a tree.

Fig. 1



P001

Training Executive Functions in a novel group approach for ADHD adolescent students

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Challenging as it might be, group interventions for ADHD adolescent students seems to multiply therapeutic effects.

Our group is a novel intervention for Cyprus: specially designed to address the specific problems of impulsivity and aggressive behaviours of adolescent students diagnosed with ADHD during childhood is the first and only group intervention for this specific population. Being in its pilot phase, has as core aim the training of Executive Functions – inhibitory control, working memory and emotional regulation. Utilizing pleasant playful activities targeted on the specific EFs, provides a safe environment for students to express their thoughts and concerns, develop social skills and work on their specific difficulties while receiving and giving peer support. Cognitive training aiming on anger management is also integrated in the intervention.

The group is currently in the middle of the first pilot phase which will be completed in 8 sessions. We will present the theory behind the intervention – how it was structured, the selected activities and how they correspond to specific aims as well as first conclusions for its effects.

P002

Sexual dysfunction assessment in persons with neurological disabilities

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Question: Has sexual dysfunction disorders have been addressed adequately in the assessment of neurological rehabilitation for persons with such disabilities?

Methods: We have done a cohort analysis of 25 patients using a telephonic interview following neurological rehabilitation

assessment. Does sexual dysfunction have been addressed in your neurological rehabilitation consultation? Is the basic question enquired? This survey was conducted by an independent Clinical Nurse Specialist (CNS) who is not part of the neurological assessment team. A further detailed questionnaire was framed depending upon the initial response. If the initial answer is no, then further exploration to find out the reasoning behind it was addressed. If the answer is yes, the exact nature of symptomatology based on gender and further strategies to their concerns questioned. Spinal cord pathologies, persons with disabilities below 18 and significant cognitive and physical impairments were excluded from the study.

Results: Out of 25 patients who had a neurological assessment, only 7 patients had sexual dysfunction addressed in their consultations. Interestingly, most of them were Multiple Sclerosis and the assessment being part of the expanded disability status scale and multiple sclerosis intimacy and sexuality questionnaires. However, the remaining 18 persons with disabilities have not been addressed with sexual dysfunction disorders as a part of their assessments. These patients also confessed that they have been disappointed with not having those discussions and hesitant to initiate this topic on their own because of the communication, religious, cultural sensitivity and time pressure barriers.

Conclusions: In spite of being a prevalent common symptom, sexual dysfunction disorders have not been adequately explored and addressed during neurological rehabilitation assessments. The significance of this should not be underestimated because of its negative impact on the quality of life to such persons. Screening questions, basic information to create awareness and counselling options should be part of comprehensive assessments in all Specialised Physical Rehabilitation Medicine Units.

P004

Quality of Life After Stroke: Development and Preliminary Psychometric Properties of the Polish Version of the Stroke Impact Scale (SIS 3.0)

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Question: Self-reported health-related quality of life (HRQoL) is increasing in importance as an outcome variable both in clinical and research applications, particularly in chronic conditions, such as stroke. To date, most data on HRQoL in Polish stroke patients is based on generic measures, since valid Polish language versions of stroke-specific tools are lacking. The Stroke Impact Scale (SIS) is one of the most widely used, self-reported tools to assess health status following stroke. Psychometric properties of the SIS were confirmed in samples from different countries, but not yet from Poland. The objective of this study was to develop the Polish language version of SIS and to evaluate selected psychometric properties of the instrument.

Methods: The procedure of developing the Polish version of SIS included: forward and backward translation, cognitive reviews and proofreading. The final Polish version was administered, along with the European Quality of Life questionnaire (EQ-5D-5L), to a sample of adult native Polish speaking, community dwelling stroke survivors. Baseline demographic and clinical data were collected. Internal consistency was assessed using Cronbach's alpha. For concurrent validity, Spearman correlation coefficients between the Polish version of SIS and EQ-5D-5L were calculated.

Results: Forty-three individuals (26 males and 17 females) aged 32-82 years (mean 58,34±12,7) participated in the study. The Polish version of SIS showed high level of internal consistency, with Cronbach's alpha ranging from 0,83 to 0,94. Moderate to strong correlations were found between SIS domains and respective EQ-5D-5L items (Spearman's correlation coefficient range from -0,67 to -0,84). All but one SIS domain score correlated positively with EQ-5D index, with correlation coefficients ranging from 0,3 for "Memory" domain to 0,9 for "ADL" domain.

Conclusion: The newly developed Polish version of SIS demonstrated an adequate internal consistency and concurrent validity. It might, therefore, be a potentially useful instrument for clinicians and researchers when measuring variables associated with HRQoL in community dwelling stroke patients in this language area. Further research is needed to support these preliminary findings and to explore other psychometric properties of the Polish version of SIS.

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P005

Experienced complaints, activity limitations, and loss of motor capacities in patients with pure Hereditary Spastic Paraplegia: a web-based survey in the Netherlands

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Introduction: Hereditary spastic paraplegia (HSP) is a group of inherited disorders, characterized by progressive lower limb spasticity (LLS). Treatment is often focused on reducing spasticity and its physical consequences. However, rehabilitation should also focus on experienced complaints, activity limitations, and loss of motor capacities to address individual patients' needs. In various patient groups with LLS, spasticity appears to be a significant contributor to experienced complaints and activity limitations, but patients with pure HSP may differ from the population with LLS at large.

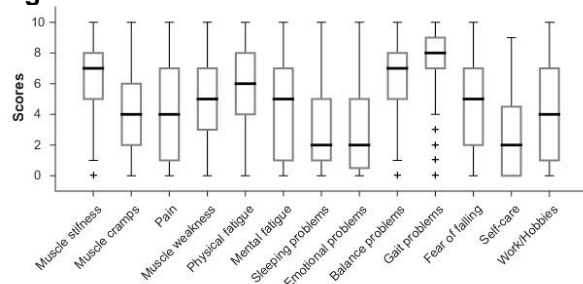
Objectives: To investigate the experienced complaints, activity limitations, and loss of motor capacities in HSP patients to better understand the functional impact of their disease. In addition, we aimed to identify demographic, clinical, and functional characteristics that are associated with increased fall risk and/or reduced walking capacity.

Patients & Methods: We developed a disease-specific online questionnaire. Questions were grouped into three response categories: "participant characteristics", "experienced complaints and activity limitations", and "loss of motor capacities". A total of 109 questionnaires met the inclusion criteria and were included for further analysis.

Results: Respondents indicated that HSP has a broad impact on their lives. Patients experienced most burden or hindrance from muscle stiffness, balance problems, and gait problems (figure 1). In addition, micturition and defecation problems were reported by 50% and 19%, respectively. Participants reported difficulties to perform certain motor capacities (figure 2): 33% reported to use walking aids indoors, whereas 46% used walking aids outdoors; 57% reported a fall incidence at least twice a year ("fallers"); in 51% a fall had led to an injury at least once; 74% reported fear of falling. Duration of spasticity, comorbidity, wheelchair use, and the capacity to rise from the floor were independent predictors of being a "faller". Age, experienced gait problems, being able to stand for 10 minutes, and difficulties with opening a heavy door had a strong association with being a "walker without aids" (>500m).

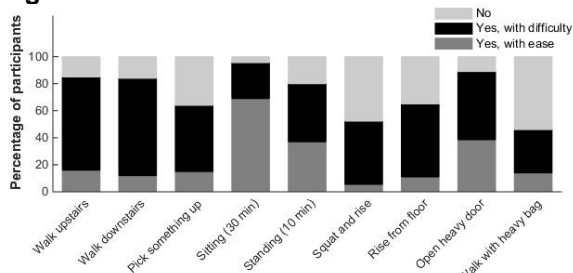
Conclusions: These results emphasize the broad impact of spasticity on the lives of HSP patients and contribute to a better understanding of the functional impact of the disease and of possible targets for rehabilitation.

Fig. 1



Median, interquartile range, and total range of the level of burden/hindrance that participants experienced in various categories (0: no burden/hindrance, 10: extreme burden/hindrance), +: outlier.

Fig. 2



Percentage of participants that responded to be able to execute specific motor capacities with ease, with difficulty or not at all.

P006

Motor-cognitive Dual-task Training for Fatigue in Multiple Sclerosis

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Aim of the study: To assess the effect of dual task training on MS-related fatigue.

Background: Fatigue is one of the most common symptoms in people with MS (PwMS) where it represents the most impairing symptom for about 40% of them.

Fatigue is now recognized as caused by a connectivity impairment in frontal and prefrontal areas, which results in increased activation.

Dual tasks exercises are the best training to stimulate at the same time different cerebral areas and some studies found a correlation between dual tasks activities and fatigue onset in PwMS.

Until now, the effect of dual task exercises on postural stability has been studied in stroke patients, Parkinson and MS patients but the effect of a dual task training on fatigue has never been explored.

Materials and Methods: We enrolled 11 patients (8F, 3M) with a mean age of 53 years in this single group open label study. Inclusion criteria were:

- Diagnosis of MS (any clinical course)
- EDSS ≤ 6.5
- Fatigue defined as cognitive and/or motor score in FSMC ≥ 22 .

All patients performed a 2 weeks training program with 10 dual task exercise sessions in addition to the usual rehabilitative treatment in an in-patient clinical setting. Each session lasted 20 minutes and included the combination of cycling and cognitive tasks focussing on working memory.

Outcome measures were:

- FSMC (total, cognitive and motor) as main outcome

- 6MWT
- 12MSWS
- TUG (single and dual task)
- HADS

Results: The positive predictive value for modifications in the final FSMC total score is the initial FSMC motor score ($p < 0.05$); the complete statistical analysis showed that after the dual task training we didn't reach a significant improvement neither for the main and secondary outcome measures.

Discussion: These preliminary data showed that motor FSMC score predicts the improvement of final global FSMC score, even if the global improvement on fatigue didn't reach the statistical significance. This may be explained by motor planning role of prefrontal region trained by cognitive training in the dual task exercise resulting in a better motor planning strategy which compensate functional disconnection due to MS probably responsible for fatigue in PwMS. Another easier explanation is that the aerobic exercise overwhelm the cognitive training of the dual task. To verify these discordant explanations, it will be necessary to investigate a larger sample population, where dual task training would be compared with simple aerobic exercise.

P007

Outcomes from the Broadgreen Phoenix Unit for Patients with Functional Neurological Disorder

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Background: A number of patients have been admitted to broadgreen rehab ward with a diagnosis of functional disorder this study was to look at the outcomes for these patients. Admission was on the agreement that it was for a 4 week assessment period and if they were not engaging then discharge would happen at this point. 3 of the 6 patients had a written contract at the start of the period stating this. All patients had to have had the formal diagnosis of a functional disorder and be accepting of this diagnosis. They also had to understand that further investigation for the symptoms/signs

would not be undertaken within the rehabilitation setting if remaining medically stable.

Methods: Review of 6 patients admitted, discharged and followed up from the unit. Looked at FIM/FAM scores both at admission and discharge, as well as looking at discharge destination and mobility. Where available the most recent clinic letter was also reviewed to monitor whether any improvements made were maintained within the community setting.

Results: Patients showed marked improvement in their FIM/FAM scores, admissions ranged in length from 4 to 11 weeks with an average of 6 weeks, all patients were discharged into their own setting, one patient with package of care of one call per day, four patients continued with follow up and remained independent following discharge.

Conclusions: These patients benefited from the relatively short admission for inpatient rehab. At present for the majority of the patients that benefit is ongoing, although two of the six patients were lost to follow up.

P008

Patients with functional gait disorder in four-week inpatient rehabilitation program

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Functional movement disorders (FMDs) are among the most common reasons to seek neurological advice and at the same time FMDs are one of the most difficult conditions to treat. Only approximately 20% of patients gain complete disease remission and left untreated suffer from long lasting dysfunction. In early rehabilitation department we decided to start new inpatient treatment for those patients.

Methods: The effect of 4-week inpatient program for patients with functional gait disorder ($n=12$) based on multimodal and multidisciplinary approach, was examined. Mean age of patients was 51,8 years (37-80), duration of gait disorder from 16 days to 11 years. Consistent and well-informed approach from all the professionals of the team is crucial. In all therapies is stressed positive

reinforcement of normal function, no-reinforcement of dysfunction. Patients are taught self-management strategies and self-distraction techniques. The demandingness of activities is increased gradually. Program includes also adapted sport activities, use of robotic devices with visual biofeedback, training outside in normal environment. Functional tests for mobility, functional independence and cognitive functions were administrated by admission and by discharge.

Results: Patients significantly improved their ability to walk and they diminished their level of dependence in daily activities. Results shows, that the biggest mean improvement in score for beginning of the treatment versus end of the treatment was in BBS (Berg Balance Scale), FIM motor score (Functional Independence Measure) and m-RIM (Modified Rivermead mobility test). In admittance there were 5 patients no able to walk at all even with a compensatory aid. 9 patients needed help of other person in mobility. There was 1 patient still bound to wheelchair by discharge, but improved in balance (BBS), which allowed him to accomplish easier transfers. Other 11 patients could walk (with or without walking aid) independently.

Conclusion: In our follow-up of the small group of patients with functional gait disorder we proved significant improvement in mobility during 4-week inpatient rehabilitation program leading to better functional independence. Bigger group of patients must be investigated in the future, but those preliminary results shows, that our program for focusing on the healthy part of the patients and not on the disability itself can have satisfactory results in mobility and functional independence.

Fig. 1

Table I. Analysis of included measurements

	T0	T1
MoCA (score range 0-30)	24,25 (8-30)	26,33 (8-30)
BDI II (score range 0-63)	11,3 (0-27)	7,8 (0-15)
FIM motor (score r.13-91)	67,91 (28-87)	78,2 (52-89)
FIM cognitive (score r. 5-35)	31,9 (27-35)	32,5 (29-35)
m-RIM (score range 0-12)	8 (3-13)	10 (5-14)
BBS (score range 0-56)	27 (5-51)	35 (11-54)

MoCA: Montreal Cognitive Assessment, BDI II: Beck's Depression Inventory – II, FIM: Functional independence Measure, m-RIM: Modified Rivermead mobility test, BBS: Berg Balance Scale, T0: baseline, T1: end of treatment intervention

P009

Congenital insensitivity to pain – learning to live in a different reality

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Introduction: Learning, experiencing and adapting to the surrounding environment are fundamental for survival, in addition to the autoprotective mechanisms provided by evolution. Altered perception of reality is associated with psychological and sensorium dysfunction. We describe the clinical case of a patient with no exteroceptive/ proprioceptive inputs, its implications and strategies to overcome it.

Clinical case: A 31-year-old woman presented at our neurorehab center in Sweden, with complaints of gait instability, joint hypermobility and abdominal pain. Trauma insensitivity and intolerance to cold was described during early childhood, associated with hypermobile joints and frequent painful luxations, including shoulders and hips. Easy bruising, echimosis and frequent scars occurred. Severe painful abdominal cramps and obstipation present since late childhood, worsening thereafter despite diets and aggravated by opioid-intake. No urinary or anal plenitude sensation. Defecation by manual stimulation every 15-21 days. Tactil and termo-algic anesthesia since the age of 15, beginning in the lower limbs and progressing upwards, including upper limbs. No ptosis, xerophthalmia, anhidrosis. Autonomic dysreflexia in late years.

At evaluation, blood pressure laying, sitting and standing were within lower limits of normal. No response to light touch, pinprick, thermal, postural and vibration from C4 downwards. Pinprick, thermal and vibration felt in V1, diminished in V2. Light touch diminished but felt until C3. Body positioning in space unknown, even with open eyes. Normal tone, strength and osteotendinous reflexes. Absent cutaneous reflexes. Dysmetria, including with open eyes. Romberg positive. Instable and fearful gait, with wide base. Hypermobility scale (Beighton scale) 9/9; VAS pain 6-9; EQ-5D 50%; normal EMG and blink reflex; Normal brain/ cervical CT; genetic studies negative for Ehlers-Danlos, on going for congenital insensitivity to pain.

Hydrotherapy ameliorated abdominal pain, relaxed the muscles and improved psychological well-being. Water temperature testing done with the face/ thermometers. Visual and hearing training to control body positioning and injury prevention. Bilateral knee and wrist orthosis prevented luxations. Balance and gait training for falling prevention strategies.

Discussion: This case outlines difficulties in diagnosis and in coping with sensorium deficiencies. Augmentative or virtual reality can have a positive input.

P010

Laser-Ankle Bracelet: A new mobile visual cue to improve walking performance in Parkinson disease

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Background: Freezing of Gait is a disabled symptom in Parkinson. Visual cue has been proved to alleviate FOG (1). However, the results in gait parameter of visual cue devices were controversy.(2-4).Our study create the ankle bracelet laser to be more practical use in daily life.

Objective: Cross-sectional study to evaluate the immediate effect of Laser-Ankle Bracelet to improve gait performance in FOG.

Method: We tested 4 patients in two situations. The first one is 10-meter walk with rapid turn and the second task is walking in figure of eight across 3 chairs for 5 meters. Gait speed and the duration of freezing were recorded.

Results: Walking with ankle-bracelet device showed significantly improve in gait speed at mean difference 0.85 m/s (95% CI 1.29-4.00; $p < 0.05$). Duration of freezing was reduced significantly at mean difference 4 s (95% CI 1.09- 6.90; $P < 0.05$)

The second task could not be accomplished in Parkinson people without the device. They got stuck during turn towards the second chair. All subjects could complete the walking with the devices without freezing episodes.

Discussion: Improve walking speed also showed large effect in clinically significant(5)(>0.22 m/s).

Conclusion: Laser Ankle-bracelet can significantly improve walking speed and reduce freezing duration in Parkinson people. The improvement was obviously found in walking in difficult direction.

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Fig. 1



P011

Theory of Mind Task Battery (TOM) for Post-Stroke Patients: Intra and Inter-Observer Concordance Study

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Question: Physical and cognitive consequences caused by stroke are important for comprehension of the rehabilitation process. The theory of mind refers to the ability of social communication and executive functioning. Once prejudiced, they can lead to difficulties in the rehabilitation programs. The objective of the present study was to analyze the intra and inter-observer concordance of the Theory of Mind Task Battery (ToM) for stroke patients.

Methods: Observational and cross-sectional study, developed with 38 post-stroke patients, with a minimum lesion time of 1 month, both sexes, who had no cognitive impairment measured by the Mini-Mental State Examination (MMSE). Three evaluators were trained to apply the ToM scale. The participants were evaluated in a quiet room, with noise control and without external interference. Only one observer (O1) performed the video capture from the time of the application of ToM and later, the other observers (O2 and O3) had access to the video and independently performed the score according to the scale application manual. The normality of the data was analyzed by the Shapiro-Wilk test, and the Kappa test was used for intra-observer concordance. The inter-observer concordance was verified by means of the Intraclass Correlation Coefficient (ICC).

Results: Patients had a mean age of 62.68 years-old (sd 13.53), with a predominance of males (52.63%; n = 20) and left hemibody affected in 68.42% (n = 26). The mean score in the Rankin Scale was 2.31 ± 0.96 and in the ToM was 4.65 ± 2.60 . The intra-observer concordance was made only with the test-retest results of the observer O1 and showed good replicability of the scale (Kappa = 0.84), with p-value <0.0001. For the inter-observer analyses, a high concordance was found among the 3 evaluators, with p-value <0.01 (Figure 1).

Conclusion: The Theory of Mind Task Battery (ToM) presented satisfactory reliability coefficient and high concordance when applied in post-stroke patients. It is a battery of tasks, whose applicability requires a faithful approach

to the standards established by the application manual. Future studies should be done to continue the process of scale validity for this population.

Fig. 1

Figure 1. Inter-observer concordance through the intraclass correlation coefficient (ICC)

Observer	ICC	CI 95%	p-value
O1-O2	0.971	0.945/0.985	<0.01
O1-O3	0.902	0.818/0.9484	<0.01
O2-O3	0.918	0.847/0.957	<0.01

[†]O1, observer 1; O2, observer 2; O3, observer 3; ICC, intraclass correlation coefficient; CI, confidence interval.

P012

Preliminary results from a holistic neurorehabilitation program on ABI patients: Can the rehabilitation outcomes be predicted by demographic characteristics?

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Introduction: Acquired brain injury (ABI) is a clinical condition often characterized by deficits on cognitive, affective, and daily functioning. Neurocognitive rehabilitation is being reported as a useful method to diminish the negative consequences of ABI.

Objectives: This study intended to present preliminary results of a holistic neurorehabilitation program (NRP) applied to ABI patients on the overall cognitive functioning, memory, anxiety and depression, and perceived quality of life (QoL). Additionally, it was explored the predictive power of age at the time of the lesion, years since onset, and educational level on the rehabilitation outcomes.

Methods: Twenty-eight ABI patients (15 female), aged between 23 and 59 years old ($M=40.9$; $SD=10.6$), participated in this study. All participants completed, at least, 4 years of formal education ($M=9.97$; $SD=3.30$; $Min=5$; $Max=17$). Participants signed an informed consent and were assessed by a trained neuropsychologist before and after the NRP,

with the following instruments: *Montreal Cognitive Assessment* (overall cognitive functioning); *Faces and Paired Associates* from Wechsler Memory Scale-III (immediate and delayed visual and verbal memory); *Hospital Anxiety and Depression Scale* (anxiety and depression); and *Quality of Life after Brain Injury* (QOLIBRI).

Results: One-way RM ANOVAs were performed to assess the effect of the NRP on the dependent variables (see above). The NRP had a significant positive effect on the overall cognitive functioning, immediate, and delayed verbal memory. No other significant effects were found. A variable was computed to represent the rehabilitation outcome on each one of the dependent variables ($DV = post - pre$ intervention). Regression analyses were performed to assess the predictive power of age at the time of the lesion, years since onset, and educational level on the rehabilitation outcomes. The model was significant for immediate visual memory, $Adj. R^2 = .343$, $F(3, 27) = 4.17$, $p = .016$, with the age at the time of the lesion being the only significant predictor ($r = -.540$, $p = .001$). None of the other outcomes were significantly predicted by the model.

Conclusion: Despite preliminary, these results highlight the positive effect of NRP on ABI patients and the influence of the age at the time of the lesion on the rehabilitation outcomes, pointing out the role of this variable on the neural plasticity and subsequent cognitive recovery.

P013

Late effects of the cerebellar tumor for oculomotor and visual mental abilities

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Introduction: Saccades are rapid eye movements which allow us to acquire visual information about the world around us. Development of the saccadic system and its functioning in children is a great interest especially for the investigation of visual perception, attention and memory. It is known that cerebellum plays an important role in saccadic performance and cognitive functions. Cerebellar lesions such as tumors lead to

considerable imminence of oculomotor and cognitive disturbances.

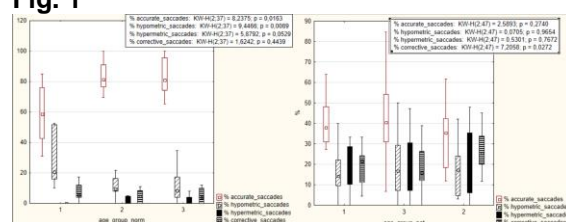
Objectives: The aim of the study was to investigate saccadic performance in children survived after cerebellar tumors depending on age. Furthermore, we research the relationship between saccadic parameters and visual mental abilities.

Patients & methods: 40 patients survived after cerebellar tumors (27 medulloblastomas, 13 – astrocytomas, remission from 2 to 5 years) and 37 healthy control children aged 9-17. We examined an execution of timed visually-guided saccades both in horizontal and vertical direction in square sequence. Eye movements were reordered by eye tracker Arrington 60 Hz. Dysmetric saccades more than 15% of adjusted amplitude were considered hypo- (if amplitude was less) or hypermetric, respectively. Also, we used the Cambridge Neuropsychological Test Automated Battery (CANTAB) to assess the visuospatial working memory capacity we used SSP (Spatial Span) test and Beery VMI to assess visual perception.

Results: Patients had a smaller number of accurate saccades (38.75 vs 79.94%, $H = 41.16$, $p < 0.00001$), more hypermetric (19.39 vs 1.74%, $p < 0.00001$) and corrective saccades (22.12 vs 5.85%, $p < 0.00001$). The number of hypometric saccades didn't differ (17.79 vs 15.09%, $p = 0.188$). After dividing patients and controls for 3 age groups (9-11, 12-14, 15-17) significant changes in saccadic parameters were observed in controls but not in patients (fig. 1). Moreover, we found the relationship between saccadic performance and value of visual working memory in SSP CANTAB Test ($r = 0.384$, $p = 0.014$); and between saccadic performance and visual perception in Beery VMI Test ($r = 0.335$, $p = 0.017$).

Conclusion: Our results demonstrate great saccadic disturbances in children survived after cerebellar tumor which continue through adolescence. Importantly, we show these oculomotor impairments are connected with weak visual perception and working memory. The results can be used in the creation of rehabilitation protocols.

Fig. 1



P014

Prophylaxis and -Therapy of Pes Equinus in Immobile Patients in the Intensive Care Unit - What is State of the Art?

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Background: With immobile patients, who are dependent on medical, nursing and physiotherapeutic assistance, uncertainties in the various occupational groups are repeatedly noted, as well as the handling of the risk of drop-foot malposition or pes equinus (PE) malposition in this patient clientele correctly counteracted can be. In acute care hospitals and intensive care units (ICU) there is also a disagreement among the interdisciplinary team about the beginning of physiotherapeutic interventions and the monitoring of prophylactic measures in order to avoid secondary complications and to improve rehabilitation.

Methods: In a systematic literature analysis, the currently available study situation was analyzed and summarized. In addition, the currently most valid and evidence-based therapeutic interventions based on physiotherapeutic benefits have been identified and published in this work.

Results: The non-traumatically acquired PE occurs with a prevalence of 15% - 70% in patients in German hospitals. At present, the incidence cannot be proven because a general definition is not available and the diagnosis is not yet standardized. The majority of patients with incipient to manifested drop-foot in the form of slight restriction of movement to pronounced myogenic contracture, already have pre-existing diseases from a neurological and / or geriatric point of view. In the acute phase on ICU, immobility through bed rest poses the main risk. Other risk factors include painful posture, prolonged sedation, perioperative storage damage, prolonged immobilization by gypsum fixation, scar tissue, neurological and / or geriatric differential diagnoses.

Conclusion: The prophylaxis and the treatment of the drop-foot is an important component with regard to the subsequent mobility of the patient. An early involvement of physiotherapy is crucial for a good outcome in terms of patient mobility.

P015

The role of REM sleep behavior disorder (RBD) and insomnia in Parkinson's disease population: correlation with motor and non-motor symptoms

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Rapid eye movement sleep behavior disorder (RBD) is a parasomnia that may occur during sleep and is characterised by transient loss of muscle atonia specific of REM phase, desynchronization of the electroencephalogram, dream enactment leading to patient complex behaviors sometimes resulting in injuries to the patient himself or to partner.

The disorder is actually rare, but there is a higher prevalence in neurodegenerative diseases patients, in particular diseases with α -synucleinopathy pathology such as Parkinson's disease (PD). However, data available on features of RBD and PD are mixed and in some occasions controversial.

Insomnia, on the other side, is frequent and may affect the evolution of PD natural history.

We are conducting a systematic review with the specific aims to study the correlation between PD and sleep disorders and the impact of RBD and insomnia on motor and non-motor symptoms, when compared with patients with no sleep disorders.

We, in June 2019, searched for articles published from 1990 to 1st of June 2019 in the PubMed, MEDLINE, EMBASE, The Cochrane Library, and CINHAIL, using medical subject heading (MeSH) keywords and the search algorithm "(Parkinson OR Parkinson disease) AND (insomnia OR RBD OR Rapid eye movement sleep behavior disorder OR sleep disorders), and in the EMBASE via the Emtree with following keywords and algorithm "(Parkinson disease) AND (insomnia OR RBD OR sleep disorders)".

Inclusion criteria are: Patients with PD, >18 years old (as diagnosed using any recognised diagnostic criteria); sleep assessment.

Exclusion Criteria: Adolescents (under 18 years of age) and elderly people (over 80).

We included randomised trials with supplement of observational studies (including cohort and case-control studies).

We found a total of 978 articles: two independent raters screened them and only 76 were selected (duplicates were excluded). Now we are evaluating the 76 selected articles: two different researchers are independently scanning full-text copies of articles selected to identify relevant papers. Customized data extraction forms will be developed specifically for this systematic literature review and will contain key elements, which are pertinent to address the objectives and questions of this review.

We will provide features on correlation between PD and sleep disorders and we will focus on the impact of sleep disorders on motor and non-motor symptoms in PD's patients. Main diagnostic features for PD (Hoehn & Yahr - MDS-UPDRS and other scores) and for RBD / insomnia will be considered, together with gender, age, drug treatment, cognitive and motor symptoms.

P016

Ambulation after stroke in senegalese patients

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Introduction: Stroke accounts for 1/3 of hospitalizations at the only neurology department in Senegal. Post-stroke disability remains generally minimal [1], but the qualitative and quantitative aspects of walking remain unknown in Senegal.

Objectives: The objective of this study was to determine aspects of walking in a hemiplegic vascular population.

Methodology: stroke confirmed with brain imaging, evolving at least 6 months, and possible ambulation were inclusion criteria. Disabling intercurrent illness (neurological or not) was the main exclusion criteria. Sociodemographic characteristics and stroke data were collected. Walking was assessed by the Functional Ambulation Classification, Get up and Go test, 10 meter test.

Results: One hundred (100) patients were included, mean age 57.5 years, sex-ratio 0.75.

The main risk factors were high blood pressure (88%) diabetes (11%), dyslipidemia (30%). Ischemic stroke was largely predominant (80%). In addition to the management of risk factors, 87% of patients were rehabilitated. Walking with aids noted in 91% of the cases. Observational analysis found mowing (59%), knee recurvatum (12%), slow walking (5%). walking speed was less than 0.5m / s in 67% of case. The mean score for the Get-up and Go test was 3.96 and average duration was 40.15 seconds (standard deviation 36.30). 26% of patients had a Get-up and Go test less than 20 seconds. According to the modified FAC, the most prevalent classes were IV, V, VI. Factors influencing walking speed were observational anomalies ($p = 0.011$).

Discussion and Conclusion: the quality of walking in our patients, according to the FAC is similar to that found by Mathias et al. However, the risk of falling concerns nearly 3/4 of patients. This means, a need to improve our equilibrium rehabilitation techniques.

P017

Sequential and propaedeutic aquatic training approach in patients with stroke: a randomized controlled trial

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Question: After a stroke, many people experience motor impairments that disrupt the motor performance of balance and gait. Aquatic therapy is a common treatment modality used to address the complexity of patients with neurological disorders with the goal to achieve a motor functional improvement. The interventions were not always matched to a land-based intervention and it was difficult to determine if the land-based represented best practice or standard care. The aim of this study is to investigate the efficacy of specific aquatic training, compared with standard aquatic training, on balance, gait and activities of daily living.

Methods: Nineteen patients (12 male mean age 70 ± 10 , 7 female mean age 65 ± 7) with diagnosis of stroke in chronic phase (six months after the event) were enrolled in the study and randomized in two groups: a control group (CG) who performed a standard aquatic rehabilitation and a sequential propaedeutic approach group

(SPA) which consisted in postural stability and gait training.

Both groups performed the training twice a week for 4 weeks in addition to standard land-based neurorehabilitation.

All patients were evaluated before and after 4 weeks of training sessions with Berg Balance Scale (BBS), Tinetti Gait Balance scale (TS), Barthel Index Modified (BIM), Stroke Specific Quality of Life Scale (SS-QOL).

Results: As the Repeated Measures ANOVA showed significant improvement was found in the SPA group with respect to the control group in the scores of BIM ($p = 0.026$), BBS ($p = 0.011$) and TS ($p = 0.013$). A positive impact was also reported on the perceived quality of life measured with SS-QOL.

Conclusion: A combination of land and aquatic sequential and propaedeutic therapy is more effective than standard aquatic training for improving gait and dynamic balance in patients with stroke.

The results could help to find new therapeutic strategies comparing more similar water and land-based therapies.

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Fig. 1



Fig. 2



P018

Combination of Intrathecal Autologous Bone Marrow Concentrate, Robotic Movement Therapy, Neuromodulation and Electric Muscle Stimulations Causes Partial Motor Recovery and Complete Sensible Recovery in Patient with Chronic Spinal Cord Injury

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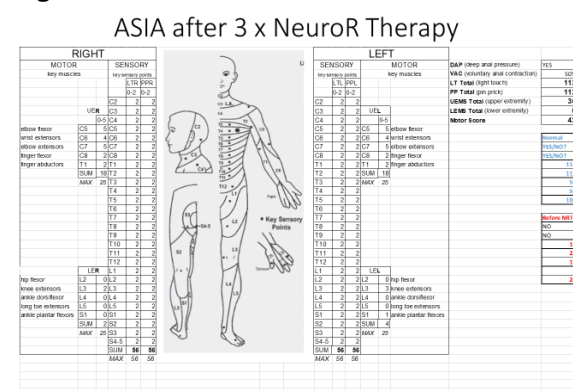
Patient's injury happened Dec. 2013, in a wrestler tournament, an awkward landing while grappling with an opponent and a dislocation of the C-6 vertebra at the base of the neck. Paralysis from the neck down.

He received one year intensive rehabilitation therapy in the best US-Centers, without leg function improvement. It was no brain controlled leg muscle activity and it was no sensitivity below C-6.

After one year he received in our NeuroRehab Clinic 3 times combination of intrathecal autologous BMC (bone marrow concentrate) + robotic movement therapy + neuromodulation + electric muscle stimulation (EMS), first 14 months after injury, second 19 months and third 30 months after injury. It was evaluated before and after therapy through our NeuroRehab and Shepherd Center in Atlanta which provides the largest and most comprehensive rehabilitation program in the United States for people with spinal cord injury. The results show complete

recovery of sensibility. The blood pressure was 80/60 before therapy and 120 /80 after therapy. Before therapy his hand scale grip was not hard enough to register 0,5 kg. After therapy his hand scale grip registered at 6 kg for the left hand and 4 kg for the right. Lower extremity specific manual muscle testing (MMT) show before therapy only 1 for three muscles right (adductor hip, internal hamstring and quadriceps) and 6 muscles left (gluteus maximus, quadriceps, adductor hip, gastrocnemius, soleus and posterior tibialis). The rest was 0 (zero). After therapy he has most major muscle groups in his legs and core registering some kind of signal from the brain. He still has a couple at zero but not many. Ten of his zeros before are now replaced by 1, 2 or 3 (on a scale of 1-5 with 5 being full function). The ASIA results on Sensibility and Motorik after therapy as compared to before therapy see on Fig. 1. The patient is strong enough to walk with leg braces and movable walker.

Fig. 1



P019

"BREMBO" the Brembana Valley Horse way to manage trunk rehabilitation in neurological disease

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Question: The aim of our study is finding a new, easy and repeatable technology to improve trunk control in post stroke patients.

Methods: "BREMBO" (fig.2) is a mechanical horse based on springs and levers moved by the patients without any electronic system and the patients' movements are more flowing. This mechanical horse is also useful to prepare

patients to hippotherapy and to rehabilitate the trunk control. We tested 12 patients affected Stroke haemorrhagic (4 patients) and ischemic (8 patients) with cardiovascular and respiratory stability, without cognitive impairment and Trunk Control Test Score (TCT) from 36 to 61. Each patient was evaluated by physician and then tested with Hunova System™ (fig.1) before riding and after the treatment with our Brembo Horse. The treatment with our mechanical horse is always under clinical control.

Results: We collected 5 women and 7 men and we got an improvement both of Trunk Control Test (TCT) score and Hunova System™. Patients find benefit in improving trunk control, balance and joint rehabilitation, they like the new exercises always trained in safety and under physiotherapist control.

Conclusions: The new technology is cheap because it doesn't need robot (Trunk Control Test can easily replace Hunova System™) and the maintenance of BREMBO HORSE is very simple. It is an opportunity for patients with these diseases. It is also useful in adults and children as a propedeutic to hippotherapy.

Fig. 1



Fig. 2



P020

Correlation of Motor Function Level and Social Participation with Chronic Stroke

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The aim of this study was conducted to investigate a correlation between motor function level and social participation with chronic stroke. In this study, Korean version of the Fugl-Meyer Assessment (K-FMA) and Korean version of the Reintegration to Normal Living Index (K-RNLI) were administered to 74 chronic stroke patients who were diagnosed with stroke and were living in a community for more than 12 months. The SPSS 21.0 was used for the analysis, and the correlation coefficient between the motor function level and the social participation was used. According to the patients' general characteristics, motor function was related to affected side, and social participation showed a significant difference with respect to the type of lesion ($p < .05$) (table 1). The results of the analysis of the motor function level and the social participation correlations showed that motor function level moderate and marked were a significant correlation with the social participation ($p < .05$) (table 2). Based on the results of this study, it is possible to consider the intervention direction according to the level of motor function of the chronic stroke patients, to promote their social participation and to carry out their role with a sense of existence as a member of the community. It should be possible to maintain a balanced life.

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Fig. 1

Variables		K-FMA			K-RNLI		
		M±SD	t/F	p	M±SD	t/F	p
Age (years)	~50	80.6±31.3	2.442	.138	66.4±31.9	.059	.811
	50~59	58.0±41.0			33.0±32.0		
	60~69	72.0±33.7			45.8±38.3		
	70~79	75.4±33.7			41.3±40.3		
	80~	65.0±45.3			42.5±36.4		
Gender	Male	70.0±39.0	3.678	.059	46.8±37.4	.002	.966
	Female	72.1±33.6			41.7±37.6		
Education	No formal education	67.9±37.6	1.380	.244	43.8±36.6	.714	.401
	Elementary school	-			-		
	Middle school	75.6±34.5			44.2±40.9		
	High school	90.5±4.9			44.5±62.9		
	College	79.7±37.1			50.0±34.6		
Type of lesion	Infarction	76.8±34.4	.148	.701	49.8±37.7	5.590	0.21*
	Hemorrhagic	50.3±35.7			24.1±28.8		
Affected side	Right	84.5±27.9	15.866	.000*	56.6±33.7	1.980	.164
	Left	61.3±37.6			35.3±37.6		
Onset (month)	12~18	73.3±35.7	.001	.978	45.2±36.4	1.101	.298
	19~24	62.7±36.3			45.4±45.1		
	24~	50.2±46.4			30.3±41.8		

K-FMA: Korean version of the Fugl-Meyer Assessment, K-RNLI: Korean version of the Reintegration to Normal Living Index, * $p < .05$, ** $p < .01$

Fig. 2

K-FMA Level	Frequency (N)	Percentage (%)	K-FMA	K-RNLI	r
Normal	28	37.8	100.0	69.4±26.8	-.210
Slight	6	8.1	98.0±8	67.5±39.5	-.442
Moderate	9	12.2	90.5±3.0	57.1±36.7	.667*
Marked	10	13.5	68.0±11.1	22.1±24.7	.643*
Severe	21	28.4	17.9±14.2	9.1±16.0	.293

K-FMA: Korean version of the Fugl-Meyer Assessment, K-RNLI: Korean version of the Reintegration to Normal Living Index, * $p < .05$

P021

The effectiveness of reaching exercise to nonparetic side using lateral wedge for standing balance in acute stroke: a randomized controlled trial

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Introduction: Lateral weight shifting is an important factor related to walking ability and risk of falling in patients with stroke. Patients with acute stroke demonstrate a deficiency in shifting their weight to the nonparetic side. It was reported that the center of foot pressure is displaced forward after a standing exercise on an upward slope. However, the effects of standing weight-shifting exercise to the nonparetic side in acute stroke are unclear.

Objectives: The purpose of this study was to clarify whether standing reaching exercise to the nonparetic side on a lateral wedge affects the standing balance and gait ability of patients with acute stroke.

Patients & Methods: This study was an assessor-blinded, randomized controlled trial. Participants were 20 stroke patients (mean age of 66.9 years old, mean days from onset of 12.4 days) and gave their written informed consent. Participants were randomly assigned to the experimental group (n=10) or the control group (n=10). The intervention was lateral reaching exercise to the nonparetic side in a standing position, with the nonparetic side on a lateral wedge that is 5° elevated from the flat plane. Reaching exercise was conducted 30 times per day, 5 days per week. The main outcome was the Berg Balance Scale (BBS) score. The secondary outcomes were force-platform data, Trunk Impairment Scale, Functional Ambulation Category (FAC).

Results: Both groups showed significant improvement after the intervention in the BBS score; however, there were no significant differences between groups. The lateral weight-shifting capacity to the nonparetic side and the

FAC changes were significantly higher in the experimental group than in controls ($p < 0.05$).

Conclusion: Our results suggest that standing reaching exercise to the nonparetic side on a lateral wedge may improve the lateral weight-shifting capacity and gait ability of patients with acute stroke.

P022

Impaired hand proprioception in Carpal Tunnel Syndrome

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Question: Hand proprioception, the ability to sense hand posture, is important for dexterous hand control. Chronic compression of the median nerve (Carpal Tunnel Syndrome; CTS) impairs touch sensitivity and fine motor skills. Yet whether CTS also impairs hand proprioception is unknown. The purpose of this study was to investigate whether hand proprioception is impaired in patients with CTS. If proprioception is impaired this may contribute significantly to the challenges CTS patients experience when handling objects in everyday life.

Methods: Hand proprioception was measured using a two-interval, forced-choice size-discrimination task. Participants used the index finger and thumb (both of which are affected in CTS) to feel two objects sequentially, and report which one was larger. Vision of the hand was prevented so that size discrimination depended solely on knowledge of the posture of the digits from proprioception. Size differences were varied to generate just-noticeable differences (JNDs), which reflect sensitivity to hand opening. We hypothesized that CTS patients will have significantly higher JNDs relative to healthy controls, due to impaired hand proprioception.

Results: CTS patients had higher size-discrimination JNDs compared to controls, indicating that CTS causes reduced sensitivity to the perceived opening of the thumb and index finger. These data suggest that CTS impairs hand proprioception.

Conclusion: Our findings indicate that hand proprioception is impaired as a consequence of

CTS. To better understand the implications of this for CTS patients in everyday life, we go on to examine how this impairment relates to the control of anticipatory features of grasping movements. As well as providing basic sensory findings about nerve compression injuries, we hope that our findings will also improve the assessment and rehabilitation of peripheral nerve injuries and neurological disorders, in which hand proprioception may be impaired.

P023

Characteristics of Gait in Stroke Subjects Compared to Healthy Subjects - Systematic Review

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Introduction: Stroke is a neurologic deficit that results from an acute local lesion in the Central Nervous System, which happens because of a vascular cause, being one of the major causes of mortality and disability worldwide. This is an injury that can lead to permanent dysfunction at different levels in survivors. Most of the stroke patients have hemiparesis, which significantly limits the gait and reduces its functional independence and quality of life. Hence, the autonomous gait is one of the main goals of Neurorehabilitation programs in stroke survivors, since the gait pattern experiences some changes, especially in the balance and its quality.

Objective: To review the studies that analyze and compare the changes in gait in post-stroke subjects with the gait of healthy subjects, in order to characterize the various deviations of normal gait and consequently objectify and enhance the assessment and rehabilitation process in stroke.

Design: We have included all the cross-sectional studies we found that discussed the gait in humans with a clinical diagnosis of stroke at any stage of evolution, and from which resulted in hemiparesis/hemiplegia and functional alterations in gait compared to the patterns of healthy, age-matched subjects. The databases used were: Pubmed, PEDro (and CENTRAL).

Results: After applying the inclusion criteria, there were 24 final studies that were included in the systematic reviews.

Discussion: There are characteristic changes in the spatiotemporal, kinematic and kinetic parameters, and dynamic electromyography patterns in hemiparesis, which may be assessed most accurately in a motion studies laboratory. Through the analysis of the results obtained in the different studies, it was verified that there was consensus in the asymmetry of the gait, in the temporal parameters (speed and cadence) and in the spatial parameters (step length and stride length). Regarding kinematics, kinetics and muscular activation there were some discrepancies in the different authors.

Conclusions: The resultant hemiparetic gait pattern after stroke is a mixture of deviations and the compensatory motion dictated by residual function; as such, each patient must be examined and his/her unique spatiotemporal gait pattern must be identified and documented.

P024

Effectiveness of Intensive Physiotherapy for Gait Improvement in Stroke - Systematic Review

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Introduction: Stroke is one of the leading causes of functional disability worldwide. Approximately 80% of post-stroke subjects have motor changes. Improvement of gait pattern is one of the main objectives of physiotherapists intervention in these cases. The real challenge in the recovery of gait after stroke is to understand how the remaining neural networks can be modified, to be able to provide response strategies that compensate for the function of the affected structures. There is evidence that intensive training, including physiotherapy, positively influences neuroplasticity, improving mobility, pattern and gait velocity in post-stroke recovery.

Objectives: Review and analyze in a systematic way the experimental studies (RCT) that evaluate the effects of Intensive Physiotherapy on gait improvement in post-stroke subjects.

Methodology: Were only included all RCT performed in humans, without any specific age, that had a clinical diagnosis of stroke at any stage of evolution, with sensorimotor deficits and functional gait changes. The databases used were: Pubmed, PEDro (Physiotherapy

Evidence Database) and CENTRAL (Cochrane Center Register of Controlled Trials).

Results: After the application of the criteria, there were 4 final studies that were included in the systematic review. 3 of the studies obtained a score of 8 on the PEDro scale and 1 obtained a score of 4. The fact that there is clinical and methodological heterogeneity in the studies evaluated, supports the realization of the current systematic narrative review, without meta-analysis.

Discussion: Although the results obtained in the 4 studies are promising, it is important to note that the significant improvements that have been found, should be carefully considered since pilot studies with small samples, such as these, are not designed to test differences between groups, in terms of the effectiveness of the intervention applied.

Conclusion: Intensive Physiotherapy seems to be safe and applicable in post-stroke subjects and there are indications that it is effective in improving gait, namely speed, travelled distance and spatiotemporal parameters. However, there is a need to develop more RCTs with larger samples and that evaluate the long-term results.

P025

Balance Effects of Robot-assisted Arm Training In The Elderly Patients with Subacute Stroke

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Objective: To investigate the effects of robot-assisted arm training on balance and functional recovery in both elderly and younger patients with stroke.

Method: Of the hemiplegic stroke patients who received robot-assisted arm training between February 2018 and February 2019, we retrospectively reviewed the medical records of patients who continued a follow-up through the outpatient clinic. A total of 31 patients (17 elderly patients ≥ 65 years and 14 younger patient < 65) were included in this study. And patients with high fall risk (initial Berg Balance Score score < 21) and lower cognition ((MMSE < 20) and were excluded. Robot-assisted arm training group received robot-assisted therapy using Armeo ® Spring

(Hocoma Inc., Zurich, Switzerland) for thirty minutes per day and five times every week during three weeks. Outcome measures were used Berg Balance Scale scores(BBS), Functional Ambulation Category scale(FAC), Modified Barthel index (MBI) for activities of daily living, Modified Rankin Scale(mRS), lower limb function assessed using the Motricity Index-Lower(MI lower), Korean-mini mental status exam (K-MMSE). All recruited patients underwent these evaluations before and after three weeks robot-assisted arm training.

Results: Before Robot-assisted arm training, both group was no significant difference BBS, FAC, MBI, mRS, MI lower, K-MMSE. After Robot-assisted arm training, both groups showed a significantly improved balance and motor function. But After Robot-assisted arm training, in the elderly group had a significantly lower balance and motor function in Berg Balance Scale scores. And In comparison of the percent changes in the BBS, MBI, MI lower, K-MMSE before and after Robot-assisted arm training, there was no significant difference between the two groups.

Conclusions: In both elderly and younger groups patients with upper limb deficits after subacute stroke, Robot-assisted arm training was considered to facilitate balance and functional recovery. The degree of improvement in balance and functional recovery after robot-assisted arm training between elderly group and younger group was similar. It is considered necessary to further expand the participation of Robot-assisted arm training in elderly stroke patients.

Fig. 1

	YOUNGER		ELDERLY	
Gender				
Male(%)	13	(76.5)	9	(64.3)
Female(%)	4	(23.5)	5	(35.7)
Total	17	(100.0)	14	(100.0)
Age				
Age, mean(years)†	53.65±7.96		74.50±5.09	
Affected side				
	LI hemi=7	RI hemi=10	LI hemi=4	RI hemi=10
Diagnosis		Infact=15		Infact=14
		Hemorrhage=2		Hemorrhage=0
Duration(days)†		17.64±28.87		14.64±15.23

†Mean±SD for continuous variables

	YOUNG				ELDERLY			
	Pre	Post	Mean Difference	P Value	Pre	Post	Mean Difference	P Value
BBS	33.76 ±8.28	46.82±5.83	13.17±6.53	<0.0001	32.57±6.96	41.9±3±7.66	9.35±7.05	<0.0001
FAC	1.82±0.95	3.17±0.63	1.35±0.70	<0.0001	1.92±0.91	3.07±0.61	1.14±0.66	<0.0001
K-MBI	48.70±15.41	66.47±9.08	17.76±10.83	<0.0001	49.28±11.49	64.35±10.27	15.07±7.91	<0.0001
mRS	3.76±0.43	2.76±0.43	-1.00±0.35	<0.0001	3.64±0.49	2.78±0.69	-0.78±0.69	<0.0001
MI lower	65.47±10.17	75.65±1.45	10.17±10.07	<0.0001	69.21±6.81	74.71±2.55	5.50±5.98	<0.0001
K-MMSE	26.47±3.33	27.58±2.31	1.11±1.93	0.030	24.50±3.77	25.71±3.14	1.21±1.67	0.018

BBS: Berg balance test, FAC: Functional ambulation Category, K-MBI (K-Modified Barthel Index), K-MMSE (K-mini mental status exam), mRS: Modified Rankin Scale, MI lower: Motrichy Index strength assessments for lower extremity
*p<0.05

Fig. 2

	YOUNG	OLD	P Value
Pre BBS	33.76 ±8.28	32.57 ±6.96	0.67
Post BBS	46.82 ±5.83	41.9 ±3±7.66	0.05*
Pre K-MBI	48.70 ±15.41	49.28 ±11.49	0.90
Post K-MBI	66.47 ±9.08	64.35 ±10.27	0.54
Pre MI lower	65.47 ±10.17	69.21 ±6.81	0.23
Post MI lower	75.65 ±1.45	74.71 ±2.55	0.23

BBS: Berg balance test, FAC: Functional ambulation Category, K-MBI (K-Modified Barthel Index), K-MMSE (K-mini mental status exam), mRS: Modified Rankin Scale, MI lower: Motrichy Index strength assessments for lower extremity
*p<0.05

	YOUNG	OLD	P Value
BBS	44.77±31.47	31.46±27.07	0.22
MI lower	18.41±20.02	8.78±9.86	0.09
K-MBI	48.84±49.24	34.82±23.90	0.33
K-MMSE	5.02±8.75	5.67±8.00	0.83

BBS: Berg balance test, K-MBI (K-Modified Barthel Index), K-MMSE (K-mini mental status exam), mRS: Modified Rankin Scale, MI lower: Motrichy Index strength assessments for lower extremity

P026

From research to clinical practice. Applying an algorithm for prognosis of upper limb function in patients with subacute stroke

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Background: Accurate prediction of recovery of upper limb (UL) function can lead to targeted rehabilitation after stroke. The PREP2 algorithm predicts UL function based on clinical assessment of UL function. Depending on their initial UL function either information on age, information on initial severity of stroke and assessment of corticospinal tract integrity using transcranial magnetic stimulation are used to make the prediction.

Despite the potential benefit, prediction algorithms are generally not used in clinical settings. A main obstacle for using the PREP2 is that it must be applied within the first 72 hours after stroke.

This Phd study has three aims: To investigate the accuracy of PREP2 when applied app. day 14 after stroke. In addition it is assessed to what extend PREP2 can predict real life UL use. The clinicians' attitudes towards prediction models is explored.

Study 1. Prediction of UL function

Aim: Assess the accuracy of PREP2 when applied 14 days post stroke.

Method: A prospective cohort study. Ninety stroke patients are included consecutively at Hammel Neurorehabilitation Center. At baseline patients are assessed according to PREP2 and UL function at three months post stroke is predicted in four categories. Expected patient inclusion is June 2018- Sep 2019.

Main outcome measure: Action Research Arm Test to assess UL function at 3 months.

Statistics: Correct Classification Rate

Study 2. Prediction of real life UL use

Aim: Examine to what extent predicted PREP2 categories are associated with actual, real life UL use.

Method: Patients included in study 1 wear triaxial accelerometers on both wrists at follow up.

Primary outcome: Use ratio between affected and unaffected UL and magnitude ratio.

Statistics: Multiple linear regression.

Study 3 Future implementation

Aim: Preparation of future implementation of PREP2

Methods: Semi-structured focus group interviews with key staff in neurorehabilitation will be conducted to explore feasibility, acceptability and perceived usefulness of prediction models for UL function.

Results: This is an ongoing study.

By the time of the congress patient inclusion will have ended.

Three focus groups are performed.

P027

Non-invasive treatment of spasticity in patients with chronic stroke using a novel device pairing trans-spinal direct current stimulation with peripheral nerve stimulation

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Spasticity is characterized by velocity-dependent increase in muscle tone, and is often found in patients following stroke, spinal cord injury, multiple sclerosis and brain injury, resulting in significantly impaired functional movement. Treatment options are limited and there are currently no non-pharmacological or non-invasive treatment options. Repeated botulinum neurotoxin injections, the most common way to treat spasticity, are associated with significant adverse effects and diminishing efficacy over time. Recent research has established important links between emergence of spasticity and motor neuron hyperexcitability. We have recently shown the first direct link between the emergence of spasticity and overexpression of NKCC1, a neuronal Na-K-Cl

co-transporter responsible for maintaining chloride gradient across cell membranes (Mekhael et al. 2019). Furthermore, we have also reported that trans-spinal direct current stimulation (tsDCS) paired with peripheral stimulation suppresses hyperexcitable spinal motor neurons causing excessive muscle contraction in mice, and lowers NKCC1 levels and spasticity levels for up to 4 weeks post-treatment. We have combined anodal tsDCS with peripheral stimulation in a non-invasive, multi-site neuromodulation device called MyoRegulator. In this crossover human pilot study, we evaluated the safety and efficacy of MyoRegulator in upper-limb spasticity in 14 post-stroke patients. Subjects received 5 consecutive days of sham MyoRegulator treatment followed by 1-week wash-out period, then 5 consecutive days of 20 minutes of active MyoRegulator treatment. Subjects came back at the end of the wash-out period for follow-up, then for 5 weekly follow-up visits after the end of active treatment. At each visit, Modified Tardieu Scale (MTS) scores, objective measures of muscle resistance, Upper Extremity Fugl-Meyer scores (UE-FM) and Wolf Motor Function Test (WMFT) scores were recorded to measure spasticity at the upper-limb joints and assess motor function. We demonstrated that 5 consecutive 20-minute sessions using MyoRegulator significantly reduced objectively measured muscle resistance and clinically measured spasticity, and significantly improved motor performance. These changes appeared immediately after treatment and persisted over 5 weeks after end of treatment, with no adverse side effects. These findings suggest that MyoRegulator treatment lowers spasticity in post-stroke patients and helps restore motor function.

P028

The role of sensory systems in maintaining balance in patients with multiple sclerosis in the period of clinical compensation

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Question: One of the most common syndromes in multiple sclerosis (MS) are vestibular disorders, accompanied by disorders

of the balance function. The balance is maintained by the interaction of the vestibular, proprioceptive and visual systems and avoids instability and falls. There are a lot of researching about balance function (BF). However, the single view on mechanisms of functioning of the system of maintaining a vertical posture and the role of its individual components no has been adopted. The aim is to evaluate the role of visual and proprioceptive systems in maintaining BF in patients with MS at the stage of clinical compensation.

Methods: Materials and methods: 20 patients with coordination disorders in multiple sclerosis were examined. The mean age of the group was 39.8 ± 2.2 years. There were used the computer stabilogram "Stabilan-01-2" with biofeedback (production of OS" RITM", Russia). The research technique included the using of the "Romberg test" (simple and modified proprioceptive afferentation), which consisted of two tests – with open eyes (OE) and closed eyes (CE). There were estimated next parameters of the statokinesigram: the average speed of the pressure center (ASPC), the area of the ellipse (EA), the quality of the balance function (QBF).

Results: In analysing the results, all parameters of the statokinesigram had significant differences: ASPC in OE 11,4(9,34;14,09) compared to the CO of 24.04 (19,86;56,49), ($p < 0.05$); EA OE 249,8 (176,7;304,5) when EA CE 696,6 (362,3;1829), ($p < 0.05$). Also in the the Romberg Test with the modified PA, the most significant: EA in OE 249,8(176,7;304,5) compared to the OE with diff. PA 475,8 (262,7; 644,3), ($p < 0.05$); QBF in OE 74.5(63,2;81,16) compared to the OE with diff. PA 62,4 (47,91;71,12), ($p < 0,05$).

Conclusion: The deterioration of all parameters of statokinesigram in condition of view deprivation, shows the significant role of visual stimuli to maintain BF and postural correction. In case of variation of the proprioceptive information, the compensation is due to the increased importance of information coming from the vestibular and visual systems. Maintaining the BF will be due to the influence of the vestibulospinal reflex on the activity of antigravity muscles. The researching of the interaction of proprioceptive, visual, vestibular, musculoskeletal systems to assess the impact on the BF, will contribute to the development of new approaches to treatment and rehabilitation.

P029

Improvement in 10 Meter Walk Test after Botulinum Taxin Type a Treatment in Chronic Stroke Survivors: A Retrospective Descriptive study

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Question: Does gait speed improve in chronic stroke survivors after treatment with botulinum toxin?

Background: Spasticity is a common complication in chronic stroke survivors, which impairs gait by decreasing walking speed and stride distance, therefore affecting the ability to perform daily life activities and reducing overall quality of life. Botulinum toxin type A (BoNT-A) injections are part of the standard of care in this patients, having a positive effect on muscle tone, nevertheless, its effect on functional gait still remains pending.

Objective: To determine the effect of BoNT-A injections on gait speed in patients with chronic hemiparesis following stroke.

Methods: We included 18 chronic stroke patients (8 females, 10 males), their mean age was $64,3 \pm 12,76$ years old and the mean age of stroke event was $52,1 \pm 11,6$ years old. 10 patients had ischemic stroke while 8 had hemorrhagic. 10 patients presented with right hemiparesis and 8 with left hemiparesis. Patients received ultrasound guided injections of BoNT-A on spastic muscles including: Gastrocnemius, Tibialis Posterior, Soleus and Adductors. Frequency of injections varied from 3 to 6 months. All patients completed initial evaluation, and 6, 12 and 24 months follow up, including clinical examination and 10 meter timed walk test where time (T), Speed (Sp), number of steps (St) and stride distance (Sd) where recorded. No adverse events were reported.

Results: Patient's characteristics were summarized in mean and standard deviation (Table 1), while measured data was analyzed using Wilcoxon matched pairs signed rank test (Table 2). There were significant improvements at 24 months follow up in: Time decreasing basal median of 18,99 seconds to a median of

15,14 seconds (p:0,14); Speed increased from basal median of 0,52 m/s to a median of 0,66 m/s (p:0,003); Number of steps decreased from a basal mean of 13 steps to median of 11,25 steps (p:0,026) and stride distance improved from basal 76 cm to 87 cm (p:0,024).

Conclusion: Decrease in walking speed is a common consequence after the advent of spasticity secondary to stroke. Our results suggest that BoNT-A injections not only target muscle tone, but also improve walking speed in these patients, with effects being perceived in up to 24 months follow up. Therefore, BoNT-A are a reasonable option to improve gait speed when gait is functionally impaired.

Fig. 1

Sex	8 women / 10 men
Age of Stroke onset	Mean: 64,3 years SD (12,76)
Age at beginning of BotA treatment	Mean: 56,7 years SD (12,14)
Type of Stroke	10: Ischemic / 8: Hemorrhagic
Cause of Stroke	8: Hypertension 3: Carotid atherosclerosis 2: Atrial fibrillation 2: Cerebral vascular malformation 3: Undetermined cause
Type of clinical deficit	10: Right Hemiparesis / 8: Left Hemiparesis
n	18 patients

Fig. 2

	T0	T6	T12	T24	Sp0	Sp6	Sp12	Sp24
Median	18,99	18,58	15,82	15,14	0,53	0,59	0,60	0,65
Percentiles								
25	13,48	11,91	11,63	11,43	0,39	0,36	0,41	0,41
75	25,39	27,63	24,07	24,16	0,74	0,84	0,85	0,87

	St0	St6	St12	St24	Sd0	Sd6	Sd12	Sd24
Median	13	12	11,5	11,25	76	83	87	87
Percentiles								
25	11	10,38	10,88	10	54	58	62	58
75	18,5	17,5	16,25	17	90	92	92	100

P030

The Brain Lesion related with Long-term Outcome of Aphasia, focused on Sub-quotients

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Question: The post-stroke aphasia is associated with activity of daily living, returning to occupation, and quality of life in patients with stroke. The present study investigated the specific brain lesions on recovery of aphasia in stroke patients, up to 12 months after onset, for

four sub-quotients; fluency, comprehension, naming, and repetition.

Methods: The present retrospective cross-sectional observational study assessed 31 stroke patients with the Korean version of the Western Aphasia Battery, at 1 year after the onset of stroke. Brain lesions were analyzed using voxel-based lesion symptom mapping (VLSM) with magnetic resonance imaging images.

Results: The damage of Rolandic cortex, Heschl's gyrus, posterior corona radiata, supramarginal cortex, superior longitudinal fasciculus, superior temporal gyrus, and insula were associated with low score of total AQ. The damage of inferior triangularis and inferior operculum of frontal cortex, supramarginal cortex, and insula were associated with poor outcome of fluency. The damage of parietal cortex, angular cortex, temporal middle cortex, sagittal stratum, and temporal superior cortex were associated with poor recovery of comprehension. The damage of angular cortex, supramarginal cortex, posterior corona radiata, superior longitudinal fasciculus, internal capsule, temporal superior cortex, and temporal middle cortex were associated with poor recovery of naming in patients with stroke. The damage of superior temporal cortex, posterior corona radiata, and superior longitudinal fasciculus were related with poor recovery of repetition component of post-stroke aphasia.

Conclusions: The present study identified several brain lesions that contributed to long-term outcome of post-stroke aphasia. These results may be useful for treatment strategies and for understanding the pathophysiology of aphasia in stroke patients.

P031

Facial involuntary movements : How much do you know about them- Seeing is believing

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Method: Electrophysiological blink-facial reflex, direct response and Surface EMG were performed. Facial dyskinesia was recorded on video in 8 patients.

Results: Blepharospasm, primary and secondary hemifacial spasm, Meige syndrome, facial myokymia and Facial chorea were made diagnoses in combination of electrophysiological examination and clinical findings on video.

Facial involuntary movements include blepharospasm, primary and secondary facial spasm (HFS), Meige syndrome, facial myokymia and facial chorea. Three electrophysiological tests are at least required to make differential diagnosis among them: direct reaction, blink reflex, and surface EMG. From the viewpoint of "Seeing is believing", we at first show blepharospasm and primary HFS on video, these are in descending order of frequency. Then, we introduce three variations of Meige syndrome. Like the other focal dystonias, they show characteristic Whack-a-mole and sensory trick phenomena. We show a special type of primary HFS in which facial spasm is induced with swallowing. A case of facial myokymia is also well known in a patient with multiple sclerosis over the pons. The facial chorea is rather difficult to make a diagnosis especially of unknown origin. The SPECT of this case involving in cingulate motor areas gives suggestions there is dichotomy of central facial palsy; voluntary and involuntary.

Conclusions: It is indispensable to differentiate a variety of facial dyskinesia by Surface EMG, blink-facial reflex and direct response.

P032

Behavioural deficits in stroke rehabilitation

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Question: How many patients after stroke show behavioural deficits, are there any differences between patients with or without limitations in activities of daily living?

Methods: 61 patients 0-6 months after stroke. Examination of behavioral deficits (Neurobehavioral-Rating-Scale), ADL-examination (Marburger-Kompetenz-Skala). Dividing up the patients in two groups: group 1 (Barthel-index 85-100 points) vs. group 2 (Barthel-index 80 points or less). These two distributions were analyzed on significant differences with the non-parametrical U-test.

Results: In postacute phase after stroke, a huge spectrum of behavioral deficits can be recognized, next to well known symptoms of depression and fear - limitations in fatigability and attention. Results of ADL showed most of all limits in recreational activities, physical work and mobility – this as well in self-assessment as well in foreign assessment. The hypothesis of a difference in NBRs, made by examination in the groups of patients with or without limitations in activities of daily living with the non-parametrical U-test, was affirmed by a score of $p < 0.001$.

Conclusions: Behavioral deficits earn during the early rehabilitation phase, especially in severely affected patients after stroke, special consideration. Individual customized neurobehavioral therapy, accompanied by therapeutic care of social and familiar environment, could be expected as an important factor for improvement of reintegration of these patients.

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P033

Hierarchical Attention Training (HAT): Computerized Cognitive Training Program for Frontal Lobe Cerebral Vascular Accident (CVA)

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Question: The prefrontal cortex (PFC) orchestrates a wide range of cognitive and affective neural functions, such as: memory, executive function, and behavior. In recent years, the development of new technologies in the field of cognitive rehabilitation has led to a greater use of computer-based cognitive tools in patients with acquired brain injury including Attention Process Training (APT) and the Paced Auditory Serial Addition Test (PASAT). In this study a computerized cognitive training program called Hierarchical Attention Training (HAT) was developed, which resulted from a fusion of APT and PASAT-like tasks.

Methods: Patients affected by frontal lobe cerebral vascular accidents (CVA) admitted to the Neurorehabilitation unit have been studied. All patients underwent HAT training, composed of tasks hierarchically organized regarding three domains of cognitive function: attention, executive functions and working memory. Training lasted 40 days, 5 times/day. Neuropsychological screening was conducted by neuropsychologist staff prior to and following the HAT training.

Results: 12 patients who sustained a frontal lobe CVA were enrolled (M 62.4±4.6; 5M/7F) including 9 who sustained a hemorrhagic CVA, 3 ischemic CVA; 6 patients sustained a left hemisphere CVA, while 6 had a right CVA. The patients were tested with neuropsychological screening before and after HAT training. All patients had been diagnosed with selective memory deficits after neuropsychological screening; long term and working memory deficits were most prominent, while impairments of executive function were also involved.

After the training all patients showed a great improvement in cognitive function. HAT training had a great efficacy in improvement of memory and executive functioning in patients with

etiologies of both hemorrhagic and ischemic CVA.

Conclusions: We conclude that computerized cognitive rehabilitation can produce satisfying results in patients with acquired brain injury. The HAT training has shown to be effective in treating impairments of memory and executive function resulting from frontal lobe lesions.

P034

The relationship between saccade and gait performance in children survived after cerebellar tumor

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Introduction: Two subdivisions of human motor system - gross (gait) and fine (eye movements) - are closely connected. Cerebellum plays a crucial role in functioning of both systems (vermis and fastigial nuclei). Its lesions lead to impaired motor control and atactic syndrome.

Objectives: Aim of present study was to compare parameters of saccadic eye movements and kinematics characteristics of tandem gait in children survived after cerebellum tumors.

Patients & methods: Research was conducted on 15 patients (8 males, 7 females, 9-17 years old, M=13.4±2.5) who survived cerebellar tumor. Eye movements were estimating in visually-guided saccades test and recorded by eyetracker Arrington 60 Hz. Patients were asked to perform 24 visually guided saccades to the tops of the square demonstrated on the monitor. Saccade amplitudes were registered. Also, we used optical system Optitrack Motion Capture (12 cameras Flex 13, 120 Hz) for estimating kinematics of tandem gait. A set of 26 reflective markers were placed on anatomical landmarks of subject body. Subjects were asked to walk 4.5 meters with eyes open, heel-to-toe, without spaces between feet along the straight line marked on the floor. We used data from one marker on heel and virtual marker represented center mass position. Also, we used two standardized tests for estimation of postural balance (Romberg Pose with open

eyes by using stabilometry) and motor proficiency (Bruininks-Oseretsky Test).

Results: Correlation analysis between motor and ocular systems showed significant relationships between measures of gait variability and saccade performance in patients. Thus, high percent of hypermetric saccades (saccades which overshoot the target and are inaccurate) was strongly associated with high tandem gait variability ($r=0.551$) and the length of the trajectory of the center of mass ($r=0.693$). Moreover, elongate scanpath (sum of the all saccades amplitudes during visually-guided saccades test) was related to elongate length of the trajectory of the center of mass ($r=0.532$). Tests for grade of motor skills and postural balance also showed significant reliability with saccadic and gait parameters.

Conclusion: So, after comparing saccade and tandem gait parameters it was discovered strong regularity that cerebellum lesions (as tumors) impair both systems: high variability of tandem gait linked to big amount of inaccurate hypermetric saccades. These results could provide new approach for the diagnosis of CNS lesions.

P035

The prevalence of pusher syndrome after a hemisphere stroke: a systematical review and meta-analysis

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Background: There is an increasing interest about the "Pusher syndrome" (PS), since its first description by Davies (1985). Here we present the results of a systematic review and meta-analysis regarding its prevalence.

Methods: We searched in Pubmed from 1985 to 2018, all the papers referred to PS or contralesional lateropulsion. Only data of unselected cohorts of hemisphere stroke were extracted. A systematic review regarding both PS and contralesional lateropulsion was conducted. Meta-analysis was performed using random effects model and the pooled prevalence estimate (95% confidence interval [CI]), the heterogeneity in this meta-analysis was assessed by I^2 statistic.

Results: Seven cohorts including 2555 individuals, were analyzed. The estimated prevalence was 12.5% (95% CI 11.2-13.9%) that was almost the same to the real prevalence 12.5% (95% CI 11.3-13.9%). Interestingly, prevalence reported for the pusher syndrome was not influenced by the use of a scale, neither by various cut-off values proposed for the Scale for Contraversive Pushing (SCP), considered as the gold standard. Beside most severe forms, many persons showed less severe forms without pushing or resistance. This lateropulsion with or without PS was analyzed by 4 studies, gathering 433 individuals. Regardless the existence of PS, its estimated prevalence was 43.5% (95% CI 29.9-58.2%) with a high heterogeneity ($I^2=87\%$), more frequent than that of PS. After a right hemisphere stroke, the frequency of lateropulsion was considerable, 57% (95% CI 44.2-69%) from 204 individuals.

Conclusion: This strong homogeneity of the PS prevalence (12.5%) between studies is due to an easy diagnosis according to Davies criteria: lateropulsion, active pushing, and resistance. Isolated or associated to PS, contralesional lateropulsion is more frequent, especially half after right hemisphere stroke. One should pay more attention to evaluate all forms of lateropulsion, regardless PS. The heterogeneity of the lateropulsion prevalence is accounted for the assessment, therefore designing a novel scale of lateropulsion should bridge this gap.

P036

Effects of visual motor illusion on resting-state functional connectivity: a preliminary study

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Introduction: In visual motor illusion (VMI), kinesthetic perception is produced through the observation of a person's physical exercise on a screen. The VMI enhances upper-limb corticomotor excitability in healthy subjects. Using functional magnetic resonance imaging during the illusion of a wrist movement, activity has also been detected in other brain regions such as the premotor cortex area (PMC) and the parietal lobe. We hypothesized the VMI might also alter the resting-state functional connectivity (RSFC).

Objectives: The purpose of this study was to investigate the effect of VMI on RSFC in healthy subjects.

Materials & Methods: We examined the right upper limbs of nine healthy subjects (mean age of 24.0 ± 4.9 years) and applied the illusion condition to the right upper limb. This study was conducted with approval by the institutional ethics committee of Tokyo metropolitan university. VMI was induced by subjects observing finger movements made by themselves in a video. We then measured and compared the resting brain activity before and after inducing the condition. Resting brain activity was measured via oxygenated hemoglobin (oxy-Hb) using functional near-infrared spectroscopy (fNIRS). We measured 40 channels in total. The regions of interest (ROIs) for fNIRS measurement were the left and right PMC, the primary motor area (M1), the primary sensory area (S1), and the parietal area (PC). Band-pass filters were applied to the oxy-Hb measurements and the correlation coefficient was calculated between each ROI. Fisher's z-transform was then performed. Bonferroni-adjusted paired t-tests were performed to identify changes in z-transformed connectivity in each pair of ROIs in the before and after condition. The degree of illusion and the degree of body ownership were measured using the 7 Likert scale (-3, strongly disagree; -2, disagree; -1, somewhat disagree; 0, neither agree nor disagree; 1, somewhat agree; 2, agree; 3, strongly agree). If subjects agree, subjects have a strong feel illusion and body ownership.

Results: After the illusion, significantly higher connectivity was seen between the left and right PMC, the left PMC and right PC, the left S1 and right PC, the left S1 and the right PC, the right S1 and the right PC. The degree of illusion and the degree of body ownership were 1 (1-1) in 7 likert scale.

Conclusion: These results suggest that several networks that are involved in the creation of an illusion are inter-connected.

P037

OnabotulinumtoxinA Reduces Temporal Pain Processing at Spinal Level in Patients With Lower Limb Spasticity

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Question: Spasticity is a muscle tone disorder associated with different neurological conditions. Spasticity could be associated with pain, high disability, poor functional recovery, and reduced quality of life. Botulinum Neurotoxin type A (BoNT-A) is considered a first-line treatment for spasticity and, more recently, it also represents a therapeutic option for various chronic pain conditions. In this open label study, we aim to evaluate the effect of the BoNT-A on the spinal nociception in patients affected by spasticity of the lower limbs with associated pain with predominantly neuropathic features.

Methods: Ten patients with Stroke, 10 with Multiple Sclerosis and 5 with Spinal Cord Injury were enrolled in the study. They were tested with clinical scales (MAS, NRS, NPSI) and with the nociceptive withdrawal reflex at lower limb to explore the spinal temporal summation threshold at baseline and 30 day after BoNT-A injection. OnabotulinumtoxinA (50 to 200 units per site) was injected in the lower limb muscles according to the distribution of spasticity. No significant differences were found at baseline for neurophysiological features across groups.

Results: Ten patients with Stroke (6 males, age 66.5 ± 8.1 , NIHSS 8.6 ± 4.0), 10 with MS (6 males, age 49.9 ± 8.8 , EDSS 7.3 ± 2.1) and 5 with SCI (5 males, 39.5 ± 9.2 , ASIA D) were studied.

A significant reduction in MAS (knee $p=0.008$, ankle $p=0.006$, and overall $p=0.003$) and NRS (referred to the overall pain sensation $p=0.024$) mean values was found in the patients overall considered for T1 vs T0 comparison. We also observed a close-to-significant reduction in NPSI score at T1 compared to T0.

For neurophysiological outcomes, no significant differences were found at T0 between patient groups except for Are. A significant increase in NWR TST ($p=0.019$) was found in the overall population when comparing T1 to T0. No significant differences in neurophysiological outcomes were found comparing T1 and T0 in single patient groups.

Conclusions: OnabotulinumtoxinA injection: 1) significantly increased the NWR TST in patients

with spasticity and pain with predominantly neuropathic characteristics; 2) significantly reduced the overall pain perception and 3) significantly improved the MAS scores in the lower limb at T1. Our data support the hypothesis that peripherally injected OnabotulinumtoxinA modulates the excitability of spinal cord nociceptive pathways, probably irrespective of the effect of the drug on spasticity.

P039

AVANT-Program: A Method for Evaluating the Implementation, Effectiveness and Patient/Trainer Related Outcomes of a Structured Basic Stroke-Rehabilitation Program in Vietnam after 3 Years

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Question: Stroke is one of the most prevalent fatalities or causes of disability in Vietnam, a low- and middle-income country. Given the structural conditions in the country, access to medical facilities and specialist acute care is difficult. The rehabilitative facilities and thus the medical-therapeutic care after a stroke are given only to a small extent and do not correspond to the standard in Austria as well as the "High Income Countries".

Method: The 'Austrian Vietnamese Advancement Neurorehabilitation Treatment', (AVANT-project), is a program for the systematization and structuring of neurological rehabilitation after a stroke in Vietnam. As part of the project, Vietnamese doctors and therapists are trained in basic therapeutic measures for neurological rehabilitation after a stroke. This is done through trainings and workshops in Vietnam and Austria. In the multiplier model, the knowledge gained by already trained therapists is further disseminated ('train the trainer' concept), thus establishing and improving long-term neurological rehabilitation throughout Vietnam. The family caregivers will be increasingly included in the care of the patients and thus reducing the burden of formal caregivers. The evaluation concept developed in the context of this work forms the basis for collecting data regarding the implementation, the effectiveness and the effectiveness of the training provided within the framework of the AVANT-project. It provides a basis for fundamental decisions

regarding the further development and continuation of the program with the aim of fully implementing the content in the neurological institutions in Vietnam.

Results: On the basis of a literature review as well as comparable projects that have already taken place, a retrospective, internet based evaluation concept for the AVANT-project has been developed and will be presented.

Conclusion: The evaluation of the AVANT-Program will start in 2020 and will provide first results on the changes in the management of stroke patients by the means of implementing a structured basic motor-rehabilitation-program in a low and middle income country.

P040

Rehabilitation outcome and multi-drug resistant organisms in severe acquired brain injured patients: a retrospective analysis

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Question: How is the impact of hospital acquired infections (HAI) on the rehabilitation outcome of severe acquired brain injured (SABI) patients? The multi-drug resistant organisms (MDROs), mainly the carbapenemase-producing Enterobacteriaceae (CPE), represent a serious threat to public health and patient safety in European hospitals. Patients with traumatic brain injury can be considered at higher risk for nosocomial infections and the infection-related mortality rates may be as high as 28%.

Methods: The purpose of this study was to understand if and how the presence of MDROs colonization or infection in SABI inpatients increases the length of stay (LOS) and reduces improvements and outcomes. 50 SABI patients admitted during 2018 in a rehabilitation institute with ICU and an early rehabilitation unit. Data were collected on colonization/infection with MDROs, LOS, outcome scores, clinical worsening.

Results: 50 consecutive patients were included, 31 were males, median age was 54 years (IQR 31-67). Aetiology of SABI were stroke, trauma, anoxia and other causes in 36%, 40%, 16% and 8% of cases, respectively. During hospitalisation, 111 HAI were identified

in 36 patients, with an overall incidence of 10.8/1000 patient-days. Patients who developed HAI were older than the others [median age, IQR: 56, 38-69 versus 43, 31-55 years; $p=0.24$; $OR=2.10$] and had a more severe disability, with a significantly higher Disability Rating Scale [median, IQR: 21, 18-24 vs 13, 8-18; $p=0.05$] and a lower Levels of Cognitive Functioning [median, IQR: 3, 2-5 vs 5, 4-6; $p=0.05$] on admission. Patients with HAI had a worse outcome ($\Delta DRS < 1$) [$p=0.05$] with a longer LOS [median, IQR: 231, 165.25-283.25 vs 105.5, IQR 80-199.5 days; $p=0.05$] and there was a significant association between $LOS > 100$ days and HAI [$OR=6.20$]. Colonized patients were at risk of infection 15 times more than non-colonized patients [$OR=15.19$; $p=0.05$], they were at risk of increasing LOS ($OR=2.17$), had a worse DRS score on admission ($OR=3.89$) and a worse outcome ($p=0.05$).

Conclusions: In SABI patients, HAI and MDROs colonization are frequent and negatively influence the outcome, also after discharge from ICU, in a rehabilitation setting. The risk of HAI is higher in older subjects and in those with a more severe disability and with little or no recovery. Further investigations are needed to identify specific risk factors and to implement antimicrobial stewardship to prevent HAI and MDROs colonization.

P041

Usage of assessment tools in neuro-rehabilitation by Austrian occupational therapists

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Question: Neuro-rehabilitation is a process that involves handicapped persons in making plans and setting goals. As a basis, assessment tools are utilised to identify impairment and disability, not only with regards to physical, but also psychological and social aspects. Various assessments help to evaluate health status or understand client's context. However, which assessments are used in occupational therapy and what is the rationale for or against using them?

Methods: The online survey questionnaire asked for demographic data, utilization of 87 assessments in neuro-rehabilitation and reasons for or against use. The authors conducted a pre-test with six individuals, revised the questionnaire, and then sent it to the

members of the Austrian occupational therapists' association. Feedbacks were analysed with the LimeSurvey statistics tool.

Results: In total 78 therapists working in neuro-rehabilitation returned the survey. 94.87% of participants were female, 5.13% were male. Participants worked in different settings, e.g. 44.87% in rehabilitation centres and 41.03% in hospitals. They all used assessments, but frequency and usage varied widely. Most of them were used infrequently only. There was a preference to use certain assessments measuring impairment of body functions such as the Nine-Hole-Peg Test, the Box and Block Test, and the Jamar Dynamometer. These can be carried out quickly and simply; they comply with quality criteria and are well established in many institutions. The Canadian Occupational Performance Measure is an occupation-based tool to detect handicaps and was popular because it helps to set client-centred goals. The Assessment of Motor and Process Skills was not applied frequently because therapists need special training. Some other assessments were not used because therapists perceived that they gave no relevant information.

Conclusions: In practice assessments are preferred that can be conducted quickly and easily. Many of them just measure physical functions, but not their impact on participation, thus do not help to understand clients' needs. The results show that assessments are not used as frequently as expected. They are the basis for evidence-based approaches to reduce disability, acquire new skills, or alter the environment. Using assessments helps to optimise the therapeutic process.

P042

Trunk training after stroke to improve abilities needed for daily life

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Introduction: Due to the rising life expectancy of humans, the number of strokes is also increasing. Therefore, the importance of physical therapy after a stroke has become more and more important. In Austria, the number of strokes amounts to approximately 20.000 a year. The condition of patients' trunks has a great impact on the prognosis of their ability to cope with everyday life situations. There are various methods for gaining trunk activity, which all have the aim to recover as

much function, activity and participation as possible. The aim of this thesis is to illustrate the effectiveness of trunk training after strokes. The research question "Is trunk training an effective way to improve abilities needed for daily life? " is answered in this thesis.

Methods: A systematic literature research in the medical databases PubMed via MEDLINE, PEDro, Cochrane Library and CINAHL has been conducted.

Results: In order to answer the research question, six studies have been analysed and discussed. All of them showed a positive effect of trunk training on abilities needed for everyday life situations. The effectiveness of trunk training is shown by an improvement of control over the trunk, which then leads to an improvement of daily life skills. This can also be illustrated through an increase of the Barthel Index. Furthermore, daily life tasks are facilitated through more control over gait, as well as better sitting balance, which can be measured via the "Trunk Control Test". The ADLs are in close relationship with balance. If balance can be improved through more control over the trunk, ADLs can be carried out with more security and accuracy. The methods of trunk trainings in the selected studies are different, but their aims are the same.

Discussion and conclusions: Hemiparesis presents itself in various ways, depending on the patient. Furthermore, the time passed since the stroke as well as the age of the participants of the study vary. Therefore, it is difficult to compare several hemiplegics with one another. There is also a difference between the various kinds of interventions as well as their duration. The authors conclude that trunk training is an important intervention after strokes, as it is an effective way to improve abilities necessary to cope with everyday life activities. The method chosen depends on the compliance and the cognitive abilities of the patient.

Key words: stroke, hemiplegia, trunk, core stability

P043

A Protocol for Randomized Controlled Trial: Combined Dual Task Intervention And Virtual Reality Training To Improve Balance And Gait In Population Of Parkinson's Disease

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Question: It is certain that patients of Parkinson Disease need a different environment to motivate themselves and need to be improved in their daily life activities. This requirement demands that the Virtual reality Intervention (VRI) and Dual Task Intervention (DTI) approach should be flexible. Hence, to establish the protocol these instruments require through simulation. It needs to be verified by using on the patients with PD. If the intervention performs better, then it could be a good substitute for conventional therapy, as they are easily and economically available these days. The Objectives of the study,

1. Combining the VRI and DTI
2. Development of rehabilitation protocol for patients affected with PD
3. Experimental verification of simulation results for the VRI

Methods: Total of 32 patient with Parkinson disease will be screened and through convenience sampling method, Demographic data will be recorded for all the patients. The patient with PD will be allocated in two groups, dual task treatment group and virtual reality treatment group by computer-generated block randomization technique.

Outcome Measures: Posturography, PDQ-39 and UPDRS

Intervention: VR(KINAPSYS BMI-1246 Rehabilitation with Rehab Games) provides precise presentation and control of stimuli within a dynamic multi-sensory 3D computer generated environments and helps to record and modifying behavioural responses. It is a way for humans to visualize, manipulate, and interest in computers. KINAPSYS provides comprehensive patient care, from the beginning of rehabilitation to the integration of specific movements. The exercises are divided by body

parts (upper limb, spine, lower limb). Specific protocols are provided for each stage of the rehabilitation process. The treatment session will be 40 minutes in a day for 5 days in a week up to 12 weeks.

Conclusion: This rehabilitation protocol helps the patients to improve their quality of life by improving their posture, balance and gait. The results of this study can be implemented into various researches by collaborating with Parkinson disease society nationally and can be used as a rehab protocol in hospitals and clinical set-ups.

P044

Rehabilitation of brachial plexus injuries using a haptic upper limb robot assisted therapy device

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Question: Brachial plexus injury, characterized by the loss of movement and sensation of the shoulder, arm, and hand, is often due to motor vehicle accident (70%) with a mean age balancing between 15 and 25 years old. The aim of our study is to evaluate the effects of a haptic robot assisted device (MOTORE/armotion system) on motor recovery.

Methods: Patients affected by Brachial plexus injury due to traumatic etiology have been studied. Every patient underwent motor training with Motore system 30m/die for 30 days, in addition to conventional therapy. The following clinical outcome measures were used: Functional Independence Measure (FIM), Motricity Index (MI), and Barthel Index (BI).

Results: Thirteen patients have been admitted to the Neurorehabilitation Unit (Mean Age 41±19; 10M/3F), 5 patients sustained a left brachial plexus injury, 8 sustained a right injury. Using the FIM scale, a good outcome of general recovery was observed (113,5-116,5 admission/discharge, $p < 0,01$), improved motor recovery observed with the MI (37-45 admission/discharge, $p < 0,02$) and an improved activity level as demonstrated by the BI (95,5-99 admission discharge, $p < 0,01$) after the

robotic training. After the training patients perceived a reduction in pain and improved sensation of the affected arm. No adverse effects were observed.

Conclusion: Rehabilitation using a haptic device has shown to be safe and beneficial to this complex condition in which reproduction of arm movement can be particularly difficult.

P045

Intra and inter-rater reliability of Valedo System to measure trunk range of movement in healthy and chronic stroke participants during the streamlined Wolf Motor Function Test

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Question: What is the intra and inter-rater reliability of the Valedo system to measure trunk range of motion (ROM) during performance of streamlined Wolf Motor Function Test (SWMFT) in stroke and age-matched healthy participants?

Trunk performance has been recognized as an important independent predictor of activities of daily living after a stroke. A recent study by Kwee 2015 showed that the trunk control measured by trunk impairment scale (TIS) is associated with upper limb (UL) function measured by SWMFT in subacute and chronic stroke. To ensure that any planned treatment for strokes is effective, therapists need accurate assessment tools or outcome measures to assess the change in function. The purpose of this study is improve assessment of trunk control in a clinical setting by testing the reliability of using a low cost wearable sensor to measure trunk movement during performance of SWMFT among stroke and age-matched healthy participants.

Methods: An observational cross-sectional study is used to establish the reliability of using the Valedo system to measure the trunk ROM in chronic stroke and age-matched healthy participants during performance of six tasks of SWMFT (hand to box, lift can, lift pencil, fold towel, extend elbow weight, turn key in lock). From March to May 2019 a purposive sample of 20 adult chronic stroke participants with UL

impairment (mild to moderate) and 20 aged matched healthy participants will be recruited. All participants will attend two assessment sessions seven to ten days apart. In the first session, the SWMFT will be recorded three times (the first and third assessment by assessor 1, the second assessment by assessor 2) with a rest period between them to test for intra and inter-rater reliability. In the second session, the SWMFT data will be recorded once by assessor 1 to assess between sessions reliability.

Results: Recorded data will be processed using MATLAB software. Subsequently, the trunk ROM during each task will be calculated. Data will be exported into Excel files and analysed using IBM SPSS 24 (SPSS Inc, Chicago, IL). For test re-test and between session reliability, measurements will be tested using the [ICC 1,1] with 95% confidence interval (CI); for inter-rater reliability, the [ICC 1,3] with 95% confidence interval (CI) will be used. Results will be presented at the conference.

Conclusion: Intra and inter-reliability of Valedo system to assess trunk ROM during SWMFT tasks will be established.

P046

Different Manual Grips in Telerehabilitation-Virtual Reality Training in Subjects After Stroke: A Proof Of Concept

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Question: Telerehabilitation-Virtual Reality Training (TVRT) improves upper extremity (UE) motor recovery after stroke [1]. TVRT is usually based on virtual representation of targets and facilitates relearning of movement performed by shoulder and elbow. Consequently, to find a modality of TVRT addressed to facilitate hand recovery would assume a clinical interest. The assumption of this proof of concept is that different hand/objects interactions during TVRT, obtained by different manual grips, could optimize hand recovery of subjects after stroke.

Methods: Two subjects, 2 and 5 months after an acute ischemic stroke underwent two 4-week periods of TVRT (20 training sessions, 1 hour long). In the first period they used a motor tracking of proximal UE segments, grasping a

cylindrical end-effector (convT-VRT). Exercises evoked multiplane proximal UE movements. After a wash-out period of one month, subjects started the second period of training performing the same exercises of the previous one but grasping different objects (bottle, rolling pin, jar etc.) in order to stimulate functional static grasps (newT-VRT) as in Figure. Before and after each period of training, the following outcome measures were acquired: Box and Block Test (BBT), Nine Hole Peg Test (NHPT), Fugl-Meyer Assessment for Upper Extremity (FMA-UE), Modified Ashworth Scale (MAS), Modified Barthel Index (MBI).

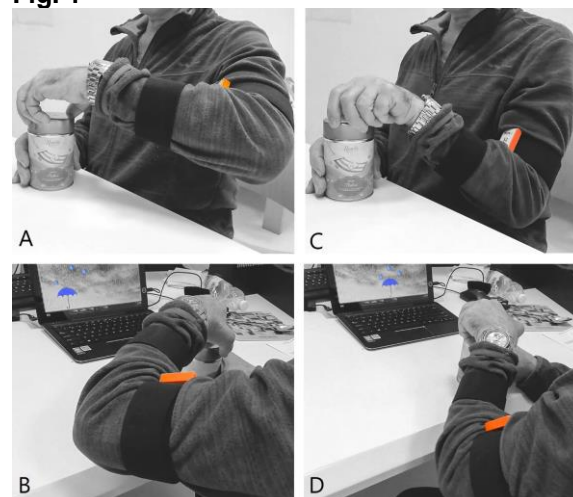
Results: Subjects showed significant clinical improvements after both training in NHPG (subject 1) and FMA-UE (subject 1 and 2). Surprisingly, in subject 2 improvements in FMA-UE related to shoulder movements were greater after newT-VRT than convT-VRT (Δ pre-post convT-VRT = 7; Δ pre-post newT-VRT = 27).

Conclusions: From preliminary presented data it would seem reasonable to design a study in order to analyze if different interactions between hand and object during TVRT is a modality to train paretic hands and to optimize the recovery of paretic shoulder in subjects after stroke.

Reference: 1. Piron L et al. Exercises for paretic upper limb after stroke: a combined virtual-reality and telemedicine approach. *J Rehabil Med.* 2009;41(12):1016-102.

Figure: An example of exercise performed in the newT-VR treatment grasping a real life object (a jar) with the proximal UL motor tracking; shoulder abduction (A, B) and adduction (C, D) were tracked by an inertial sensor placed on arm segment (displayed in orange) using the Virtual Reality Rehabilitation System (VRRS, Khymeia Group, Italy).

Fig. 1



P047

Kjellin syndrome, a rare form of Hereditary Spastic Paraplegia type 11 - what to offer to the patients?

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Introduction: Kjellin syndrome is a rare autosomal recessive neurodegenerative disease, associated with Hereditary Spastic Paraplegia (HSP) type 11 and characterized by spastic paraplegia, retinal flecks and dementia. Wheelchair assistance is needed after 10-20yrs of disease-onset and life expectancy is 30-40yrs. A multidisciplinary rehabilitation team is fundamental to assure quality of life (QoL).

Case report: A 29-year-old, right-handed woman, with learning difficulties in infancy but physically very active during adolescence, with no relevant family history, presented to our neurorehabilitation center with spastic gait and balance disturbances first noticed 3 years before, as well as neuropathic pain in the feet and slight spastic dysarthria. Genetic diagnosis had been done 1-month before.

At admission, patient had slight spastic dysarthria, spastic paraparesis with spasticity grade 1+, 2 in different lower limb (LL) muscle groups (Ashworth modified scale), vivid rotulian osteotendinous reflexes, right Babinski sign and weak bilateral dorsiflexion. Dysesthesias were present up to the knee level, bilaterally and rated as 6 in the pain visual analogic scale. Normal proprioception. Romberg negative. Spastic gait, without aids, for short distances. No cognitive, bladder or intestinal dysfunction. Lumbar puncture had identified higher neurofilament levels and brain magnetic resonance showed 2-3 millimetric white spots in the left frontal lobe subcortical white matter.

During the 5-week multidisciplinary rehabilitation in-patient period, the patient underwent different tests: Montreal Cognitive Assessment normal (28/30), spastic paraplegia rating scale 25/52, 6-min walk-test stopped at minute 5, after 151m, due to exhaustion. EMG showed very slight sensory-motor axonal

neuropathy and slight/ moderate chronic neurogenic involvement in proximal and distal LL segments. Bilateral retinal flecks in the ophthalmological examination. The patient trained balance and gait in the swimming pool and gym. Ankle-foot orthosis were prescribed, improving gait considerably, as well as a rollator and wheelchair. Psychology, occupational and speech therapy support were provided. Gabapentin was started and raised to 2100mg/day but with very mild results. The patient was discharged home with full support, including home/ job adaptations.

Discussion: Progressive neurodegenerative diseases require a multidisciplinary team focused at ameliorating patients functionality and QoL.

P048

Constraint-Induced Movement Therapy in a Group Format for Improvement of the Upper Limb Function: Comparing two Protocols with Follow up

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Question: This study aimed to compare two protocols (3 hours and 6 hours) of Constraint Induced Movement Therapy (CIMT) in a group format.

Methods: Five chronic stroke subjects attended a group based CIMT program, 3 hours per day, during 10 days of treatment, and five months later the same participants attended a group based CIMT program, 6 hours per day, during 10 days of treatment. The patients were assessed through the Wolf Motor Function Test (WMFT), Motor Activity Log (MAL) and the Canadian Occupational Performance Measure (COPM) before, after and three months after protocol. For the clinical training, all the traditional CIMT components were used, including the behavioral package, task specific training and restraint. For the restraint of the less affected upper limb, it was used a glove meant to be worn by 90% of waking hours while outside of therapy. Home exercises were personalized according to the information collected in the COPM. The interventions procedure included common activities for both protocols.

Results: All participants were from the rehabilitation clinic outpatient stroke program, from the Faculty of Health Sciences Trairi, Rio Grande do Norte – Brazil. Participant characteristics are detailed in Table 1. Both types of CIMT intervention increase the function and use of the affected upper limb, but the 3 hour protocol was shown to be statistically better when compared to the 6 hour protocol (Table 2).

Table 1. Participant characteristics

Tabel 2. Functional results

Conclusion: A 3 hour protocol of CIMT showed to be better than a 6 hour protocol of CIMT for improvement of the upper limb function in adults with stroke when delivered in a group format.

Fig. 1

Tabel 1. Participant characteristics

Characteristic	Value
Sex, n (%) male	3 (60%)
Age in years, mean (SD)	59.2 (12)
Side of hemiparesis, n (%) right	4 (80%)
Time post stroke in years, mean (SD)	5 (4.6)

(SD, Standard deviation)

Fig. 2

Table 2. Functional results

Variables (n=8)	3 hours protocol				6 hours protocol			
	Pre-test	Post-test	Follow up	p-value	Pre-test	Post-test	Follow up	p-value
MAI- Amount Of Use	1,27 (0,75)	2,84 (0,76)	2,71 (0,91)	0,093	2,31 (1,03)	3,18 (0,72)	2,90 (1,14)	2,90 (1,14)
MAI- Quality Of Movement	1,27 (0,68)	2,88 (0,69)	2,82 (0,98)	0,036	2,20 (0,91)	3,60 (1,08)	2,98 (0,97)	2,98 (0,97)
WMFT- Time	7,96 (2,92)	4,44 (1,59)	5,12 (2,69)	0,132	6,61 (3,56)	4,77 (2,33)	6,59 (4,9)	6,59 (4,9)
WMFT- Grip Strength	9,65 (6,19)	14,03 (6,48)	20,39 (14,92)	0,581	14,93 (8,73)	17,05 (10,95)	18,19 (9,34)	18,19 (9,34)
WMFT- Functional Ability Scale	3,53 (0,07)	3,97 (0,58)	3,91 (0,2)	0,065	4,06 (0,47)	4,34 (0,51)	4,37 (0,5)	4,37 (0,5)
COPM- Performance	3,48 (2,09)	5,84 (2,01)	5,96 (2,03)	0,023	4,7 (1,96)	5,58 (1,84)	5,77 (2,01)	5,77 (2,01)
COPM- Satisfaction	3,48 (2,09)	5,84 (2,01)	5,96 (2,03)	0,023	5,06 (2,8)	5,94 (2,35)	5,89 (2,22)	5,89 (2,22)

Statistical test: Analysis of variance (ANOVA) p-value < 0.05. All scores are showed in mean (Standard deviation).

P049

Evaluating the comprehensibility of the Arm-Hand-Activity-Scale (AHAS-German version) as part of establishing psychometric quality criteria

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Question: Arm paresis is a frequent long-term consequence after stroke with a major impact on tasks and activities. Depending on severity, different treatment pathways should be applied.

Currently, a variety of scales of arm function both on the level of body functions and task performance are available. Most of them are quite time consuming and difficult to apply. A simple categorization for arm-hand-activities after central paresis is lacking.

Methods: We empirically established a five-step categorization of arm and hand activities (see fig. 1)

In order to determine psychometric quality criteria, we designed a questionnaire with 24 questions based on the Fugl-Meyer arm section instructions to evaluate the comprehensibility of each category. A cut-off of 75 percent of correct answers was deemed to be sufficient to specify intelligibility. In order to calculate a significant descriptive statistic a sample of 60 persons was assigned.

Results: 76 persons (70 professionals and 6 patients / relatives) responded to the German version of the AHAS. We found a high consistency in the clearness of the five categories (overall CI=87,1%-99,5%). There were no significant differences between professionals and patients / relatives.

Conclusion: The AHAS categories are comprehensible both for professionals and patients / relatives. After having established cut-off values for the different categories using the Fugl-Meyer scale as reference, the AHAS will provide a simple classification system for determining the severity of central arm paresis. This will help choosing appropriate treatment strategies according to severity of the paresis.

Fig. 1

No activity	Fixing objects	Holding objects	Auxiliary arm/hand	Near-normal arm/hand activity
No usable activities for everyday life.	The arm or hand can be actively or passively moved to a horizontal plane and can be used to fix objects in place.	The arm can be stabilised on a horizontal plane. The muscle tone can be roughly controlled. The hand can perform minimal grasping/releasing activities and can be used to fix larger objects in place.	The arm can be moved upwards against gravity. The hand can be used as an aid when performing fine-motor tasks with both hands (e.g. eating using cutlery with built-up handles).	The affected arm can be used in bimanual tasks possibly with slight restrictions (e.g. slight coordination disorder and fluctuations in muscle tone, moderate slowdown). (e.g. grasping object and handling them bimanually such as driving in a nail, eating using both hands, ...)

P050

The Vojta Therapy in the overall concept of the treatment of spinal cord injury

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In the physiotherapeutic treatment of spinal cord injury, a variety of techniques are available, all based on a training of compensatory motor skills.

However, it should be considered that postural control as the basis of any spontaneous motor function is irreplaceable and plays a decisive role in its developmental dynamics. The majority of the therapies aim at correcting the incorrect posture through conscious or volitional training of normal movements patterns. But it is very difficult to train this random motor skill and the patient likes to fall back on a compensatory posture.

Vojta therapy takes a completely different path.

The special feature of reflex locomotion according to Vojta is that through a defined stimulation innate posture and movement patterns are activated involuntarily. These address the postural control automatically and purposefully.

Developmental kinesiology demonstrates that the automatic control of body position is one of the basic functions of the CNS. This constitutes a major component in the healthy development of humans. In all stages of kinesiological development, body posture and movement are controlled in a very complex manner, in patterns. These individual regular patterns allow us to accurately identify pathological irregularities in the observed movements.

Methods: Using case studies, the movement patterns of patients and their spontaneous motor skills are described kinesiological. With these case studies it can be shown that activating with reflex locomotion according to Vojta the kinesiological expression of the

posture and movement patterns of spontaneous motor skills can be changed. Access to the necessary, involuntary muscle functions require for activities of daily living are "freed" and innate patterns of movements are activated.

Result: Activation with the Vojta Therapy activates the postural control in the best way possible. Vojta Therapy therefore creates the framework and foundation for an active exercise program. The development of compensation patterns, which can lead to further disfunction, are reduced.

P051

New approaches in spasticity- a comparative study

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Question: Spasticity is a challenge for any physician, and this pathological issue affects the ability to move.

Method: The authors studied 56 patients with vascular accident and high spasticity in the upper limb. Patients were evaluated on the Ashworth scale at a minimum of 3 score and the Frenchay scale with a minimum score of 40. Patients were divided into two lots: Lot A also received botulinum toxin therapy in the upper limb muscle with ultrasound control. The lot B received oral medication with baclofen 25 mg/day. Both lots received a rehabilitation program adapted to the neuro-motor deficit. The assessment was made using the Ashworth and Frenchay scales before therapy, at 7 days and 3 months.

Results: The Lot A obtained better scores comparative with the group who received baclofen, both as spasticity and functionality.

Conclusions: Botulinum toxin therapy proves its utility during three months after injection. Functionality is greatly improved in patients who followed a recovery program.

P052

Dual-transcranial direct current stimulation: before or during physical therapy? Effect on lower limb performance in sub-acute stroke

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Transcranial direct current stimulation (tDCS) has been introduced as an adjunct to rehabilitation after stroke. However, the time which tDCS can be combined with physical therapy to maximize performance changes is rarely presented. We conducted a randomized sham-controlled trial to examine when (before or during) dual-tDCS should be applied to improve lower limb performance in sub-acute stroke who underwent active (before or during) or sham tDCS combined with physical therapy. Dual-tDCS; anodal over the lesioned hemisphere, cathodal over the non-lesioned hemisphere (2 mA, 20 mins) was applied over the primary motor cortex before and during PT. Participants in all three groups received conventional PT for an hour. For during group, participants had dual-tDCS for the first 20 mins of PT. Lower-limb performance was assessed by the Timed Up and Go (TUG) and Five-Times-Sit-To-Stand (5TSTS) tests before and immediately after the intervention. Our results showed that dual-tDCS applied before PT better enhanced motor performance compared to baseline and sham condition. This suggests that tDCS applied before PT is probably more favorable choice for stroke rehabilitation.

P053

Prevalence of postural patterns of upper extremity" and its impact on quality of life in post stroke patients in Chile

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A high number of people with stroke develops spasticity of the upper extremity (UE), due to the hyperactive excitability of the MN and the rheological alterations that occur in the affected muscles. These alterations limit the use of the UE, restricting the functional activities and

affecting the quality of life and social participation.

Objective: To determine the prevalence of postural patterns of UE and their impact on the quality of life of post-stroke patients.

Material and method: Descriptive cross-sectional design, the sample will consist of 200 people attending health care centers in Chile during 2018, who meet the inclusion criteria and sign the informed consent. The study will include a measurement made by a trained professional of each participating center using a file that allows obtaining clinical information and the evaluation of the Hefter Pattern, wrist, finger and thumb. The Functional Independence Measure scale and the Barthel Index to assess functional independence and quality of life.

Results: In each of the four pattern taxonomies, the prevalence was investigated using the χ^2 single-group test followed by the inspection of standardized residuals (z) in each cell. The ANOVA univariate intersubject test was used to examine relationships between each of the four patterns and the two measures of independence (FIM and Barthel). Applicability: The results will determine the prevalence of the patterns in this geographical sector, disseminate this classification and promote the use of a common language among professionals to enhance their daily work. In addition, it will allow to determine how the affectation of the upper limb through the identification of the pattern alters the quality of life. This new information can be a fundamental input in the generation of future studies that seek to guide in relation to the use of therapeutic strategies in these people.

Conclusions: In the patterns of UE, a high prevalence of Pattern III and a low prevalence of Patterns I, II and V were observed. In the wrist, the neutralized cubital pattern showed a high prevalence while the cubitalized pattern in extension and the category "other pattern" presented low prevalence. In the fingers, high prevalence was found in the deep and mixed flexor patterns and low prevalence in the "other pattern" category. Finally, with respect to the thumb, a high prevalence was noticed in Patterns 3, 4, a low prevalence in Pattern 2, and the "other pattern" category.

P055

Leveraging Wearable Sensor technology and Taiko for Rehabilitation and chronic Pain Management

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Taiko refers to a Japanese drum and the drumming style that has evolved using taiko drums. Recent studies have confirmed the purported health benefits of drumming, which helps control chronic pain, boost the immune system, and aid in healing a wide variety of physical disabilities.

Taiko is unique to drumming in that it involves motion of the whole body. Large movements and rhythm training have been shown to aid in the therapy of people with Parkinson's Disease and those who have experienced brain injury. Occupational therapy using taiko helps improve balance, muscle strength and flexibility, endurance, coordination of movements, dexterity and overall physical and mental well being.

This study targeted patients with movement disorders who have limited upper extremity function and provides therapy using a digital Interactive Metronome (IM) technique with taiko. Interactive Metronome is a form of rhythm and timing training therapy shown to reduce errors in the response of movement, allowing people to gain greater control over their extremities.

This study instrumented the Interactive Metronome using Wearable wireless 9-axis Inertial measurement units (IMUs) and an iOS App. Inertial measurement units are recognized as a portable and cost-effective motion analysis systems and have the potential to be introduced into clinical settings for the assessment of functional movement quality of patients.

A functional, affordable and portable taiko drum set was developed for this study to accommodate numerous therapy settings.

The goal of this study is to measure the effectiveness of taiko therapy to increase the upper extremity motion range while improving hand/eye/brain coordination through rhythm and timing training in a clinical setting.

Findings indicate that occupational therapy patients undergoing digital IM treatment recover faster post-surgery. The study has demonstrated that it is possible to leverage wearables and taiko for pain management.

P056

The first patient treated with a triple combination-therapy of task oriented training, anodal tDCS and Cerebrolysin® therapy after recurrent ischemic stroke: a case presentation

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Question: A 69 year old male patient was admitted to our rehabilitation facility at the Clinic Pirawarth following a second stroke (ESUS) in the area of the right middle cerebral artery in March 2017 (proximal ACMD, M1 segment). He suffered a first ischemic stroke in the same vascular area in October 2016. When he was admitted to our clinic in May 2017, he already had completed 4 weeks of rehabilitation as an inpatient in another rehabilitation facility with only minor improvements in his motor functions. The patient presented with left sided hemiparesis, left hemianopia and left hemineglect. He was able to walk with one cane and the hemiparesis was affecting especially his left upper limb with distal weakness (distal MCR Grade 1-2, proximal MCR Grade 3-4). He was not able to manipulate small parts or perform isolated finger movements (e.g. to pick up coins, using the cutlery etc.). The primary goal of our rehabilitation efforts were aiming to improve the motor activity-level of his left upper extremity and to promote manual dexterity.

Methods: In early June 2017 we decided to offer the patient a 2 weeks course of multimodal therapy comprising: intensive occupational therapy of a minimum of one hour task oriented training per day, daily anodal transcranial direct current stimulation (atDCS 2x20 minutes, over the left motorcortex M1) on five days a week from Monday to Friday and a 2 week course of daily Cerebrolysin infusion (30ml i.v.) for 14 days.

Results: We assessed specific outcomes of arm function and hand dexterity after 14 days (Table 1). The patient improved in the ARAT score (Action Research Arm Test) from 38 to 49 out of 57 points (corresponding to a 60% proportional recovery rate). He was now able to

perform fine motor tasks with his paretic hand and was able to transfer these improvements into motor tasks of everyday use. He could also improve manual speed functions (Nine Hole Peg Test), expand his active range of motion of the left shoulder and gain grip strength.

Conclusion: This is the first ever reported case of a patient with a chronic stroke who, although there was virtually no motor recovery seen during the early phase of recovery and rehabilitation, he showed profound improvements in functional motor recovery by using a triple therapy including Cerebrolysin. We hypothesize that this induces a milieu of heightened neuroplasticity, possibly by promoting BDNF-mediated synaptic plasticity.

Fig. 1

Test	Beginning	End
9 Hole Peg Test	r : 25,42 sec l : 2min 47 sec	r: 20,84 sec l: 1min 48 sec
Hand grip force	r: 38/39/31 kg l: 10/9/9 kg	r: 38/40/40 kg l: 11/10/10 kg
Functional Hand Scale (1-5)	r:5 l:3	r:5 l:4
ARAT Score	38/57 pts.	49/57 pts.
AROM left shoulder	ABD - 90°	ABD - 135°

P057

Preserving Pulmonary function and functional capacity in children undergoing abdominal surgery: A two group pretest posttest, Randomized open label trial

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Aim: The aim of the study is to determine the effects of preoperative physiotherapy education (POPE) in preserving lung function in children undergoing open abdominal surgery

Methods: The study was an open label, randomized controlled trial of two group pretest-posttest design. Total 21 children were recruited in the study. After obtaining ethical approval, children were divided into two groups by 1:1 randomization. Preoperative physiotherapy education is given to the POPE group only. After surgery, Postoperative physiotherapy (POP)

was given to both the groups for five days. Follow-up measurements were taken on baseline and on postoperative POD5, Spirometry (FVC, FEV1, FEV1/FVC, PEFR), TUGT, 10mWT, Chest expansion, 6MWT, 9SCT and chest expansion were used as outcome measure.

Results: Independent t test and Mann whitney u test was used to compare the outcome measures between the groups. Repeated Measure ANOVA, Wilcoxon sign test and paired t test was used among the groups. Improvement in all the outcome measures excepts 9SCT in POPE group when compared to POPE. While, Statistical significance is noted in the chest expansion at T2 and T4 level and 9SCT. This might be attributed due to small sample size.

Conclusion: Preoperative physiotherapy education along with postoperative physiotherapy might help in improving pulmonary function and functional capacity after open abdominal surgery

P058

What do stroke survivors actually learn when regaining standing and walking ability? A protocol for a repeated-measurements prospective cohort study.

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Question: During the first 3 to 6 months post-stroke, typically large improvements in leg paresis and walking are observed. However, previous studies suggest that these improvements are mainly driven by learning compensation strategies rather than by restoring inter-limb coordination.

What are the neurological and behavioral changes responsible for improvements in walking ability during the first 6 months post-stroke?

Methods: In total, 24 participants with leg paresis (i.e., NIHSS item 6 >0) and limited walking ability (i.e., FAC ≤3) will be included within the first 14 days after a first-ever hemispheric stroke.

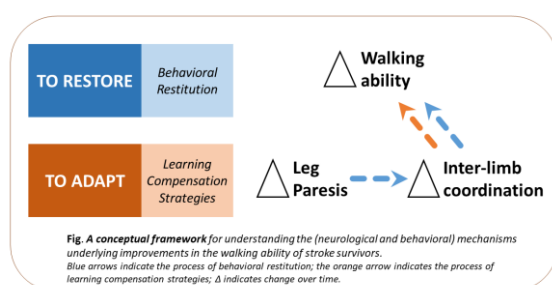
Longitudinal changes in selected outcomes will be investigated at 3, 5, 8, 12 and >24 weeks post-stroke. Leg paresis (i.e., Fugl-Meyer Assessment, Motricity Index) as well as standing (i.e., posturography) and walking ability (i.e., gait speed) will be assessed.

In addition, kinetic and electromyographic analyses during upright activity will be performed as soon as participants are able to stand unsupported. For this purpose, muscle activation patterns and the center-of-pressure displacements will be calculated to estimate the contribution of paretic and non-paretic side to the control of balance and locomotion.

Results: In the present study, we will investigate behavioral restitution and compensation strategies for improvements in standing and walking ability (see Fig.) during the first 6 months post-stroke.

Conclusions: A better understanding of what patients actually learn when regaining walking ability is required to give evidence-based guidelines for clinicians in order to choose for restorative (i.e., impairment-focused) or adaptive treatment strategies early post-stroke.

Fig. 1



P059

The Aphasia Communication Team (TACT): The Cypriot experience

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The Aphasia Communication Team – TACT is a communication/ conversation group that involves stroke survivors with chronic aphasia. Aphasia is a debilitating communication deficit that affects comprehension and production of spoken and written language. TACT aims to provide stroke survivors support for learning and communication opportunities to promote living well with aphasia. Stroke survivors are recruited by the Cyprus Stroke Association (third-party stakeholder) and TACT is held at the premises of the Rehabilitation Clinic of the Cyprus University of Technology once a week, for one and a half hours. The group so far has 6 stroke survivors with chronic aphasia and 6 communication buddies. Communication buddies are speech and language therapy students who serve as communication facilitators of each group member. TACT works on the barriers (areas of weakness of the person with aphasia and conversation partners that make communication difficult) and on what communication tools members could use to improve communication. TACT has a broad outlook for living well with aphasia and improve quality of life. Another goal targeted is the understanding that aphasia can be a long-term condition and that aphasia is a "family issue"—not just for the person with aphasia. TACT promotes full participation and engagement in activities of interest. TACT encourages a safe, positive, environment, and is inclusive to all. Therapy consists of a 12-week block of weekly sessions. Group members are initially assessed on psychometric measures (language, cognition, and quality of life) at the start and at the end of each block of therapy. This is deemed necessary to measure improvement or change in behaviors post-therapy. Group members are encouraged to share experiences by using technology and tablets. They also practice total communication skills i.e. adding gesture, drawing, and writing to speech. The main topics of discussion is learning about/refreshing knowledge on stroke and aphasia, linking the information to members own experiences, asking questions and discussing stroke and aphasia. It is also important for members to share stories about life before the stroke.

Keywords: stroke, aphasia, group work, technology, total communication, quality of life

P060

A novel wearable system for detecting and monitoring freezing of gait in Parkinson's disease

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Background: Freezing of gait (FoG) is a disabling symptom of advanced Parkinson's Disease (PD) and it is associated with increased risk of falls. FoG does not always manifest during neurological examination and its severity is difficult to estimate. Various wearable devices have been recently developed and tested to detect PD symptoms, including FoG, which have primarily based on inertial sensor measurement. Here we report results of a novel wearable device: a pair of sensor insoles equipped with pressure force sensors and 3D accelerometer.

Research Questions: Does the measurement of foot plant pressure produce safe, significant and reliable methods for FoG detection when used as add-on to inertial sensors?

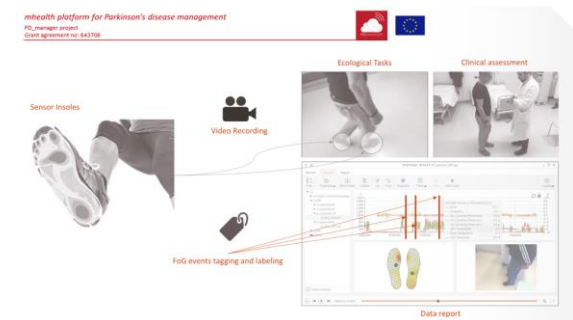
Methods: We tested the device in a clinical setting by enrolling 20 PD patients, attending a motor assessment protocol organized in 8 multiple video-recorded sessions of clinical test and ecological task, executed both in on and off state condition.

Results: We compared the data coming from the insoles with the video-recorded FoG events tagged by a clinician and we have been able to implement an algorithm that correctly detected 90% of the episodes by either FoG or no FoG. The false-positive rate was 6%, the false-negative rate 4%.

Conclusions: Freezing of Gait assessment results to be particularly important in the context of Parkinson's disease whereby this peculiar complication occurs, that is especially advanced phase of the disease progression. A proper and reliable measure of the different features of such episodes can be used to monitor, prevent and manage the risk of falls as

well as the better personalization of rehabilitation strategies. In particular the pressure sensors could recognize FoG manifesting before the first step of gait with leg trembling and adding more information than conventional devices.

Fig. 1



P061

Virtual Reality Helpful in Motor and Cognition in Corticobasal Degeneration: A Case Report PET Study

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Question: Corticobasal Degeneration (CBD) is a progressive neurodegenerative disorder resulted by combination of basal ganglia and cerebral cortex involvement and can be manifested by symptoms like balance problems and cognitive impairments. The purpose of this case report is to show the effects of virtual reality training (VR) in addressing symptoms of CBD.

Methods: Case Description: A 64-year-old, right-handed man applied to the outpatient neurology clinic at Istanbul Medipol University Hospital one year after the onset of complaints including impaired balance, frequent falls during transitional movements, disturbances in the Activities of Daily Living and amnesia. Following the clinical evaluations and Positron Emission Tomography (PET) scan, patient was diagnosed with CBD by a neurologist. During clinical evaluations performed by the neurologist, obvious balance impairment in the trunk and decreased Deep Tendon Reflexes in

the upper extremity were noted. Neuropsychological testing revealed a slight decline in the executive functions.

Outcome Measures were Montreal Cognitive Assessment (MoCA), Timed Up and Go test (TUG), 6-Minute Walk Test (6MWT), The Activities-specific Balance Confidence (ABC), Berg balance scale (BBS) and PET scan.

Intervention: Medications were regulated by the neurologist. A VR training was applied to the patient 3 times per week for 6 weeks (totally 18 sessions) using Nintendo Wii Fit Balance Device. Nintendo Wii Fit Plus games covering gait, static and dynamic balance applied during every session lasting for one hour.

Results: TUG decreased from 15 to 13.51 seconds. The patient had an improvement in the 6MWT from 210 to 260 meters. MoCA improved from 18 to 26. Patient's balance confidence increased from 1380 points to 1580 and BBT changed from 48 to 53.

Comparison between PET scans before and after the intervention revealed that the asymmetrical hypometabolism in the right thalamus and basal ganglia which were seen before the intervention, became normal. Also a relative improvement was noted in the visual evaluation of the cortical involvement.

Conclusion: VR by the means of Nintendo Wii Fit Plus improved patient's functions both in the motor and cognitive aspects after 6 weeks of rehabilitation. Using virtual reality can be beneficial in the motor and cognitive outcomes in patients with CBD, however further randomized controlled studies are needed to compare these effects with conventional forms of rehabilitation.

P062

Measuring the level of participation for robot-assisted gait rehabilitation using a brain computer interface

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Question: Stroke attacks often result in life-long impaired motor functions. A fast and almost full recovery would be beneficial for patients and would help saving healthcare

costs. Gait robots are promising therapy devices for stroke patients with impaired lower limbs as they can perform a high number of movement repetitions. A drawback of current gait robot systems is that the level of participation of patients remains unclear. This is particularly disadvantageous for the early phase of rehabilitation, because patient's motivation can quickly decrease significantly due to the lack of visible therapeutic success. The question of this current trial is to find out whether it is possible to measure the level of active participation during training by integrating a Brain Computer Interface into an existing gait robot system.

Methods: We developed a neurofeedback system consisting of a wireless EEG device, algorithms for decoding the relevant motor activity and visual-, auditory-, and tactile feedback units. This system was integrated into the PerPedes gait robot and was used to measure the participation of a test person during training. EEG was recorded from 7 healthy probands executing two paradigms given by "both legs active" and "no leg active". The goal was to distinguish between these two states and thereby to detect whether the patient is actively participating in the therapy or not. For the detection algorithm we combined a Common Spatial Patterns filter and a Linear Discriminator Analysis classifier. The training of the classifier was done for each proband separately. Half of the recorded data was used for training and the rest for testing.

Results: We used the above approach to distinguish between active and passive participation for 7 healthy probands. The classification results were calculated for each gait cycle phase separately. The best classification performance for an individual subject was given by 93% correctly classified trials, while the average classification performance over all probands was given by 76%.

Conclusion: The results for the current trial using healthy probands are promising, considering that we were able to find gait cycle phases where a high classification accuracy can be achieved. This proof of concept shows the possibility to measure the level of active participation of subjects during gait robot exercises.

Single Case Study: Low threshold electrical stimulation (LTES) using the Mollii suit as treatment modality for severe ataxia in an adult with Multiple Sclerosis

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Question: Does using the LTES Mollii suit subdue symptoms of ataxia and improve function in an adult with multiple sclerosis?

Method: Single case study. The participant is a 40 year old male with primary progressive multiple sclerosis (MS). He was either hoisted for transfers or completed a slide transfer from his wheelchair to bed and vice versa prior to the trial. Over the period of 3 years, the participant engaged in various rehabilitation strategies in both inpatient and community settings. However we did not notice much progress and he was showing a gradual deterioration. The ataxia was so significant that he lost his standing ability within a year. There has been a recent emergence of evidence, indicating the benefits of the Mollii suit (Remotion Ltd) in patients with ataxic symptoms. Therefore with written consent from the patient, we agreed to trial this suit. It uses low frequencies at 20 Hz (below level of muscle contraction to allow spinal cord reflex to allow spinal reflexes to occur). It targets spinal reflexes to alleviate their disruption, based on the mechanisms of activity versus underactivity in any upper motor neuron lesion. It selects the underactive muscles over the over active at the spinal cord level (reciprocal inhibition). Modified Fatigue Impact Scale, Motricity Index, Scale for the Assessment and rating of ataxia(SARA), Arm Activity Measure(ArMA), video of arm movements and slide transfers were utilised as outcome measures. Apart from wearing the Mollii suit wear for an hour every day, he also participated in intense routine rehabilitation as earlier.

Results: The participant demonstrated significant progress in all the measures; Modified Fatigue Impact Scale-42% progress; Motricity Index (Trunk score 278%, Arm score: 51%, Leg score: 32%); SARA-significant increase in control and co-ordination reflected in the reduction of scores in each tasks was observed and ArMA-Section A : 18%, Section B: 24% progress were observed (table

1).Videos of pre and post intervention demonstrated significant progress in the quality of functional tasks. He was also able walk 100 metres using the pulpit frame with assistance. Participant also demonstrated increased independence in feeding and drinking. We are planning to repeat the measures after 4 weeks and 8 weeks to monitor progress.

Conclusion: It was clearly evident that the Mollii suit was very beneficial to control ataxic movements and demonstrate significant improvements in functional tasks.

Fig. 1

Measure	Pre-Intervention	Post-Intervention	Change percentage
Modified Fatigue Impact Scale (MFIS)	278%	278%	0%
Motricity Index (MI)	278%	278%	0%
SARA	278%	278%	0%
ArMA	278%	278%	0%
Slide transfers	278%	278%	0%
Arm movements	278%	278%	0%
Leg movements	278%	278%	0%
Feeding	278%	278%	0%
Drinking	278%	278%	0%
Walking	278%	278%	0%
Standing	278%	278%	0%
Transfer from wheelchair to bed	278%	278%	0%
Transfer from bed to wheelchair	278%	278%	0%
Transfer from wheelchair to toilet	278%	278%	0%
Transfer from toilet to wheelchair	278%	278%	0%
Transfer from wheelchair to shower	278%	278%	0%
Transfer from shower to wheelchair	278%	278%	0%
Transfer from wheelchair to car	278%	278%	0%
Transfer from car to wheelchair	278%	278%	0%
Transfer from wheelchair to house	278%	278%	0%
Transfer from house to wheelchair	278%	278%	0%
Transfer from wheelchair to garden	278%	278%	0%
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phase after stroke with a SULCS score of 1-6 were included. Participants received twelve interventions of RSS (sham-stimulation in the control group) within a period of three weeks. The stimulation of the fingertips was conducted with the device tipstim (Bosana, Germany) for 45 minutes each (frequency=20Hz). Subsequent to each stimulation, all patients received robot-assisted therapy for another 45 minutes. Outcome measures were the Fugl-Meyer-Assessment (FMA) for the upper extremity, Box-and-Bock-Test (BBT), grip strength and Stroke Upper Limb Capacity Scale (SULCS). Assessments were performed before and after the treatment period and 3 weeks later for follow-up.

Results: At the date of the analysis, 19 patients in the intervention group and 18 patients in the control completed the study. In total 8 patients were lost to follow-up. Patients of both groups significantly improved their motor function from baseline to post interventional and follow-up measurements, as displayed by all outcome assessments. However, none of the measurements showed any significant group differences (baseline-post, baseline-follow-up, all p -values>0.272). A sensitivity analysis conducted in a subgroup of 15 patients with enhanced baseline motor function confirmed these results. The majority of participants considered the RSS as comfortable and no adverse event occurred.

Conclusion: RSS failed to show superiority regarding motor improvements compared to the control group receiving sham stimulation. Potential effects of RSS on the sensory function which was also measured in this study will be analyzed as a next step.

P065

A protocol for joint stiffness assessment using a rehabilitation robot

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Question: The goal of the study was to develop and evaluate a protocol for joint stiffness assessment, that could be used in rehabilitation diagnostics to evaluate the progression of joint rigidity or muscle spasticity. The method presented in this paper has been evaluated on the measurements of joint torque in an elbow

joint, during continuous passive motion of a patient's limb by a robotized device. In this paper a Luna EMG neurorehabilitation robot is used.

Methods: Two groups, were investigated, each consisted of ten subjects:

neurological patients with central nervous lesions

control group, without movement deficits caused by the central nervous system disorders

To avoid the influence of muscle spasticity on test-retest reliability, only spastic-free patients were included (Ashworth Scale = 0). Both groups performed the test, which consisted of continuous passive motion in the elbow joint. Three velocities were applied: 10 °/s, 30°/s, and 50°/s, each for 60 seconds. The test was performed twice on the same day and once, the following day, for both upper limbs. The ROM was set between 30 and 150 degrees.

Figure 1. Patient position during assessment

Results: Results are shown in table 1.

Table 1. Torque values during continuous passive motion among neurological and healthy subjects

Strong correlations ($r>0,5$) between tests were found for the healthy group, for 10°/s (right arm), 30°/s and 50°/s (both arms), for mean and maximum torque values (in green-see table 1.). The test performed among neurological patients, was repeatable in terms of the maximum values, for the speed 30°/s and 50°/s for affected and unaffected arm. The mean values were not reliable and shouldn't be used in periodical stiffness analysis.

Conclusion: The proposed protocol of joint stiffness analysis with the use of mean torque during continuous passive motion on a Luna EMG robot, has proven yield reliable and repeatable results, especially at 30°/s and 50°/s speeds. Using mean torque during the same movement yields inconsistent results and shouldn't be used in rehabilitation diagnosis.

Bibliography: Schmartz, Annick C., et al. "Measurement of muscle stiffness using robotic assisted gait orthosis in children with cerebral palsy: a proof of concept." *Disability and Rehabilitation: Assistive Technology* 6.1 (2011): 29-37.

Zhang, Mingming, et al. "A novel assessment technique for measuring ankle orientation and stiffness." Journal of biomechanics 48.12 (2015): 3527-3529.

Fig. 1



Fig. 2

		10 deg/s affected			10 deg/s unaffected		
		Correl 1/2	Correl 1/3	Correl 2/3	Correl 1/2	Correl 1/3	Correl 2/3
Torque [Nm]	mean extension	0.15	0.45	0.45	0.39	-0.31	-0.26
	mean flexion	0.27	-0.33	-0.24	0.47	0.04	0.42
	peak extension	0.57	0.49	0.40	0.51	0.24	0.63
	peak flexion	0.33	-0.07	0.72	0.36	0.32	0.59
		30 deg/s affected			30 deg/s unaffected		
		Correl 1/2	Correl 1/3	Correl 2/3	Correl 1/2	Correl 1/3	Correl 2/3
Torque [Nm]	mean extension	0.06	0.39	0.41	0.04	0.50	0.17
	mean flexion	-0.29	0.01	-0.24	0.60	0.42	0.44
	peak extension	0.59	0.77	0.61	0.77	0.83	0.75
	peak flexion	0.71	0.73	0.70	0.71	0.81	0.80
		50 000 affected			50 000 unaffected		
		Correl 1/2	Correl 1/3	Correl 2/3	Correl 1/2	Correl 1/3	Correl 2/3
Torque [Nm]	mean extension	0.28	0.44	0.46	0.49	0.26	0.66
	mean flexion	0.12	0.00	-0.38	0.59	0.25	0.42
	peak extension	0.58	0.77	0.61	0.60	0.65	0.86
	peak flexion	0.84	0.79	0.49	0.83	0.64	0.74
		10 deg/s right			10 deg/s left		
		Correl 1/2	Correl 1/3	Correl 2/3	Correl 1/2	Correl 1/3	Correl 2/3
Torque [Nm]	mean extension	0.34	0.54	0.77	0.74	-0.92	-0.56
	mean flexion	0.91	0.96	0.90	0.68	-0.74	-0.37
	peak extension	0.84	0.95	0.82	0.62	-0.69	-0.54
	peak flexion	0.95	0.84	0.73	0.75	-0.64	-0.36
		30 deg/s right			30 deg/s left		
		Correl 1/2	Correl 1/3	Correl 2/3	Correl 1/2	Correl 1/3	Correl 2/3
Torque [Nm]	mean extension	0.91	0.60	0.70	0.67	0.72	0.28
	mean flexion	0.83	0.83	0.81	0.90	0.82	0.88
	peak extension	0.82	0.69	0.69	0.84	0.72	0.61
	peak flexion	0.63	0.35	0.49	0.93	0.85	0.91
		50 deg/s right			50 deg/s left		
		Correl 1/2	Correl 1/3	Correl 2/3	Correl 1/2	Correl 1/3	Correl 2/3
Torque [Nm]	mean extension	0.92	0.77	0.83	0.70	0.73	0.45
	mean flexion	0.90	0.69	0.84	0.90	0.87	0.89
	peak extension	0.68	0.94	0.68	0.87	0.81	0.86
	peak flexion	0.97	0.60	0.63	0.65	0.90	0.88

P066

The possibility of using biofeedback in the correction of balance disorders and vestibular dysfunction in migraine

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Introduction: There are a high comorbidity of vestibular dysfunction (VD) and imbalance about 27% in migraine. Biopotential control is based on biofeedback allows to train the patient to control the reactions of body under the influence of various cues.

Objective: to assess the possibility of biofeedback in the correction of vertigo and balance disorders associated with migraine.

Materials and methods: There were trained 12 patients (2 men and 10 women), mean age – 49.5 ±7.4 years with migraine (International classification of headache, 2013), vertigo and balance disorders in the anamnesis. For the detection of VD there was performed vestibular test. Balance was assessed by the method of stabilography "Stabilan – 01-2" (JSC "RITM", Russia) using the Romberg test, the test "Turns of the head", optokinetic stimulation. The stabilographic training was conducted with open and closed eyes on the complex "Rehacor" (Russia) and the stabiloplatform ("Stabilan – 01-2") to influence the static and dynamic components of balance with the presentation of changes in visual and audible range as the mechanisms of objectification of the control of balance.

Results: Vestibular testing revealed the provocative nystagmus in the De Klein test in 8 cases and in the Dix-Hallpike maneuver in 10 cases. It is a sign of latent VD in the attack-free interval. Latent VD can be caused by the pathological afferentation of trigger points in the neck muscles and discirculation in the vertebral artery basin (BA). According to the stabilography, the head turns significantly worsen the indicators of statokinesigram ($p < 0.05$) in patients with migraine. It indicates to a significant contribution of voltage pericranial muscles and discirculation in the pool of BA in the pathogenesis of latent VD. After the course of stabilographic training with biofeedback, there were revealed a tendency to improvement the indicators of statokinesigram upon presentation of mixed optokinetic stimulation, significant improvement in the Romberg test in patients with migraine and balance disorder and vertigo paroxysms in the anamnesis.

Conclusions: Biofeedback is a promising area of modern rehabilitation medicine. Using of the biofeedback trainings in neurologist practice for therapeutic and prophylactic purposes will allow to develop individual treatment and recovery programs depending on the patient's condition and specialist's tasks for patients with VD and coordination disorders associated with migraine.

P067

Dysfunction assessment of upper limb function by clinical scales and accelerometer in people with multiple sclerosis

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Introduction: Tremor can be defined as an involuntary rhythmic oscillatory movement of a part of the body and in multiple sclerosis (MS) belongs to one of the most disabling features. Its objective evaluation in clinical practice is missing. The aim of this study was to describe dysfunction of upper limb function by clinical tests and accelerometer.

Method: People with MS and healthy individuals were assessed by the 3-axis accelerometer and 3-axis gyroscope chip (Motion Tracking sensor MPU-6050, Havlík et al., 2019), and by three clinical examinations for the function of the upper limbs (Hand grip strength, Nine-Hole Peg Test, Coin rotation task).

Results: A total of 17 subjects with MS and 18 healthy subjects were examined. People with multiple sclerosis had significantly weaker grip on the dominant right hand ($p=0.018$), significantly impaired fine motor skills ($p>0.001$) and dexterity of both upper extremities ($p>0.001$). Spectral analysis of tremor revealed that in subjects with multiple sclerosis, the frequency of maximum tremor and rate of tremors at this frequency differed significantly from that of healthy individuals ($p>0.001$), and at the same time that both hands were affected by tremors equally.

Table documents difference of maximal frequency between people with multiple sclerosis and healthy controls:

fmax [Hz]	U value	Z value	P value
RUE Open	123,50	0,11	0,88
RUE Close	104,00	-0,89	0,38

LUE Open	48,50	-2,98	0,003
LUE Close	108,50	-0,72	0,47

R right, L left, UE upper extremity

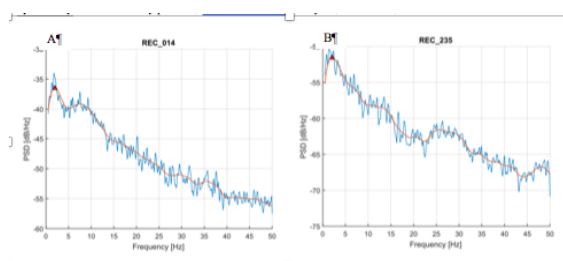
Legend to graph 1: spectral power density of accelerometer for LUE and RUE in person with MS

Conclusion: Both the results of clinical functional tests and the results of spectral analysis of tremor showed statistically significant differences in upper limb function in people with multiple sclerosis compared to healthy subjects.

Reference: HAVLÍK, J., HORÁK P., ŘASOVÁ K., ŘEZNÍČKOVÁ J., ZEMAN J. The Evaluation of the Tremor: Signal Database of Healthy Control Subjects. LHOTSKA, Lenka, Lucie SUKUPOVA, Igor LACKOVIĆ a Geoffrey S. IBBOTT, ed. World Congress on Medical Physics and Biomedical Engineering 2018 [online]. Singapore: Springer Singapore, 2019, 2019-05-30, s. 547-550 [cit. 2019-05-03].

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Fig. 1



P069

Management of urinary disorders in myelitis and spinal cord compression

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Urinary disorders are frequent in spinal cord injury and complications make prognosis restricted and alter the quality of life. Early and adaptative management improve

quality of life. But in developing country, so many difficulties make this management late, and often limited. The aim of our study was to evaluate our management in urinary disorders associated of spinal cord injury.

Patients and Methods: A prospective study was done at the departments of Physical medicine and Neurology in the teaching hospital, Fann, Dakar Senegal. Were included, all patients with urinary disorders concomitant of a spinal cord injury. Patients with others diseases which can explain the urinary symptoms, were excluded. After determine the Urinary symptoms (Urinary symptoms profile scale) and quality of life (qualiveen short form), patients meet the specialist of rehabilitation who establish type of management of urinary disorders. Secondly patients were received in a variable time, for appreciation evolution. Results: 39 patients were included. Mean of age was 42,7 years and sex ratio (H/F) 1.6. Dysuria associated of overactive bladders (38,46%) and overactive bladders (28,20%) dominate the symptoms. Urinary infections (15.4%) were the common complications. Risk factors of alteration of quality of life were overactive bladder and leaks during physical effort. The overage decline was 2.7 years. Quality of life was improved by Alfuzozine in all patients with score dysuria under 0,63 and by Oxybutinine in 64.3%. 5 patients benefited of perineal rehabilitation. Permanent catheterization noted in 17.9% of cases.

Discussion and Conclusion: Our results are similar of the literature according for symptoms and risk factor of alteration of quality life. Drugs treatment can improve the quality of life. Intermittent catheterization is difficult in our practice.

P070

Immediate effect of Kinesthetic illusion induced by movie of ankle dorsiflexion with increased exercise intensity for sit-to-stand movement

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Introduction: The ankle function affects the smoothness of sit-to-stand movement. The effects of kinesthetic illusion induced by visual stimulation (KiNvis) on the ankle function of healthy people and stroke patients have been reported. Previously, we compared KiNvis of ankle dorsiflexion using a movie with increased exercise intensity (Power KiNvis) with KiNvis of normal ankle dorsiflexion using a conventional movie (Standard KiNvis). Power KiNvis resulted in a larger increase in the ankle dorsiflexion angular velocity. Thus, Power KiNvis may have a greater influence on sit-to-stand movement; however, such an influence has not been examined.

Objective: The purpose of this study was to compare the immediate effects of KiNvis on sit-to-stand movement of healthy subjects using a movie of ankle dorsiflexion exercise with increased exercise intensity and a conventional movie.

Material and Methods: The subjects were 18 healthy people whose dominant leg was the right. We used the power movie (PM), which depicts exercise with resistance to barefoot right ankle dorsiflexion, and the standard movie (SM), which depicts dorsiflexion without resistance. During KiNvis, a display was set over the left ankle in the sitting position and the subjects watched a movie for 2 min showing inverted dorsiflexion of the right ankle joint. The evaluation was conducted before and after rest (rest condition: RC), before and after power movie observation (power condition: PC), and before and after standard movie observation (standard condition: SC). The maximum flexion angle of the left ankle joint, its duration, and the left ankle dorsiflexion angle per unit time at the time of sit-to-standing from 20 cm were evaluated by the motion analysis system, and the change rate was calculated. The kinesthetic illusion level was evaluated using the visual analog scale (VAS) after watching the two movies. Data were analyzed by one-way analysis of variance with repeated measures and the paired t-test.

Result: The kinesthetic illusion level by VAS was significantly greater in PM than in SM. The rate of change in the duration of ankle dorsiflexion was significantly smaller in PC than in SC and RC. The rate of change in the ankle dorsiflexion angle per unit time was significantly greater in PC than in RC.

Conclusion: Power KiNvis may have a greater influence on the angular velocity of ankle dorsiflexion during sit-to-stand movement than Standard KiNvis.

P071

Pharyngeal width (*JOSCYL width*) over Time as an Indicator of Dysphagia in Stroke Patients

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Question: Do we use pharyngeal width at rest as a tool to assess the improvement of dysphagia?

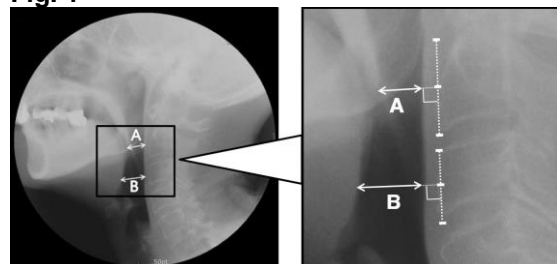
Methods: A total of 45 acute stroke patients was first tested within 30 days from the onset of stroke and tested next for follow-up over 30 days. We measured two oropharyngeal widths at rest at the middle level of the second and third cervical vertebral bodies using lateral neck x-ray within stroke patient group in chronological sequence. The average value of the upper and lower oropharyngeal widths was named as *JOSCYL width*, which is a combination of the first letters of the developers' surnames, formulating the *JOSCYL scale* by "*JOSCYL width* x 100 / Neck circumference." We made comparisons between difference values from penetration aspiration scale (PAS), dysphagia outcome and severity scale (DOSS), *JOSCYL widths* and *JOSCYL scales* respectively, using Spearman correlation.

Results: 1st assessment was done on 16.9 ± 6.4 days after stroke, and next assessment was done on 110.7 ± 175.9 days after stroke. The follow-up *JOSCYL widths* and scales were smaller than the initial values of them ($p < 0.05$). The PAS scores in the second tests were also smaller than the first test value ($p < 0.01$), but conversely, the DOSS scores in the second tests were larger than the next ones ($p < 0.05$). The uphill linear correlation between the changes of the *JOSCYL widths* and the PAS values existed significantly ($r = 0.563$, $p < 0.01$). Likewise, the difference values of *JOSCYL scales* and the PAS scores were correlated positively ($r = 0.571$, $p < 0.01$). The changes of the *JOSCYL widths* had significant downhill linear correlation with the ones of the DOSS score ($r = -0.510$, $p < 0.01$). The difference values of *JOSCYL scales* were also negatively correlated with the ones of the DOSS score ($r = -0.507$, $p < 0.01$).

Conclusions: The *JOSCYL width* and *JOSCYL scale* well reflected the changing

condition at each dysphagic patient with stroke over time and could be an easier way to evaluate whether alleviation of dysphagia occurred following stroke.

Fig. 1



P072

Comparison of changes in swallowing function between nutritional feeding methods in dysphagia patients with difficulty in oral intake

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Question: Learned non-use in dysphagia is considered to be caused by tube feeding. The use of a nasogastric tube increases the frequency with which saliva is suctioned and reduces the frequency of saliva swallowing due to difficulty in swallowing because of the presence of the tube in the pharynx, which further aggravates dysphagia. We compared changes in severity of dysphagia between patients receiving nasogastric tube feeding without oral intake and those receiving gastrostomy tube feeding or intravenous feeding without oral intake.

Methods: The subjects consisted of 7 patients (mean age, 82.4 ± 7.6 years) with dysphagia due to a stroke, neurodegenerative disease, or aging who were receiving nasogastric tube feeding and 10 patients (mean age, 79.4 ± 8.1 years) receiving gastrostomy tube feeding or intravenous feeding. The period without oral intake did not differ between the two patient groups. In each group, the latent time of swallowing, repetitive saliva swallowing test (RSST) count (the number of swallows during a 30-second period), maximum tongue pressure, jaw opening force, and the simple reaction time using the simple reaction time task were measured at the time of the initial measurement and after swallowing training for 1 month.

Statistical analysis was performed using the t-test.

Results: At the initial measurement, the nasogastric tube feeding group showed a significantly shorter latent time of swallowing and a significantly higher RSST count than the gastrostomy tube feeding or intravenous feeding group. In the nasogastric tube feeding group, a significant increase in the latent time and a significant decrease in the RSST count were observed after the 1-month training, but there were no significant changes in the other items such as the simple reaction time. In the gastrostomy tube feeding or intravenous feeding group, no significant difference was observed in any item between the value at the initial measurement and that after the 1-month training.

Conclusion: Comparison between the two patient groups showed milder dysphasia in the nasogastric tube feeding group at the initial measurement. However, in the nasogastric tube feeding group, the elicibility of the swallowing reflex decreased even after the 1-month eating and swallowing training compared with the initial measurement time. These results suggest a decrease in swallowing function due to learned non-use.

P073

Secondary low back pain in neurological diseases and disorders

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Low back pain is not only a common comorbidity, but also a secondary complication in neurological patients while being in inpatient or outpatient neurorehabilitation treatment. It might be caused by trunk instability due to pareses or muscular weakness, by spinal cord deviations due to rigidity, spasticity or dystonia, or by overmovements due to hyperkinesia, tremor, myocloni or seizures. Treatment options have to reflect on the (pre-)existing neurological conditions and include normally (neuro)pharmacotherapy and physical measurements, not reviewed in the guidelines for non-specific low back pain. Upper and lower back pain needs special focus in neurorehabilitation as it limits mobility and health related quality of life (HRQoL).

P074

Continuous Chain of Neurorehabilitation and Outcomes

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Question: Determine whether continuous chain of neurorehabilitation with early screening of patients with traumatic brain injury (TBI) improve functional outcomes.

Methods: A continuous chain of neurorehabilitation with early screening of all TBI patients by physiatrist in an acute Neurosurgery ward was implemented. A total of 491 patients were screened and reviewed between November 2010 and October 2012.

Out of the 491 screened patients, 116 patients were directly transferred to acute inpatient rehabilitation unit (continuous chain of neurorehabilitation). Functional progress was evaluated upon rehabilitation admission and discharge using the Functional Independence Measure (FIM). FIM gain and FIM efficiency were calculated for each patient. Functional outcomes of this group of patients were compared against a conventional group of patients i.e. before implementation of this program, patients were transferred to acute inpatient rehabilitation unit only when requested via ad hoc referral from the acute team.

Results: The early screened group was significantly older than the conventional group (66.7 ± 17.8 vs 47.8 ± 20.1 years, respectively, $p < 0.001$). The RLOS of early screened group was longer than the conventional group (28.9 ± 29.4 vs 20.4 ± 16.9 , $p = 0.02$). The average ALOS of the early screened group was shorter than the conventional group (17.2 ± 16.0 vs 24.3 ± 45.9 , respectively, $p = 0.286$). The average total LOS of the early screened and conventional groups were 46.1 ± 39.7 and 44.7 ± 52.8 , respectively ($p = 0.871$).

The FIM efficiency of the early screened and conventional groups were 1.5 ± 3.9 and 1.2 ± 1.3 respectively ($p = 0.631$). The FIM gain of early screened and conventional groups were 20.9 ± 29.3 and 20.0 ± 23.1 , respectively ($p = 0.841$). The average total admission FIM score of the conventional group was 59.2 ± 27.2 and that of the early screened group was 59.1 ± 35.5 ($p = 0.984$). The average total discharge FIM score of the conventional group was 79.2 ± 27.8 .

and that of the early screened group was 79.6 ± 30.5 ($p = 0.936$).

Conclusion: Although there is no difference in the FIM efficiency and FIM gain between early screened group and conventional group, the early screened group of patients were transferred to acute inpatient rehabilitation earlier and were older. This could indicate both young and old patients with TBI might benefit from continuous chain of neurorehabilitation in addition to a shorter acute length of stay.

P075

ICF in assessing the condition of patients with multiple cerebral aneurysms after endovascular treatment

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Question: study of the severity of neurological symptoms, activities of patients with multiple cerebral aneurysms after endovascular treatment in the immediate postoperative period.

Methods: 100 observations with multiple cerebral aneurysms were analyzed: 36 men, 64 women. The average age is 52.25 ± 1.7 years. 100 patients identified 217 aneurysms. The International Classification of Functioning (ICF) scale was used.

Results: Subarachnoid hemorrhage (SAH) in history was in 58 cases, 77,6% (45/58) were reported in the "cold" period of SAH, 22,4% (13/58)-in acute. Complications of the acute SAH period: cerebral vasospasm with ischemia in 3 cases, intracerebral hematoma - in 2, repeated SAH- in 3. Complications of endovascular interventions: thromboembolism of the cortical branches of the middle cerebral artery (speech and movement disorders)- in 1 observation, SAH (movement disorders)- in 1. Evaluation of impaired functions was carried out in the early postoperative period with the help of the ICF. Disturbed functions of attention and memory were identified (b117, b140, b144): lungs in 61 observations, moderate- in 10, severe- in 5. Motor disorders(b 7302, b 7352, b 750): lungs- in 7 observations, moderate- in 6, severe- in 4, absolute- in 1. Coordinator disorders (b 7603, b 2401, b 2402): lungs in 39

observations, moderate- in 2, severe- in 1. Speech disorders (b 167, b 170, b 166): lungs in 2 observations, moderate- in 1, heavy- in 1. Severe and absolute disorders were identified in patients with ischemic complications, the formation of intracerebral hematoma. Activity was assessed according to the determinant capacities. Communication(d330, d345): mild and moderate disorders were observed in 11 cases, severe disorders- in 3. Mobility: (d410, d415, d420): minor disorders- in 17 cases, moderate- in 6, severe- in 5. Walking(d450): light violations- in 7 cases, moderate- in 6, severe- in 5. Self-care(d510, d520, d530, d540, d550): in 4 cases -light, in 9- moderate and severe violations.

Conclusion: the severity of neurological disorders, the daily activity of patients depends on the presence of complications of the acute period of subarachnoid hemorrhage, the presence of complications of endovascular treatment. Considering the existence of a restriction of daily activity in patients, it is necessary to carry out early rehabilitation measures (cognitive rehabilitation, measures for movement and coordination disorders) to improve the quality of life of patients

P076

Autonomic dysfunction in the early rehabilitative phase after traumatic brain injury: reversal with intrathecal Baclofen therapy and long-term outcome improvement, a case study

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Question: What are the advantages of early ITB therapy in patients with severe TBI and AD?

Autonomic dysfunction (AD) is a major complication following severe traumatic brain injury (TBI). Conventional drug treatment often fails to control AD sufficiently. Additionally, systemic drugs (clonidine, clonazepam, morphine etc.) can hinder or prolong the neurorehabilitation process of TBI patients. Another approach to control autonomic instability is the application of intrathecal baclofen (ITB) [1]. The effect of ITB on TBI patients with AD has been investigated in a limited number of promising studies. In this case study we report the effects of ITB on AD and its

key role in the neurorehabilitation process of a patient with severe TBI.

Methods: A 16 year old male patient with TBI (GCS 3) and AD following a scooter accident was selected for ITB therapy. Radiology showed signs of diffuse axonal injury, hypoxic brain injury, and falx subdural and sub-tentorial hematomas in the setting of poly-trauma. Two months after injury the patient still had severe AD despite best medical therapy unresponsive wakefulness syndrome was described. A single shot, intrathecal baclofen injection (75mcg) was performed and the decision for definitive ITB pump implantation was made.

Results: The patient's clinical state regularly improved after ITB pump implantation and the dose was titrated to 600mcg/d. Notably, the GCS improved to 13 and systemic medications could be reduced due to resolution of AD. At the time of discharge the dosage could be reduced to 86.79 mcg/d the patient was ambulatory with a GCS of 15. 20 months later the ITB pump was explanted.

Conclusion: Through the use of ITB other medications could be reduced which resulted in clinical improvements. Before ITB therapy neurorehabilitation was not possible. Early implantation significantly reduced the resources required to stabilize the patient and facilitated the de-escalation of therapy from intermediate care to a standard neuro-rehabilitative care setting, reducing the overall time of hospitalisation. The requirement for baclofen therapy was not permanent which resulted in further improvements to quality of life.

[1] Pucks-Faes E, Intrathecal baclofen in paroxysmal sympathetic hyperactivity: Impact on oral treatment. *Brain Behav.* 2018 Nov;8(11):e01124. doi: 10.1002/brb3.1124.

P077

Effects of Early Goal Directed Physiotherapy in Neurological Patients on the Intensive Care Unit

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Question: The positive effect of physiotherapy (PT) in neurologically affected patients, especially after stroke, has already been significantly proven in scientific studies.

But what is the effect of PT in early rehabilitation, starting in the intensive care unit (ICU) or stroke unit (SU)? Is early goal-directed PT on ICU a profitable measure in rehabilitation and what special features can be expected in these patients at an early stage?

Methods: In a literature review, suitable publications were searched for in the scientific biomedical databases PubMed, Cochrane and the physiotherapeutic database PEDro. On the basis of these contents an up-to-date overview of early goal-directed physiotherapy in neurological early rehabilitation was compiled. As well, a guideline for the professional physiotherapeutic handling of neurologically affected patients is presented by the author.

Results: Early and goal-directed PT shortens the stay at ICU and requires a faster transfer to further rehabilitation facilities. What is important here, however, is not the superiority of a therapeutic measure, but the early and intensive (repetition, duration) start. A further role here is not played by a conceptual approach, but by the specificity of the treatment in terms of content and goal direction identified by the special impairments of the patients.

Conclusion: PT in neurology is an integral part of adequate rehabilitation of patients. In the special situation of ICU and SU, PT also represents an important therapeutic option in early neurological rehabilitation with regard to reducing existing neurological deficits as quickly as possible and restoring normal movement patterns. This favours the possibility for these patients to return to a largely normal life.

P078

Auditory-Based Minimally Invasive Neglect Therapy - A blinded and controlled pilot study in early-acute patients with left-sided spatial neglect

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Question: Experimental studies found that neglect patients can partially overcome their spatial inattention when being exposed to auditory cues that move towards the neglected side of space. The present blinded and controlled pilot study investigated the long-term impact of repeated right-to-left moving auditory

streams of information on neglect severity in a clinical therapeutic setting.

Method: During 15 therapy sessions, 11 early-acute patients with left-sided neglect listened to music or audio books equipped with a dynamic right-to-left movement effect. Egocentric and allocentric neglect severity were evaluated twice before the start of therapy, after the last session, and three days later. In addition, autonomy in daily living activities was surveyed. Due to the kind of stimulation chosen, line bisection was defined as the primary outcome parameter. Results were compared to a control group of 14 neglect patients who had received 15 sessions of an unspecific neuropsychological therapy.

Results: The intervention but not the historical control group experienced a reduction in egocentric neglect severity that even persisted after therapy termination. There was, however, no definite improvement of allocentric neglect and no transfer to functional abilities.

Conclusion: This study revealed that hearing right-to-left moving auditory streams of music or audio books can help neglect patients lastingly to attend their contralesional side of space. Accordingly, this well-tolerated stimulation could expand the range of therapeutic options available for treating neglect.

P079

Experiencing the rehabilitation from a different perspective: the perspective of patients with SCI

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The life of a person can change immediately and drastically in the moment of the accident which causes spinal cord injury (SCI). We can only imagine the perspective, the situation from where these patients perceive their environment. We were interested in how they see the world around them: starting from their arrival to the rehabilitation department.

We documented the patients' condition and improvement in our Rehabilitation Department for Spinal Cord Injuries for decades. In the last three years we have had the opportunity to use GoPro head cameras and see the environment and the daily activities from the patients'

perspectives from the early rehabilitation until the daily activities outside the institute, in community setting (e.g. public transportation).

Getting familiar with these recordings helps the health care professionals (nurses, physiotherapists, psychologists, ergotherapists, physicians) to understand how the patient perceives the therapies. This is important to improve the relationship between the health care providers and the person who receives it, thus increasing the efficiency of the rehabilitation.

With this presentation we have aimed to introduce the perspective of patients' with SCI, and encourage our colleagues to recognize the different viewpoint and to treat them with empathy. Familiarizing the therapists with this perspective helps them to optimize communication with the patients and to design more appropriate rehabilitation environment.

P080

Influence of posture on blink reflex prepulse inhibition induced by somatosensory inputs from upper and lower limbs

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Question: Prepulse inhibition (PPI) is a neurophysiological phenomenon whereby a weak stimulus modulates the reflex response to a subsequent strong stimulus. Its physiological purpose is to filter salient from irrelevant information at the subcortical level, thereby preventing undesired motor reactions. The pedunculopontine nucleus (PPN) plays an important role in mediating PPI as well as in controlling posture and arousal state. Our aim was to assess the effect of upright versus supine posture on PPI elicited by somatosensory prepulses to either the upper or the lower limb on blink reflexes evoked by electrical supraorbital nerve (SON) stimulation. As postural change from supine to standing mostly concerns the processing of afferents from the lower limbs we could expect a greater effect of PPI for inputs from the lower limbs in the upright posture.

Methods: Thirteen healthy volunteers underwent bilateral blink reflex recordings following SON stimulation either alone (baseline) or preceded by an electrical prepulse to the index finger (D2) or to the sural nerve (SN). All conditions were tested in supine and standing. Stimulus intensity was 8 times sensory threshold for SON, and 2 times sensory threshold for D2 and SN, respectively. Eight stimuli were applied in each of the six conditions.

Results: Baseline blink reflex parameters did not differ significantly between the two postures. Prepulse stimulation to D2 and to SN caused significant inhibition of R2. In standing, PPI-SN caused significantly more inhibition of R2 than in supine, while the inhibition caused by PPI-D2 was similar in both conditions (Fig.1, 2).

Conclusion: An increase of PPI of the blink reflex induced by afferent somatosensory stimuli from lower limbs may be required for better postural control when standing. Moreover, reduced blinking could be convenient when an unsuspected stimulus arrives in the feet while standing. A posture-dependency of arousal level underlies a common neural substrate (PPN neurons) and underscores the use of early verticalization in neurorehabilitation of brain injured patients. We provided further information on posture related changes in somatosensory integration at subcortical level.

Fig. 1

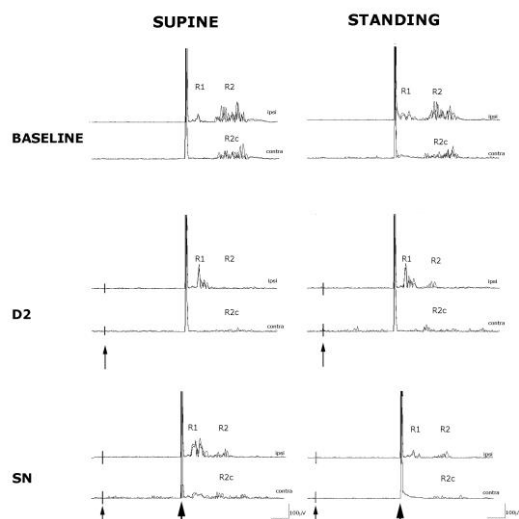
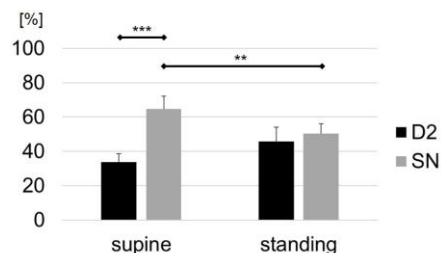


Fig. 2

MODULATION OF R2 AREA BY PREPULSE AND POSTURE



PS01

Stimulation of the oromotor system in children with a detetctive swallowing disorder at an early age

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Perinatal tension and neurodevelopmental problems poses a high risk of swallowing in children. In spite of processing of food in the oral phase of swallowing insufficient attention is paid from the early aged (to 3 years of life) the craniofacial development has a direct impact of speech.

Preverbal abillities disorder is a frequent phenomenon of damaged invervation in the orofacial field.

Coordinated activity of muscles in the area of lips, jaw, tongue, soft palate, larynx, respiratory muscles is a premise of a correct speech manifestation of a man.

The presentation focuses on the evaluation of food processing in early age in children and the stimulation of recovable subsystems with the support of supportive orofacial techniques, methodologies and the basic orientation among them. Also points out comparison of the impact of standard therapeutic procedures with combined sensorimotor approaches based on practice.

PS02

Pathologies in the ultrasound examination of the shoulder in patients after stroke - preliminary results

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Question: Stroke predisposes to pain and limitation the range of motion in the shoulder joint on the affected side. The study concerned patients in the early post stroke period. Our goal was to assess whether pathologies in the shoulder structures of the affected side can already be seen in this period and whether they are more frequent compared with non affected side.

Methods: The study involved 21 people staying in the Rehabilitation Clinic of the University Hospital no. 1 In Bydgoszcz, who suffered an ischemic stroke less than three weeks before admission to the Rehabilitation Clinic. A shoulder ultrasound examination was performed on the affected side and comparatively on the non affected side. Results: There was a subacromial impingement syndrome in the affected side in 15 people (71.4%), whereas in the non- affected side in 5 people (23.8%). The **biceps tendon sheath** effusion was found in two cases (9.6%) both the affected and non- affected side. Supraspinatus muscle tendon injury occurred more often in the non- affected side: 4 people (19%) whereas in affected side there were 3 cases (14.2%). Infraspinatus tendon injury occurred in the affected side in two people (9.6%) and in the healthy side in one person (4.7%). In three people in the affected side effusion in subacromial bursa occurred (14.2%), while on the healthy there was no such a case.

Discussion: It is probable that subacromial impingement syndrome treatment in the early period after stroke may prevent the rotator cuff damaging.

Conclusions: Stroke may results in subacromial impingement syndrome without damaging supraspinatus tendon. Other tendons in the early period after stroke are not more frequently damaged in the affected side. Further research is needed.

PS03

Thromboembolic and hemorrhagic complications in the phase of rehabilitation in a patient after spinal cord injury - a case report

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A 57-year-old patient hospitalized in the Rehabilitation Clinic in University Hospital in Bydgoszcz, Poland after spinal injury on the Th12 level, got injured one month before admission. The physical examination: flaccid paralysis of the lower limbs and abolished pain and touch sensation from level L2. The third day of hospitalization in a Doppler ultrasound screening examination of the lower limbs venous system massive deep vein thrombosis (DVT) was found. At the time of diagnosis, the patient had no clinical symptoms. D-dimer value was increased (8035mg / l). Therapeutic dose of enoxaprine 2x 0,8ml was enrolled. On the 11th day of treatment massive edema of the right lower limb occurred. The ultrasound examination revealed a massive hematoma within the iliac muscle extraperitoneally, the rectus femoris and vastus medialis size 120x80x50mm. A CT scan confirmed the hematoma of the iliacus muscle and quadriceps, size: 220 mm long. In the angio-CT active bleeding in the basin of the deep femoral artery was confirmed. Low-**molecular-weight heparin** (LMWH) was discontinued and the filter into the inferior vena cava was implanted. In subsequent days, the edema was observed in both lower limbs. UD examination revealed thrombi in the deep veins of the thigh and shin in both lower limbs. Anti- coagulation treatment was re- activated. The absorption of the right thigh hematoma was observed. After 2 months the deep vein system of the right lower limb was recanalised, while the deep veins of left limb was not. Femoral and popliteal veins of left limb and, veins of the left shin were filled with thrombi.

Conclusions: in patients after spinal cord injury in whom DVT has been diagnosed and anticoagulation treatment was implemented, haemorrhagic complications may occur. Discontinuation of anticoagulation may result in additional complications in coagulation system.

PS04

Caregiver burden and strain of primary caregivers of Turkish patients with aphasia

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In this study, our aim was to define relationship between quality of life of patients with aphasia and caregiver burden regarding their stress level to find a mean to support them and increase the possible health services they receive. Data were collected from 10 caregivers elicited by Caregiver Strain Index (CSI) (Robinson, 1983; Turkish validation: Ugur et al., 2010), Caregiver Burden Inventory (CBI) (Novak and Guest, 1989), SF-36 Quality of Life Scale - Short form (Pinar, 1996), Barthel Index for Activities of Daily Living (Collin et al., 1987) and Katz Index of Independence in Activities of Daily Living (Katz, 1983; Turkish validation: Arık et al., 2015). To analyze our data, we used nonparametric Mann-Whitney U and correlation tests. When education level of patient with aphasia and caregivers burden was compared, there was a statistically significant difference ($p=,024$). The result showed that the lower the educational level of the patient, the higher the burden of the caregiver. Paralysis was another factor that affect caregivers strain significantly ($p=,019$) and physiological functions were significantly affected ($p=,049$) in the patients with paralysis. Correlations between subtests of the SF-36 test were high ($p=,007$) and there was no significant correlation between CSI and Barthel tests ($p= ,579$). These results indicate that caregivers are under much stress when the aphasic person has paralysis and it increases their stress level and lowers their life satisfaction. Family-centred care, in which the spouse is closely involved, is an important part of the rehabilitation process, so the quality of life and caregiver's burden should also be taken into consideration in the management of aphasia. It may be helpful to form support groups for caregivers to share their experiences and feel less isolated. It is an important and culture focused study for Turkey, as health services for the impaired are still developing in which many problems are hidden within the family.

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PS05

Intensive short-term Physiotherapy for the improvement of gait and balance in people with chronic stroke - case series

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Introduction: Stroke is the most common cause of acquired brain injury and the third leading cause of death and disability in developed countries. After stroke, gait in these individuals is often slow, checking for changes in balance and quality and gait adaptation. Concerning intervention in these cases, there are several forms of which we emphasize intensive short-term training. These are approaches based on repetition and massive practice of specific tasks in a multi-hour training program. This study aims to describe and analyze the results obtained in balance and gait in 5 post-stroke patients, in chronic phase, after the application of a short-term intensive physiotherapy program.

Methodology: A case series study was conducted with five subjects, who underwent a 10-day intensive physical therapy program for gait training and balance training. The study presented six moments of evaluation. As outcomes measures we used: the Berg Balance Scale (BSE), Dynamic Gait Index (DGI), Timed Up and Go test (TUG) and the 6-minute gait test (6MGT). Pain and fatigue levels were also evaluated before and after each of the intervention sessions, as well as the number of sessions and the intervention hours performed by each participant. A description of gait quality and balance was also made.

Results: All subjects completed the 10 sessions. There were no adverse events reported. None of the subjects had pain. There

was a significant improvement in the variables studied in the 5 subjects.

Discussion: Our results showed that these individuals presented functional improvements in gait and balance after an intensive and varied intervention, of short duration. Our results are in agreement with other studies. Further studies are needed to investigate the effects of intensive interventions with different dosages in order to establish optimal intervention parameters for this type of population.

Conclusion: This protocol appears to be an intervention applicable in individuals with chronic stroke. The gait and balance functional gains were verified after the 10 intervention sessions and were maintained after 2 weeks of interruption. Further types of studies that incorporate a larger sample size with different dosing parameters are needed to help determine the most appropriate dose of this protocol or other short-term intensive interventions in this population.

PS06

Brain activity, games and balance training in the older adults: A series of cases with Wii-based therapy

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Question: Virtual reality-based therapy challenges sensory motor integration by promoting the interaction of motor, sensory, and cognitive systems, thereby inciting neuroplastic mechanisms related to functional improvements. Further investigation on the effects of this intervention on brain activity may reveal improvements in motor learning. This study aimed to describe the brain activity of older adults after a balance training with Wii games.

Methods: Three female participants were examined. A functional electroencephalographic (EEG) evaluation was performed by using a portable and wireless EEG headset during the execution of two classical balance tests, considering static (standing on a stable surface with open eyes for 60s) and dynamic condition (Timed Up and Go Test). EEG outcomes were alpha (10 Hz) and beta (22 Hz) power in a 2D brain map regarding all the 14 channels of the EEG headset. Assessments were performed before and after

10 sessions of balance treatment (50 min each, twice a week for 5 weeks) using 10 Nintendo® Wii games.

Results: The mean age was 67.33 years. EEG data revealed that beta power decreased, and alpha power increased in Patient 1 in frontal region, the area responsible for the attention and concentration for the planning and execution of a task. In the EEG analysis of Patient 1 we can conclude that in both tests, the change in alpha and beta power may indicate automatism. In Patient 2, the alpha power decreased, except in two channels (AF4 and O2) that intensified, suggesting that the patient turned her attention to her environment. Beta power decreased in its magnitude in general, indicating a lower state of alertness. For Patient 3, the frontal region showed a decrease in alpha and increase in beta after the intervention, additionally, the area responsible for the audio-tactile interaction had an increase in both power, showing that the task may have become stressful for Patient 3.

Conclusion: Wii-based therapy was positive for all patients, with different influences on brain activity, indicating neural activation after a challenging stimulus, respecting the principle of individuality.

Keywords: older adults, balance, virtual reality, electroencephalography.

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PS07

The Effects of Community Based Group Exercise Program in Frail Older Females: 24 Weeks Prospective Study

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Question: To determine the effects of supervised community based group exercise (SCGE) program in frail older adults by assessing multiple aspects of frailty including

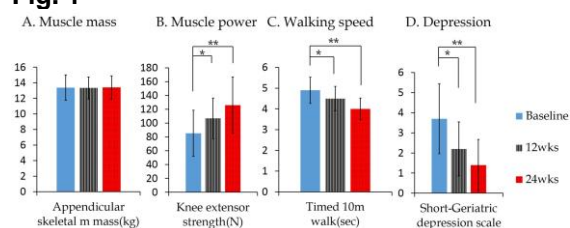
muscle strength, whole body and local muscle mass, physical activity, fear for fall, balance function, gait function and depressive mood.

Methods: 22 physically frail older individuals in regional community (21 female, age 76.3 ± 4.4 years old, height 151.2 ± 4.9 cm, weight 55.1 ± 6.2 cm, body mass index 24.2 ± 3.1 kg/m², appendicular skeletal muscle mass index 5.8 ± 0.5 kg/m², cross sectional area of rectus femoris 417 ± 58 mm², cross-sectional area of multifidus 609 ± 72 mm²) participated in 24 weeks exercise program consisted of spine extension stretching, abdominal bracing exercise, extremity stretching exercise, strengthening exercise, balance training and gait training. Clinical outcome was measured by muscle strength measurement, physical activity scale for the elderly, depression scale, fall efficacy scale, balance function, gait function, whole body muscle mass by bioelectrical impedance analysis, ultrasonographic measurement of cross-sectional areas of the rectus femoris and multifidus.

Results: No musculoskeletal injuries were reported during and after the program. Significant improvements were achieved by SCGE in grip and knee extension strength, functional reach, unipedal stand, timed up and go, Berg balance test, fall efficacy scale, gait for short physical performance battery, short-geriatric depression scale, 5 chair stand time and 30seconds chair stand ($p < 0.05$). However, no meaningful improvement was observed in appendicular skeletal muscle mass index, cross sectional areas of rectus femoris and multifidus.

Conclusion: Frail older people were able to gain significant muscle strength, functions and even improved mood without meaningful increase of muscle mass, either by whole body or local measurement, through 24 weeks of SCGE. These results demonstrate that SCGE is beneficial for physical and mental functions of old people without incurring musculoskeletal injuries.

Fig. 1



PS08

Games and Physical performance in older adults: A series of cases with Virtual Reality-based therapy

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Question: Healthy aging is generally associated with functional independence; however, conditions associated with old age, such as disturbances in postural control, may lead to motor deficits. In this sense, a variety of commercial virtual games such as, Nintendo(R) has been widely used to improve functional mobility in older adults. This is a series of cases that aimed to describe how the intrinsic characteristics of Wii games may impact functional mobility of older adults.

Methods: Three participants were examined. Physical performance was assessed with the Short Physical Performance Battery (SPPB). Assessments were performed before and after 10 sessions of balance treatment (50 min, twice a week for 5 weeks) using 10 Nintendo® Wii games.

Results: Improvements were observed in the scores of 5 games (Snowboard Slalom, Ski Slalom, Basic Step, Table tilt and Tilt City) for all patients. Although the performance in the games varied, there were some similar patterns, such as the Snowboard Slalom and Ski Slalom, both games present similar cognitive (attention) and motor demands with fast displacement of the centre of gravity (CG), being anteroposterior for the first game and laterolateral for the second. The Basic Step, Table tilt and Tilt City games are similar because they require a more agile motor response; while Table tilt and Tilt City are multi-directional CG displacements, Basic Step is similar to the task of going up and down stairs. Patient 1 showed an improvement in 70% of games and increased from 6 to 11 points in SPPB. Patient 2 demonstrated the worst performance in SPPB (5 to 7 points), but improved in 80% of the games. Patient 3 improved in 60% of the games and presented the maximum performance in SPPB (9 to 12 points). Therefore, the physical demand for Wii-based therapy may not be as sensitive for patients with good balance than for those with higher deficits in balance.

Conclusion: The cognitive and motor demands from the games may improve functional mobility in older adults. Wii-based therapy was positive for all patients, with different influences on mobility. Therefore, the principle of individuality is the key to the proper use of Virtual reality.

Keywords: older adults, balance, virtual reality, functional mobility.

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PS09

Development of an expert-consensus-based treatment recommendation for the PADOVAN-METHOD® in neurorehabilitation

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Question: Neurological disorders and language impairment with traumatic or congenital origin such as Down syndrome, microcephalia and developmental disorders amongst others are regularly treated with logopedic therapy in some cases equal to the Padovan-Method® as an approach of integrative medicine to neurorehabilitation[1-3]. Its use is based on a long-time experience of certified therapists, but official treatment recommendations are still lacking[4].

Methods: A two-step project was set up according to literature[5] to develop a consensus-based indication and treatment guideline for the use of the Padovan-Method® in neurorehabilitation. (1) Systematic literature search, (2) expert inquiry (Delphi-process).

Results: In the first step relevant and available literature with a focus on treatment recommendation, qualitative or quantitative trials and case reports to provide an outline of the therapy options and to define a scope of step two which aims to collect the expert knowledge in an online-based Delphi-process including a pretest to define a treatment recommendation.

Conclusion: A feasible and evidence-based approach to develop a treatment recommendation for the Padovan-Method® in neurorehabilitation is hereby presented. The outcome will provide indicating diagnoses and an expectancy level for prescribing physicians.

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PS10

The relationship between severity of bladder dysfunction and pelvic floor muscle strength, quality of life, fall and fatigue in Multiple Sclerosis

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Question: Bladder dysfunction is a common symptom of Multiple Sclerosis (MS). The aim of this study was to investigate the relationship between severity of bladder dysfunction and

pelvic floor muscle strength, quality of life, fall and fatigue in MS patients.

Methods: 37 female patients with MS diagnose were included in the study. The Expanded Disability Status Scale (EDSS) bladder and Body Mass Index(BMI) scores of the patients, duration of MS and incontinence were recorded. Pelvic floor muscle strength (PFMS) was evaluated with Electromyography Biofeedback (EMG-BF) (Solar Uro model). The Urogenital Distress Inventory-short form (UDI-6), Incontinence Impact Questionnaire-short form (IIQ-7), Fall Efficacy Scale (FES), Fatigue Severity Scale (FSS) were used to assess effects of incontinence, quality of life, fall and fatigue.

Results: The median scores of age was 39 (23-62) years; Body Mass Index was 24.77(16.16-33) kg/m²; MS duration was 110.95 (±85.88) and incontinence duration was 24 (0-180) months; EDSS bladder score was 1 (0-4), UDI-6 score was 5 (0-13), IIQ-7 score was 7 (0-27), FSS score was 48 (11-63), FES score was 13(0-100) points. The mean value of EMG-BF was 66.37 (±41.64) uV. There was a negative correlation between EMG-BF value and EDSS bladder, UDI-6, IIQ-7, FES scores. A positive correlation was found between FSS and FES scores, IIQ-7 score and UDI-6, FSS, FES scores (p<0.05).

Conclusion: These results showed that higher pelvic floor muscle strength is related to higher quality of life and lower fear of falling. When fatigue increases, fear of falling also increases. Higher fatigue and fear of falling reduce quality of life in MS patients. According to these results urinary incontinence should be included in evaluation when aiming to control falls and fatigue in MS patients.

PS11

Evidences on motor impairments, non-motor symptoms and compliance of telerehabilitation in Patients with Parkinson's Disease

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Parkinson Disease (PD) is a chronic neurodegenerative disease with specific needs from tailored drug therapies and rehabilitation programs with peculiar aims to increase residual abilities and activities, to improve quality of life (QoL). Despite great efforts for

early diagnosis, prevention and proper drug therapies, long term efficacy is poor. Also rehabilitation programs deal with difficulties to access to NeuroRehabilitation (NR) services and failure in maintaining frequency and intensity of treatments with a great impact on outcome results. Moreover, health's issues in costs both for patients and for health systems have an important impact on all stakeholders.

Telemedicine and TeleRehabilitation approaches are increasing and may offer a help in dealing with all mentioned issues.

We are conducting a systematic review with the specific aims to study if the telerehabilitation approach may improve both motor and non-motor impairments in Patients with Parkinson's Disease when compared to standard rehabilitation at home or as out patients at hospital. Secondary objects of the review are: how telerehabilitation is accepted, preferred and suitable to patients with PD; how Caregivers (CG) cope with technologies as NR means for PD patients.

We, in May 2019, searched for articles published from 1995 to 1st of may 2019 in the PubMed, MEDLINE, EMBASE, PEDro, The Cochrane Library, and CINHAL, using medical subject heading (MeSH) keywords and the search algorithm "(Parkinson OR Parkinson disease) AND (telerehabilitation OR remote rehabilitation OR home-based rehabilitation OR telehealth OR telemedicine OR quality of life), and in the EMBASE via the Emtree with following keywords and algorithm "(Parkinson disease) AND (telerehabilitation OR telemedicine OR quality of life)".

Inclusion criteria are: Patients with PD, >18years old (as diagnosed using any recognised diagnostic criteria).

Exclusion Criteria: Adolescents (under 18 years of age) and elderly people (over 80).

We included randomised trials with supplement of observational studies (including cohort and case-control studies) to assess the beneficial effects of the treatments.

We found a total of 291 articles: two independent raters screened the 291 articles and only 147 were selected; then 34 were evaluated as duplicates. Now we are evaluating 113 articles.

Two different researchers are independently scanning full-text copies of articles selected to identify relevant papers and to identify if they

meet the inclusion criteria for this review. Publications, which meet all the inclusion parameters, will be included in this review. A third researcher will blindly solve any conflicts. Customized data extraction forms will be developed specifically for this systematic literature review and will contain key elements, which are pertinent to address the objectives and questions of this review.

We will provide found details of PD Patients who performed studies on telerehabilitation, considering: diagnostic features (Hoehn & Yahr - MDS-UPDRS and other scores), gender and age, drug treatment if described; (L-Dopa or D-agonists), cognitive aspects (MoCA or other scale scoring) and outcome results in terms of feasibility of home telerehabilitation, efficacy and compliance or adherence to treatments with consideration on scoring of 6 minutes walking test, mini-bestest, time up and go test, fall/near fall, new freezing of gait questionnaire and other outcome measure such as PDQ-8 for QoL.

PS12

Prematurity Predicts the Co-Occurrence of Cerebral Palsy and seizures in a representative group of Population. Racial Variances Co-exist

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Background: Cerebral Palsy reflects brain and neurologic dysfunction characterized by Cognitive, motor impairments and several comorbidities including though not limited to seizures, intellectual disabilities, bowel dysfunction, renal insufficiency, and sleep abnormalities. While the specific etiology remains heterogenous prematurity, low birth weight, very small for gestational age (VSGA), maternal steroid use, brain/CNS infections, and hypoxia can predispose to cerebral palsy. We aimed in this study to assess cerebral palsy and seizure co-occurrence and to determine prematurity as an exposure function of the co-occurrence. Additionally, we aimed to determine racial variability in the correlation between prematurity and co-occurrence.

Materials and Methods: An atypical case non-case cross-sectional hybrid design was used to assess representative data from the national survey of children health, 2016, of children age 0-17 years age. Variable as ascertainment

involved the cerebral palsy seizure co-occurrence as a response or outcome, prematurity as a single predictor variable (independent and explanatory), race, sex, brain injury, low birth weight, very low birth weight, education, and poverty level. The assessment of prematurity as an exposure function of the co-occurrence was performed using a binomial regression model. The examination of confounding and effect measure modifiers was achieved through mantel haenszel stratification analysis.

Results: Of the 50,212 co-occurrence was observed in 70 children, 0.15 95% CI = 0.11 - 0.18 of the respondents. There was an association between prematurity and co-occurrence, compared to children who reported of prematurity, those who were not premature were 81% less likely to be associated with co-occurrence of cerebral palsy and seizure, RR = 0.19 95% CI = 0.11 - 0.30. There was racial heterogeneity with African American/blacks more likely to present with co-occurrence as well as prematurity as a potent predictor compared to Hispanics, whites and multirace in the correlation between prematurity and co-occurrence.

Conclusion: In a representative sample of the united states children, prematurity predicts cerebral palsy and seizure cooccurrence, additionally there exists racial/ethnic heterogeneity in these correlations. These findings are suggestive of the need to examine the risk markers in co-occurrence and to map intervention, given the several comorbidities and complexities involved in cerebral palsy.

PS13

Investigation of Long-term Potentiation- and Depression-Induced Tau Phosphorylation in Rats with Starch Based Sugar

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Objective: A lot of evidence supports the hypothesis that the mechanism of memory trace formation at the cellular level is long-term potentiation(LTP)and long-term depression(LTD).LTP and LTD are initiated postsynaptically by the activation of N-methyl-d-aspartate(NMDA)receptors(NMDARs),resulting in Ca²⁺ influx and the subsequent activation of several kinases.Studies in which experimental animals were fed with fructose for a long time

showed that insulin resistance occurred and this was associated with poor performance in hippocampus dependent learning. We wanted to study that LTP/LTD-related modifications of tau phosphorylation could be, or not be, changed with high-fructose Corn Syrup consumption.

Methods: The study was performed on sixty 21-day old male Wistar Albino rats. On the 21st day, the male rats leaving their mothers are fed with unrestricted standard rat chow and tap water, HFCS solution (8%; 0.24 Kcal/mL) or sucrose solution (10%, 0.4 Kcal/mL) for at least 21 days. The field potentials were recorded from the right dentate gyrus with stimulation of the right medial perforant path. Long-term potentiation (LTP) and LTD were induced by high and low frequency stimulation (HFS and LFS), respectively. Total and phosphorylated forms of Tau were measured in the hippocampus at least 60 min after induction of plasticity.

Results: The input/output curves of the study groups did not differ ($P > 0.05$). After 1 hour of induction, LTD was $92 \pm 8\%$ and $90 \pm 5\%$ of the pre-LFS value in the control and sucrose groups, while LTP was $121 \pm 4\%$ and $119 \pm 5\%$, respectively. There was no statistical significance between these groups ($P > 0.05$). In the group fed with HFCS, the LFS and HFS did not induce LTP or LTD responses. In control and sucrose groups, it was found that the induced LTD was accompanied by spike potentiation ($154 \pm 8\%$ and $128 \pm 15\%$, respectively) and this potentiation was not observed in the HFCS group ($P < 0.01$). Western blot experiments indicated that tau protein was hyperphosphorylated at ser416 epitope upon LTP but rather hypophosphorylated at thr231 epitope upon LTP in the whole hippocampus of HFCS-fed rats. These changes concomitantly occurred with notable alterations in the levels of total Tau.

Conclusion: These findings suggest that high fructose-containing diets may disrupt the balance between two forms of synaptic plasticity and thus adversely affect learning processes. Epitope specific tau phosphorylation had been emphasized for Alzheimer's disease-like learning deficit due to feeding with HFCS.

PS14

Transcranial alternating current stimulation over the prefrontal cortex enhances episodic memory recognition

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Introduction: Noninvasive brain stimulation has the potential to modify reconsolidation of episodic memory. It remains unknown whether transcranial alternating current stimulation (tACS) affects episodic memory, and the effect of gamma oscillations delivered to the left prefrontal cortex (PFC) on long-term memory retention has not been fully investigated.

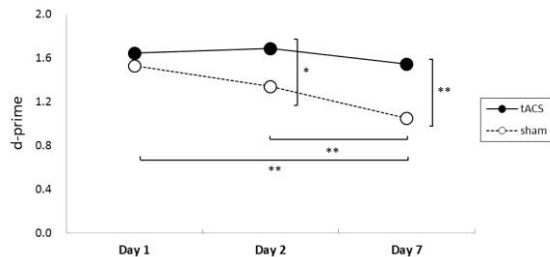
Objectives: The aim of this study was to examine whether tACS over the left PFC enhances recognition of episodic memory compared to sham-control stimulation.

Materials & methods: The study enrolled 36 healthy young adult volunteers. The participants were randomly assigned to either a tACS group [$n=18$; 14 females; mean (SD) age=21.2 (0.4)] or a sham-control group [$n=18$; 14 females; mean (SD) age=21.2 (0.4)]. Participants received either tACS or sham stimulation both while conducting a learning task on day 1 and a recognition task on day 2. The recognition task was also conducted on days 1 and 7, and response accuracy was measured at all 3 time points (days 1, 2, and 7). We calculated d-prime to confirm the accuracy of the performance. Data taken on day 1, day 2, and day 7 were compared with a two-way repeated-measures analysis of variance (ANOVA). Significant differences were further analyzed with a Bonferroni post hoc test.

Results: A two-way repeated measures ANOVA of d-prime values revealed significant main effects of intervention [$F(1, 34)=5.39$, $p=0.026$, $\eta^2=0.137$, $1-\beta=0.616$], time [$F(2, 68)=12.21$, $p<0.001$, $\eta^2=0.264$, $1-\beta=0.994$], and the intervention \times time interaction term [$F(2, 68)=4.86$, $p=0.011$, $\eta^2=0.125$, $1-\beta=0.785$]. A post hoc analysis revealed significant differences between tACS and the sham-control group at day 2 ($p=0.035$) and day 7 ($p=0.002$). There were also significant differences between day 1 and day 7 ($p<0.001$) as well as between day 2 and day 7 ($p<0.001$) for the sham-control group. Patients in the tACS group were better able to retain long-term memory compared with those in the sham-control group.

Conclusion: tACS delivered over the left PFC enhanced episodic memory retention compared to sham-control stimulation. These findings suggest that tACS over the left PFC may enhance recognition of episodic memory in healthy young adults.

Fig. 1



PS16

Intensive Motor-Cognitive Rehabilitation Treatment in Parkinson's disease: what about gender?

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Question: Parkinson's disease (PD) is a neurodegenerative disorder characterized by a plethora of motor, cognitive and behavioural symptoms. There are several indications of gender differences (GD) in PD. Motor-cognitive rehabilitation has been recognized as an effective treatment for PD, particularly for the management of axial and no-drug responsive disturbances. The effect of GD in rehabilitation outcome has not been yet analysed in PD.

Methods: we enrolled consecutive PD patients hospitalized to undergo an intensive, motor-cognitive training (IMCT). Several variables were collected, in order to evaluate the demographical features (age, education), the clinical status (years of disease, side of motor symptoms predominance at onset, LEDD, H&Y) and the neuropsychological profile (MMSE, FAB, MoCA, TMT A and B, RAVLT, WCST Stroop Test, STAI I and II, BDI, PDQ39). Different outcomes measures (including 6MWT and TUG) have been collected before and after IMCT.

Results: 143 males and 101 females were enrolled. GD were observed in LEDD ($p=0.02$ at admission, $p=0.014$ at discharge - higher dopaminergic drug doses in males), RAVLT (<0.0001 , better performances in females), PDQ39 total score ($P=0.01$, worse QoL in females) and in subdomains "mobility" ($P=0.0003$), "well-being" ($p=0.006$), "communication" ($P=0.03$) and "pain"

($p<0.0001$). A borderline difference was found in side of motor symptoms predominance at onset ($p=0.059$), with a lower incidence of left side in males, and in 6MWT ($p=0.06$) at admission, which was lower in females. At discharge, all outcome measures improved significantly in both groups ($p0.12$).

Conclusions: in line with previous data, GD are observed in LEDD, memory and QoL. Males intake higher doses of dopaminergic drugs, females show better performances in memory and their QoL is worse. Conversely, both males and females gain the same benefits from IMCT in all outcome measures. Therefore, it is conceivable that GD do not hamper the capability to re-learn actions through a motor-cognitive training. Moreover, cognitive data indicate that, while executive functions are equally exploitable, verbal strategies could be much more useful for rehabilitating females.

PS17

Changes in Structural and Functional Neural Networks in Central Post-stroke Pain following Intracerebral Hemorrhage

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Question: What changes occur in the functional and anatomical integrity of thalamo-cortical network and pain-processing network in patients with CPSP?

Methods: Forty-three patients with ICH were examined. Probabilistic tractography was performed with five cortical seeds to examine thalamocortical pathways for structural connectivity. Group differences in asymmetry of mean fractional anisotropy (FA), diffusivity, and tract volume were measured. The functional connectivity of the thalamocortical network and the pain-processing regions was explored using resting-state fMRI.

Results: The CPSP group exhibited significantly higher mean diffusivity laterality index (LI) levels and lower fractional anisotropy LI levels in the thalamo-occipitoparietal tract. The FA LI levels of in the thalamo-occipitoparietal tract were shown to be significantly negatively correlated with resting state functional connectivity of the ipsilesional insula to the ipsilesional orbitofrontal cortex. Significantly increased functional connectivity was found between the ipsilesional insula and

the ipsilesional orbitofrontal cortex, paracingulate gyrus, dorsolateral prefrontal cortex, superior frontal gyrus and the contralesional cerebellar lobule VIII. Pain intensity was significantly correlated with the functional connectivity of the ipsilesional insula to the ipsilesional dorsolateral prefrontal cortex.

Conclusions: This study showed that CPSP was accompanied by the disruption of white matter properties in the thalamocortical pathway including spinothalamic tract and changes in functional connectivity between brain regions processing the cognitive-affective aspect of pain.

Figure legends: Figure 1. Brain regions show significant differences in resting state functional connectivity between the CPSP and non-CPSP group. (A) Brain regions exhibiting enhanced resting state functional connectivity with the ipsilesional insula in the CPSP group compared with the non-CPSP group. (B) Brain regions exhibiting enhanced resting state functional connectivity with the ipsilesional posterior parietal cortex in the CPSP group compared with the non-CPSP group. All statistical images are thresholded at a voxel level threshold of $p < 0.001$ and a cluster-level FDR-corrected $p < 0.05$.

Figure 2: Correlation between the severity of CPSP and the resting state functional connectivity of the ipsilesional insula to the ipsilesional DLPFC in patients with CPSP.

Fig. 1

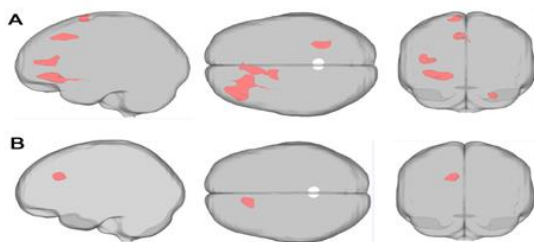
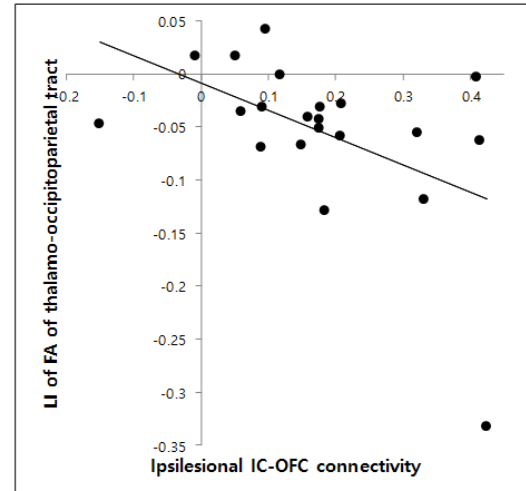


Fig. 2



PS18

Analysis of Spatio-Temporal Gait Parameters in Individuals with Hemiparesis: Effect of Lateralization

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Question: Gait dysfunctions is one of the biggest problem in hemiparesis. The aim of this study was to show effect of lateralization on spatio-temporal parameters of gait in individuals with hemiparesis.

Methods: One hundred and eight (72 participants with hemiparesis and 36 healthy control) were included in this study (ages ranging from 20 to 65 years). 72 hemiparetic participants having a score of ≤ 3 for Modified Rankin Scale and a score of ≥ 8 for Hodkinson Mental Test participated: 36 with left hemiparesis; 36 with right hemiparesis. All participants were evaluated using by BTS G-Walk Gait Analysis System to determine their spatio-temporal parameters during walking.

Results: The mean age of participants with right hemiparesis (Group 1) was 51.25 ± 12.81 years, left hemiparesis (Group 2) was 50.42 ± 11.28 years and healthy control (Group 3) was 50.11 ± 11.99 years. When gait analyses results compared to lateralization, participants with right hemiparesis had more symmetric gait ($p < 0.05$) and asymmetric pelvis movements ($p > 0.05$). At the same time, when gait parameters were compared between hemiparetic and healthy participants, cadence, gait speed, double step length and walking symmetry of hemiparetic participants decreased and duration of walking period was

found to be increased ($p < 0.05$). Hemiparetic participants have decreased pelvic tilt, pelvic oblique and pelvic rotation symmetries compared to healthy subjects ($p < 0.05$).

Conclusions: Consequently, lateralization affects spatio-temporal parameters of gait in hemiparetic patients. Participants with right hemiparesis have a more asymmetric pelvis motility but more symmetric gait than left hemiparesis. For this reason, considering of lateralization and pelvic movements in physiotherapy will be more beneficial in terms of rehabilitation.

Keywords: hemiparesis, lateralization, spatio-temporal analyses, gait

References:

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PS19

Effects of Matrix Rhythm Therapy on Balance and Gait Parameters in Spastic Hemiparetic Individuals: A Single Blind, Randomized Controlled Study

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Question: The increase in muscle tone in hemiparetic individuals causes balance and gait problems. Neurophysiological approaches, a variety of exercise programs and methods are used to improve balance and gait. The aim of this study was to investigate the effect of Matrix Rhythm Therapy(MRT) on balance and gait parameters in spastic hemiparetic individuals.

Methods: Between 20-65 years, a total of 30 hemiparetic individuals having a score of ≤ 3 for Modified Rankin Scale and a score of ≥ 8 for Hodkinson Mental Test were included in this study. Participants were randomly divided into

two groups: MRT group (Group 1; $n=15$) and control group (Group 2; $n=15$). Spasticity intensity of lower limb muscles was evaluated by Modified Ashworth Scale (MAS) and the active/passive range of motion (ROM) was evaluated by goniometric measurements. "Stand on one leg test" which was the one of BESTest sub-parameters was used to evaluate static balance. Dynamic balance was evaluated by "Timed get up&go" test which was the one of BESTest sub-parameters. Spatio-temporal characteristics and pelvic kinematics of gait were evaluated by BTS G-Walk Gait Analysis System. All individuals underwent Bobath therapy for a total of 4 weeks, 3 days a week for 60 minutes. In addition to Bobath therapy, MRT was applied to trunk and the affected lower limb for a total of 4 weeks, 3 days a week for 60 minutes in Group 1.

Results: Initially demographic and clinical features were similar in groups($p > 0.05$). While spasticity intensity, active/passive ROM, static/dynamic balance, gait velocity and cadence, and pelvic symmetries were improved in Group 1, just only dynamic balance improved after treatment in Group 2, after treatment($p < 0.05$). When the groups were compared, significant improvements were observed in spasticity intensity, active/passive ROM of knee flexion, plantar flexion and passive dorsiflexion, static and dynamic balance, gait velocity and cadence in favor of Group 1($p < 0.05$).

Conclusion: The results showed that Bobath therapy plus MRT was more effective on lower limb spasticity, balance and gait in spastic hemiparetic individuals.

Keywords: Hemiparesis, Spasticity, Matrix Rhythm Therapy, Balance, Gait

References:

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PS20

Perceived barriers to exercise in poststroke community ambulators

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Introduction: Stroke survivors usually have motor, sensory, mental, and/or language impairments, which may manifest in activity limitations and restrictions in social participation.

Objectives: To identify the perceived barriers to exercise and the associated factors of sub-acute, community ambulating stroke survivors.

Materials & methods: For this exploratory study, barriers to exercise were identified by the Exercise Barrier sub-scale of the Exercise Benefits/Barriers Scale (EBBS). Step-wise multiple linear regression analysis was employed to identify which of the clinical and sociodemographic variables, ie, age, walking speed, levels of physical activity, socioeconomic status, and depressive symptoms, could significantly predict the EBBS-barrier sub-scale scores.

Results: Ninety-five individuals, who had a mean age of 63 (13) years and a mean time since the onset of the stroke of 4 (1) months participated. The main reported barriers to exercise were related to fatigue, as well as availability and distance from the exercise places. Additional reported barriers were "lack of a person to help" and "knowledge on how to practice exercise". Perceived barriers were associated with depressive symptoms and socioeconomic status. Together, they explained 9% of the variance in the EBBS-barrier scores ($p < 0.01$).

Conclusion: Fatigue, reduced number of places, and long distances to exercise places were the main reported barriers to exercise. Depressive symptoms and socioeconomic status were the only variables that explained the variance in the EBBS-barrier scores. Stroke rehabilitation should include strategies to reduce fatigue during and after exercise, provide guidance regarding both structured and unstructured exercise venues, in addition to screening and managing depressive symptoms.

Keywords: Stroke; Barriers; Exercise; Physical Activity; Rehabilitation.

PS21

Role of Injection Laryngoplasty in Preventing Post-Stroke Aspiration Pneumonia, Case Series Report

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Introduction: Injection laryngoplasty is a common procedure for patients with vocal fold dysfunction, but the literature on its benefits has been mainly focused on those related to structural lesions or laryngeal nerve involvement. Stroke patients may be at increased risk of aspiration due to insufficient vocal fold motion. However, how injection laryngoplasty can be of benefit in stroke patients has not been reported yet.

Objective: This case-series aim to show that the injection procedure can be an effective and feasible treatment in those with post-stroke dysphagia.

Methods: We report six chronic stroke patients with long-standing swallowing difficulties and severe aspiration despite long-term swallowing rehabilitation. Laryngoscope evaluation revealed insufficient glottic closure as the cause of aspiration. Injection laryngoplasty was done per-orally under local anaesthesia in an office setting. The following parameters that included peak cough flow(PCF), maximal inspiratory pressure(MIP), maximal expiratory pressure(MEP) were collected at two time points; at baseline and 2-weeks after the procedure. Penetration-Aspiration Scale(PAS) and Functional Oral Intake Scale(FOIS) were collected at three time points; at baseline, 2-weeks and 3-months after the procedure.

Results: At two weeks, the mean peak cough flow ($\Delta = +95.09\text{L/min}$) increased significantly after the procedure. The maximal expiratory ($\Delta = +18.40\text{cmH}_2\text{O}$) and inspiratory ($\Delta = +20.20\text{cmH}_2\text{O}$) pressures also improved, indicating that injection laryngoplasty was effective in augmenting respiratory and cough parameters (Fig.1A). Postoperative PAS decreased (6.00 ± 2.23 , $p = .048$) and FOIS increased (5.00 ± 0.75 , $p = .027$) (Fig.2B). Follow-up laryngoscope findings showed improved glottic closure (Fig.2).

Conclusion: According to our cases, injection laryngoplasty proved an effective treatment that led to improved glottic closure, subsequently resulting in higher peak cough flow and improved airway closure. This all led to reduced aspiration and improved swallowing function.

Figure1. (A) Measurements of the PCF, MEP and MIP at baseline and post-2-weeks after injection laryngoplasty, one case had missing data for post-intervention MEP and MIP. (B) Measurements of the PAS and FOIS at baseline, post-2-weeks and post-3-months visits.

Figure2. Laryngoscope images showing a noticeable glottic gap before the laryngoplasty procedure, and improved glottic closure after the procedure.

Fig. 1

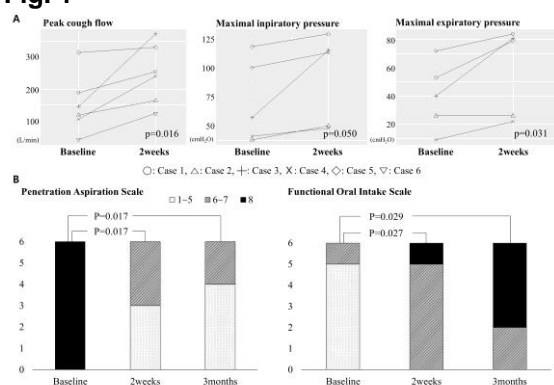
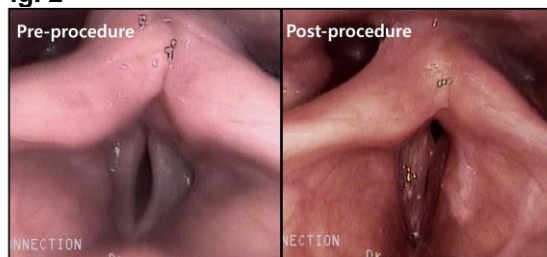


Fig. 2



PS22

Korean language specific dysarthria associated with idiopathic peripheral facial palsy

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Objective: To investigate the patterns of dysarthria in patients with idiopathic peripheral facial palsy in Korea.

Method: Seventy-eight patients diagnosed with peripheral facial palsy with time from the onset of symptom within seven days were prospectively enrolled. The initial symptom of facial palsy was examined by the House-Brackmann scale (HBS). All patients were tested by Urimal-Test of Articulation and Phonology (U-TAP), which is specialized for evaluation of dysarthria in Korean language, Han-guel, when they first visited and followed up at 4 weeks later of the onset time, respectively. The facial electromyography was performed after 7 days from presentation to the first symptom. Electric stimulation therapy and simple facial exercise education was performed in all patients. The patterns of dysarthria were analyzed by initial and follow-up U-TAP results, respectively.

Result: Among 78 patients, 50 patients (64.1%) had dysarthria in the first assessment. The six consonants and three vowels were errored in U-TAP test. The bilabial consonants "ㅂ" [p] or "ㅍ" [p^h] were substituted to labiodental consonant [f], and hard plate consonants were replaced to alveolar consonant; such as "ㄷ" [d^h] to "ㅌ" [t^h]. Bilabial consonant "ㅁ" [m] was replaced to soft palate consonant "ㅇ" [ŋ]. Liquid consonant was altered to nasal sound; for example, "ㄹ" [r] to "ㄴ" [n]. The velar consonant "ㄱ" [k] was pronounced to "ㅋ" [k^h]. The alveolar consonant in jong-seong, optional consonant located in the syllable below, was slowly spoken. The diphthong vowels "ㅜㅣ" [uɪ], "ㅡㅣ" [ø] or "ㅗㅏ" [wa] were pronounced to monothong "ㅣ" [i], "ㅓ" [ɛ] or "ㅑ" [a], and "ㅜㅓ" [moɪ] is slowly pronounced. After four weeks, 14 patients still mistook in five consonants and three vowels. The most common errors were substitution.

Conclusion: Among 78 patients with idiopathic peripheral facial palsy, dysarthria lasted more than four weeks in 14 patients. Five consonants ("ㅁ", "ㄷ", "ㅍ", "ㄹ", "ㄱ") and three vowels ("ㅏ", "ㅑ", "ㅜㅣ" or "ㅗㅏ") were still mispronounced after four weeks, and most errors were substitution. Therefore, speech evaluation and speech therapy specialized for errors in high frequency of consonants and vowels are needed in patients with idiopathic peripheral facial palsy, in Korea.

Table 1. Baseline characteristics of patients (n = 78).

Table 2. Among the patients initially with dysarthria, affecting factors of patients with improved or persistent dysarthria followed up at four weeks later.

Fig. 1

Table 1. Baseline characteristics of patients (n = 78).

	Total patients (n=78)	patients with dysarthria (n=50)	patients without dysarthria (n=28)	P value
Average age (year)	50.63 ± 16.71	56.66 ± 14.17	39.86 ± 15.33	0.000*
Gender (male: female), n	36 : 42	22 : 28	14 : 14	0.610†
Initial HB grade, n				
I				
II				0.015‡
III	3	0	3	
IV	14	8	6	
V	31	18	13	
VI	18	12	6	
ENoG in orbicularis oris muscle	10	10	0	
PCC	49.76% ± 26.48	43.93% ± 26.35	61.95% ± 21.93	0.002*
PVC				
Articulatory accuracy	97.49%(± 3.33%)	96.09%(± 3.37%)	100%	
	91.26%(± 10.41%)	86.36%(± 10.00%)	100%	
	96.25%(± 4.21%)	94.15%(± 3.87%)	100%	

HB grade, House-Brackmann grade; ENoG, Electroneurography; PCC, percentage of consonant correct; PVC, percentage of vowel correct.

* P < .05 for differences in mean values between patients with and without dysarthria by Student t-test.

† P < .05 for differences between patients with and without dysarthria by Chi-square test.

‡ P < .05 for differences between patients with and without dysarthria by Fisher's exact test.

Fig. 2

Table 2. Among the patients initially with dysarthria, affecting factors of patients with improved or persistent dysarthria followed up at four weeks later.

	Patients with improved dysarthria (n=36)	Patients with persistent dysarthria (n=14)	P value
Average age (year)	55.31(±14.64)	60.14(±11.62)	.241
Gender (male: female), n	17 : 19	5 : 9	.304
Initial HB grade, n			.030*
I	0	0	
II	7	1	
III	16	2	
IV	9	3	
V	4	6	
VI	0	2	
ENoG in orbicularis oris muscle	48.45(±25.05)	28.74(±23.16)	.756

HB grade, House-Brackmann grade; ENoG, Electroneurography

* P < .05 for differences between patients with and without persistent dysarthria by Logistic regression analysis.

PS23

Exploring the Practitioners Problems Identified in Community Reintegration in Korea

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Question: This was to develop a standard community reintegration model for convalescent patients with stroke and spinal cord injuries using the Knowledge-To-Action(KTA) framework. "Problem identification" was performed as the first phase of the KTA framework to explore the practitioners' problem identified in the process of community reintegration to develop a standard community reintegration model in rehabilitation setting.

Methods: Fifteen practitioners(6 social workers, 2 physiatrist, 2 nurses, 2 PT, 2 OT, and 1 psychology counselor) with average 17.4 years of clinical experiences were participated. Participants were divided by professional groups and each group was asked to discuss identified problems for 60 minutes. A summative content analysis was used to evaluate the transcribed interviews. Themes were classified into one of the institutional, interpersonal & individual levels based on the Socio-Ecological model.

Results: Thirteen themes were emerged as practitioner's problems identified in the process of community reintegration. For institutional level, (1)necessity of changing hospital policy from hospital- to community-centered reintegration support, (2)necessity of agreed definition about reintegration services and role and responsibilities of practitioners related to reintegration services (3)necessity of reintegration guidelines differentiated by patient status, (4)a manpower shortage for supporting reintegration, (5)difficulty in connecting discharged patients to the community, and (6)necessity of computing system for information sharing between departments were emerged. For interpersonal level, (1)necessity of team approach in designing and implementing reintegration programs, (2)lack of uniformity in the way of conducting reintegration services, (3)necessity of information sharing between intra and inter departments, and (4)increased workloads of social workers. For individual level, (1)necessity of customized reintegration services by type of disability,

functional status, disposition and needs of patients, (2)necessity of introducing early psychological intervention, and (3)necessity of complementing reintegration services for preparing a discharge were emerged.

Conclusion: The problems on the institutional and interpersonal levels were much more identified than those on the individual level by participants. This result suggests that more systemic and cooperative approach in the process of community reintegration services is needed.

PS24

Long-term Hand Function Prognosis and Corticospinal Tract Integrity in Chronic Stroke Patients

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Introduction: The restoration of hand function is an important goal for patients with stroke.

Objectives: This study investigated the relationship between corticospinal tract (CST) integrity and the functional status of the hand in patients with stroke 6 months after onset and evaluated which values would be useful for predicting hand function

Methods: The present retrospective cross-sectional observational study assessed 44 patients with stroke who were able to walk without using a walking aid or orthosis. Patients were classified into three groups by hand function: no recovery (unable to grasp), partial recovery (able to grasp, unable to oppose), and full recovery (able to grasp and oppose). All subjects underwent diffusion tensor imaging (DTI) at 6 months after stroke onset. Values for fractional anisotropy (FA) at the mid-pons and pontomedullary junction and CST fiber number (FN) were measured. The normalization ratio for FN and FA was calculated using the following formula: data for affected hand/data for non-affected hand.

Results: The normalized FN, FA (mid-pons and pontomedullary junction) values differed significantly. The FA (mid-pons) value for the full recovery group was higher than those for the other groups. The FA (mid-pons) value for the partial recovery group was higher than that for

the no recovery group. The normalized FA (mid-pons) value differed significantly among all three groups.

Conclusions: The present study showed that CST integrity in patients with chronic stroke was related to functional hand status. In addition, the mid-pons FA value was more predictive of functional restoration of the hand than the FN or FA value at the pontomedullary junction. These results may be useful in predicting the functional restoration of the hand and understanding the functional prognosis of stroke.

Figure 1. Representative images of the CST in subjects from the (A) full recovery, (B) partial recovery, (C) no recovery groups. The non-affected tract is shown in red, and the affected tract in yellow.

Table 1. Median (interquartile range) of normalized values of each group.

* $P < 0.01$. The three groups were compared using the Kruskal–Wallis test.

Comparison between P1: full and partial recovery, P2: partial and no recovery, P3: no and full recovery groups with the Mann–Whitney U -test with the Bonferroni correction. P1, 2, 3 < 0.0167 deemed to be significant.

Ref. Jang et al. *Neurosci Lett* 572, 1-6. doi: 10.1016/j.neulet.2014.04.044.

Fig. 1

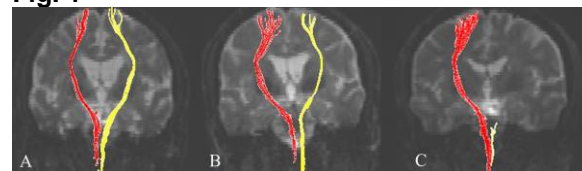


Fig. 2

	Full vs Partial		Partial vs No		Full vs No	
	Full recovery	p ¹	Partial recovery	p ²	No recovery	p ³
Normalized FN	0.54 (0.40 – 1.07)*	0.022	0.29 (0.12 – 0.62)*	0.017	0.03 (0.00 – 0.09)	0.000
Normalized FA (Mid-pons)	0.92 (0.86 – 1.08)*	0.000	0.74 (0.64 – 0.85)*	0.009	0.62 (0.17 – 0.71)*	0.000
Normalized FA (pontomedullary junction)	0.83 (0.74 – 1.07)*	0.136	0.81 (0.66 – 0.89)*	0.001	0.57 (0.24 – 0.66)*	0.000

Effects of Adjuvant Mental Practice Using Inverse Video of the Unaffected Upper Limb in Subacute Stroke: A pilot Randomized Controlled study

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Question: Mental practice(MP) is defined as a dynamic process during which motor action is re-activated internally without any active body movement. It has been proposed as a potential adjunct to promote motor restoration after stroke. In this study, we aim to assess whether adjuvant MP is more effective than conventional rehabilitation therapy alone in subacute post-stroke patients with severe motor impairments utilizing inverse vide based on a recent case study demonstrating the effectiveness of MP using an inverse video of a post-stroke patient's unaffected limb via complementing the vividness of MP.

Methods: Participants (n=20) with severe hemiplegia after a unilateral first-ever stroke within 6 month were devided to 2 groups. (Fig.1). The Experimental group(Group A) performed MP for 20 minutes, 5 times a week by watching via their smart phone or tablets in addition to following a conventional rehabilitation therapy for 30 minutes 5 times a week, over 4 weeks. Control group received only the conventional rehabilitation therapy over 4 weeks. Primary outcome measure were the Fugl-meyer assessment for the Upper extremity(FMA-UE), Manual function test (MFT) and Functional Independence measure(FIM).We assessed twice for each, at baseline and after the intervention.

Results: Baseline characteristics such as age, gender, time since stroke onset, stroke type and K-MMSE were not significantly different between 2 groups. In FMA-UE and FIM scores, significant differences were found from baseline to post intervention assessments in both groups, whereas in between-group analysis, there was no statistically significant mean differences in FMA-UE, MFT and FIM scores. (Fig. 2)

Conclusion: In this study, the results of our study showed that adjuvant mental practice has no positive effect on motor recovery and functions in subacute post-stroke patients with severe motor impairment.MP would be an

attractive treatment approach for the post-stroke patients who rarely use their limb. Further studies with large samples sizes are needed to verify its" clinical values for post-stroke rehabilitation.

Figure Legends:

Fig. 1. The flow diagram of enrollment

Fig. 2. Box and whisker plot of primary and secondary outcome measures for pre and post intervention.

Fig. 1

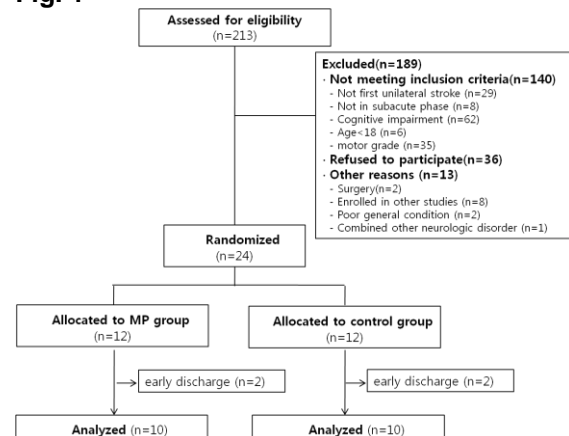
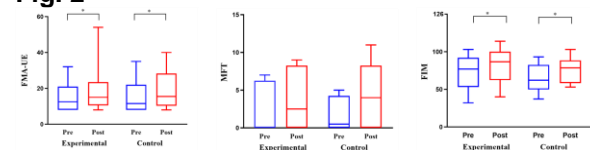


Fig. 2



Pulmonary Function Test as a Functional Outcome Predictor of Stroke Patients

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Introduction: Stroke patients may experience pulmonary dysfunction due to reduction of respiratory muscle strength. These phenomena lead to the weakness of trunk muscle including intercostal and abdominal muscles which makes it difficult to control posture and which can result in functional movement disorders.

Objective: We think that post-stroke pulmonary function indirectly reflects the trunk control ability of patients who are not able to maintain sitting balance. Therefore, we aimed to examine the association between pulmonary function test (PFT) and trunk balance, and the

relationship between short-term clinical outcomes and PFT in subacute stroke patients.

Patients & Methods: We prospectively recruited 52 patients with first-ever stroke during the period of August, 2017 through April, 2018. All patients were the inpatients referred to our rehabilitation department within 6 months of onset and cognitive capability of complying with pulmonary function test. Patient with recent surgical procedure, disease of respiratory condition and tracheostomy status were excluded.

To evaluate respiratory function including peak cough flow (PCF), maximal inspired pressure (MIP), maximal expired pressure (MEP), forced vital capacity (FVC) and forced expiratory volume in 1 second (FEV1) and FEV1/FVC were performed at baseline and 4 weeks after conventional rehabilitation. Trunk balance was checked by using trunk impairment scale (TIS). To evaluate correlation of respiratory function and functional outcomes (Berg Balance Scale (BBS) and functional independence measure (FIM)) were also checked. Spearman's correlation analysis was used to analyze the correlation of them. Multiple regression analyses were performed.

Results: Table 1 revealed initial PCF, FVC and FEV1 were correlated with those of TIS at admission. The initial PCF and FVC is a significant predictive value for TIS score only in multivariate regression analysis. Table 2 reveals that initial PCF is a significant predictive value for follow up BBS and FIM score at discharge in multivariate regression analysis.

Conclusion: Several parameters of PFT could reflect the trunk balance in post-stroke patients. We suggest that the PFT can be used for evaluation of trunk balance. This can also be used as a predictor for functional outcome.

Fig. 1

Table 1. Partial correlation coefficient(*r*) adjusted for Age, Height and Weight and Multiple Linear Regression adjusted for sex, age, body mean index, mini-mental state examination(MMSE) and albumin between the Pulmonary Function and TIS (n=52)

Variables	Partial Correlation(TIS)		Regression(TIS)	
	<i>r</i>	<i>p</i> -value	β	<i>p</i> -value
PCF	0.646	<0.0001**	0.733	<0.0001**
MIP	0.007	0.959	0.040	0.445
MEP	0.171	0.239	0.056	0.704
FVC	0.446	<0.001**	0.341	0.019*
FEV1	0.317	0.026*	0.235	0.110
FEV1/FVC	0.064	0.662	0.021	0.884

P*<0.05, *P*<0.01
PCF, Peak cough flow; MIP, Maximal inspired pressure; MEP, Maximal expired pressure; FVC, Forced vital capacity; FEV1, Forced expiratory volume in 1 second; TIS, Trunk impairment scale at baseline

Fig. 2

Table 2. Multiple Linear Regression Analyses for Functional Outcome(dBBT, dFIM) adjusted for Sex, Age, Body Mean Index, Mini-Mental State Examination(MMSE) and Albumin

Variable	dBBT		dFIM	
	β	<i>p</i> -value	β	<i>p</i> -value
PCF	0.513	0.001**	0.283	0.025*
MIP	0.225	0.113	0.153	0.177
MEP	0.217	0.145	0.051	0.672
FVC	0.387	0.008**	0.054	0.658
FEV1	0.280	0.062	0.024	0.845
FEV1/FVC	0.028	0.851	0.017	0.889

P*<0.05, *P*<0.01
PCF, Peak cough flow; MIP, Maximal inspired pressure; MEP, Maximal expired pressure; FVC, Forced vital capacity; FEV1, Forced expiratory volume in 1 second; dBBT, Berg balance scale at discharge; dFIM, Functional independence measure at discharge

PS27

Effects of trunk exercise on unstable surface on balance in patients with stroke

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Question: Imbalance is common among patients with stroke and may cause difficulty in daily activities or increase risk of falling. Using unstable surface for exercise training may increase balance demands and facilitate better coordinated muscle activations for balance control. Previous studies of unstable surface trunk exercise (TR-ex) for chronic stroke patients showed inclusive effects based on clinical measures. It is unclear if TR-ex training on unstable surfaces would lead to better sitting and standing balance in subacute stroke patients when assessed by more sensitive biomechanical measures.

Methods: Twenty-three first time unilateral stroke patients were randomly assigned into experimental (EXP, n=13) and control (CON, n=10) group to receive 30 min, twice weekly exercise training for 6 weeks in addition to their daily routine stroke rehabilitation. EXP received TR-ex on unstable surfaces in supine and sitting positions and CON received upper limb exercises in a seated position with back support. The primary outcome measures included postural sway (maintaining static balance for 30 sec) and forward and lateral (to the hemiparetic side) leaning distances (dynamic balance) in sitting and standing, measured by a force platform to derive center of pressure motion. A clinical measure of trunk control and balance (Trunk Impairment Scale, TIS) was also used. The assessors were not aware of the group assignment. Nonparametric

tests were used for within- and between-group comparisons.

Results: Between-group comparisons of the pre-test data showed that the two groups did not differ significantly in their age, gender, onset duration, TIS or sitting and standing balance (table 1). Within-group comparisons showed significant improvement in TIS and static and dynamic sitting and standing balance for both groups after training (figures 1 and 2). Between-group comparisons of the post-test data showed that EXP had significantly greater forward and lateral leaning distances in sitting and standing, but not better TIS score or smaller postural sway, compared to CON (figures 1 and 2).

Conclusions: Unstable surface trunk exercise was effective in improving dynamic sitting and standing balance. Clinical measures, such as TIS, might not be sufficiently sensitive to detect the effects.

Fig. 1

Table 1. Patient characteristics and performance at baseline.

	Experimental group Mean (SD) (N=13)	Control group Mean (SD) (N=10)	p
Basic characteristic			
Age (year)	58.8 (11.1)	62.8 (16.2)	0.334
Gender (Male:Female)	9:4	6:4	0.492
Height (cm)	163.1 (7.8)	165.3 (6.4)	0.473
Weight (kg)	62.0 (11.7)	73.0 (16.7)	0.831
Stroke type (Hemorrhagic : Ischemic)	4:9	3:7	0.461
Onset time (week)	7.4 (2.6)	6.7 (1.8)	0.512
Trunk Impairment Scale	14.6 (3.5)	13.3 (4.2)	0.374
Sitting balance			
Static (mm) ^a	13.9 (11.0)	12.1 (10.3)	0.313
Dynamic (mm) ^a			
Forward leaning	43.9 (19.2)	36.0 (15.2)	0.051
Lateral leaning	54.4 (16.0)	63.3 (7.7)	0.443
Standing balance			
Static (mm) ^a	837.4 (1193.4)	552.2 (414.2)	0.744
Dynamic (mm) ^a			
Forward leaning	54.0 (13.7)	44.9 (14.7)	0.270
Lateral leaning	94.6 (30.3)	70.3 (34.1)	0.181

^apostural sway area of the center of pressure; ^aleaning distance

Figure 1. Trunk Impairment Scale before (filled bars) and after (striped bars) training

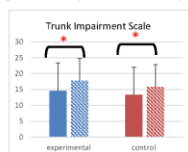
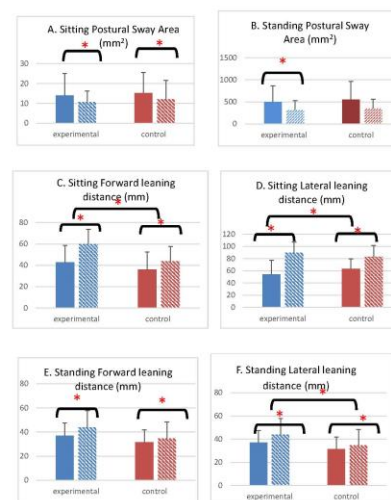


Fig. 2

Figure 2. Balance performance before (filled bars) and after (striped bars) training. *p<0.05



PS28

Effects of Cerebrolysin® in Patients with Minimally Conscious State After Stroke: An Observational Retrospective Clinical Study

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Introduction: The neurotrophic drug Cerebrolysin is composed of low-molecular weight peptides and amino acids and has been shown to have neuroprotective and neuroplastic properties. Cerebrolysin has been reported to promote the recovery of motor functions in central nervous system disorders, however, the effects on the cognitive functions in post-stroke patients have not yet been studied extensively. Therefore, we aimed to examine the effectiveness of Cerebrolysin on improving the consciousness level of stroke patients with minimally conscious state (MCS).

Methods: In this retrospective study we included ischemic and/or hemorrhagic stroke patients with MCS according to the Coma Recovery Scale - Revised (CRS-R), who were admitted to our hospital between 2014 and 2017.(Fig.1) All patients received comprehensive rehabilitation therapy including physical and occupational therapy. We compared patients treated with Cerebrolysin against patients who did not receive Cerebrolysin. Patients were included in the verum group if they received 10 mL Cerebrolysin IV for at least 20 days. CRS-R scores were assessed at admission and discharge.

Results: Of 1531 patients screened, 75 were included in the study (Cerebrolysin, n=43; control, n=32). Baseline characteristics were similar between groups. At discharge, approximately two months post-stroke, Cerebrolysin treated patients improved significantly in the CRS-R ($p=0.010$), especially in the oromotor ($p=0.003$) and arousal subscales ($p=0.038$). (Fig. 2) No safety issues were observed.

Conclusion: This retrospective study suggests that Cerebrolysin may improve the level of consciousness in stroke patients with MCS, which should be further investigated in a well-designed, double-blind, placebo-controlled, randomized trial.

Fig. 1

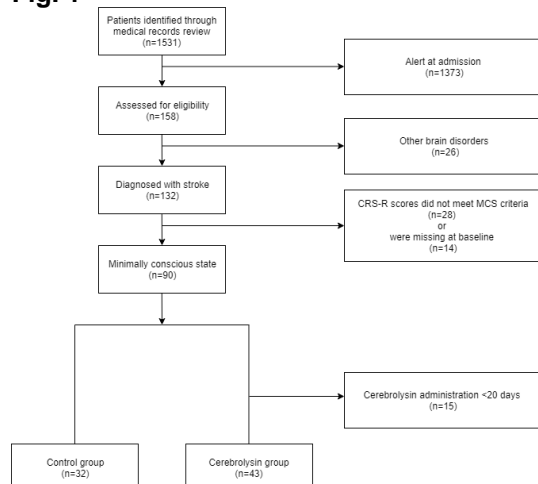
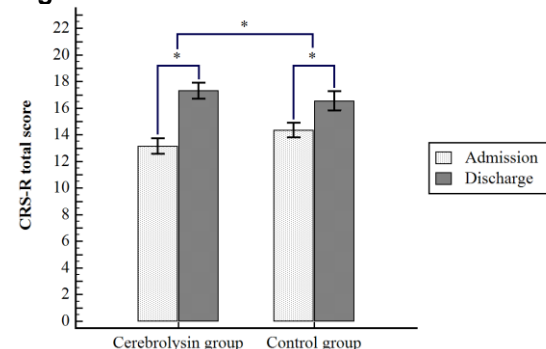


Fig. 2



PS29

Physical activity after neurorehabilitation

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Question: Physical activity enables social participation and is a crucial aspect of overall health. Therefore, it is one of the most relevant aspects of neurorehabilitation of stroke patients. However, little is known about the development of the patients' physical fitness and activity in the first months after rehab discharge. Moreover, factors that predict the patients' progress have not yet been identified.

We investigated the level of physical activity of stroke patients during their stay in neurorehabilitation and four to six weeks after discharge. The aim of this study was to detect changes in activity between neurorehab in a clinical setting and the first weeks at home and to identify predictors for this change.

Patients and methods: We included 167 patients who had an ischemic (n=154) or haemorrhagic (n=13) stroke with a mean age of 72.5 years. Physical activity was measured by activity trackers the patients wore within the last week of their neurorehab and within one week four to six weeks after discharge from the clinic. Additionally we used multiple questionnaires (e.g. IPAQ, AES, HADS) and clinical scores (e.g. Barthel Index, Rankin Scale) to search for possible predictors of a change in activity.

Results: The analysis revealed heterogeneous results, in that some patients showed a higher level of physical activity after being discharged from the clinic while others decreased their activity. Overall, there has been a mean decrease of 39% [-69%; -9%] in activity. Most of the time patients who were more active in the clinic remained also more active at home than

patients who were less active during the rehabilitation. Furthermore, there is a strong correlation between subjective reports on the activity via IPAQ and the objective measure with the activity tracker; $r_s=.501$, $p<.001$.

In a linear multiple regression we found a significant influence of premorbid activity ($\beta=.296$, $p=.011$), Barthel-Index at the time of discharge ($\beta=.392$, $p=.001$) and AES ($\beta=.253$, $p=.027$) on the physical activity during the second time of measurement.

Conclusion: Stroke patients' physical activity at home often decreases in comparison to their activity during rehabilitation. Apathy, low premorbid activity and a lower Barthel-Index predict a decrease in activity. Outpatient therapies are needed to help these patients maintain their progress made in neurorehab.

PS30

Contra-lateral unintended upper arm movement during unimanual tasks in children with cerebral palsy

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Objective: To characterize the associated reaction (AR) in unintended contralateral arm movement (defined association reaction) across multiple muscles during unimanual tasks and to identify factors related to AR in children with cerebral palsy (CP).

Design: Cross-sectional study

Setting: University hospital pediatric rehabilitation clinic

Participants: Thirty-five children with CP (21 unilateral CP and 14 bilateral CP)

Interventions: Not applicable

Main Outcome Measures: The extent of AR of the contra-lateral, non-task hand was assessed while performing three tasks. Surface electromyography (SEMG) was used to assess the root mean square (RMS) values of firing muscular activity.

Results: The AR scores of children with unilateral CP were significantly higher in both more-and less-affected limbs than those of children with bilateral CP and also were higher

in the more-affected limb than in the less-affected limb of children with unilateral CP. SEMG data on the non-task hand showed motor overflow up to elbow muscles in the more-affected limb. The RMS ratio was significantly higher in children with AR than in children without AR ($p<0.05$). In the more-affected limb, AR was strongly associated with Melbourne Assessment 2 (MA-2) and moderately associated with RMS ratio and age, whereas on the less-affected side, AR score was moderately associated with MA-2. On multivariable analysis, both age and MA-2 were related with the AR scores only in the more-affected limb. ($p<0.05$).

Conclusions: Children with visible AR displayed altered muscle activation patterns depending on task and side. Age and upper arm function were the significant factors related to extent of AR in the more-affected limb in children with CP.

PS31

Oxygen consumption and energy cost of the paretic and non-paretic upper limbs of individuals with stroke during unilateral arm crank submaximal exercise testing

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Introduction: After a stroke, high energy demands during physical activities may lead to physical inactivity and adversely impact functionality. The knowledge about energy expenditure of various physical activities of stroke individuals is important for the development of physical activities and exercise programs for this population.

Objective: To investigate the oxygen consumption and energy cost of the upper limbs of individuals with chronic stroke during unilateral arm crank submaximal exercise testing, compared with healthy controls.

Materials & methods: For this experimental study, fourteen individuals with chronic stroke and 12 healthy controls, matched for age, sex, and body mass index participated. Main **outcome measures included** oxygen consumption (VO_2), obtained using a gas analysis system; and energy cost, calculated by

dividing the peak VO₂ by the maximum load achieved during testing.

Results: For the oxygen consumption, ANOVA did not reveal any significant differences between the sides or groups. However, for the energy cost, significant interaction between side and group factors was found ($F=9.34$, $p=0.005$), indicating that the groups demonstrated different behavior during the tests. The energy cost for the paretic side of the stroke group was $0.47 \text{ mL.kg}^{-1}.\text{min}^{-1}.\text{W}^{-1}$ (95% CI 0.12 to 0.81) higher than that for their non-paretic side and $0.42 \text{ mL.kg}^{-1}.\text{min}^{-1}.\text{W}^{-1}$ (95% CI 0.02 to 0.82) higher than that for the non-dominant side of the control group. The percentage difference regarding the energy cost between the sides was 41% higher for the stroke, than for the control group.

Conclusions: During unilateral arm crank submaximal exercise testing, there was no difference in oxygen consumption between upper limbs of either group or between groups. However, the energy cost of the paretic upper limb was nearly double that of both the non-paretic upper limb of the stroke group and the non-dominant upper limb of the control group. The high energy cost of the paretic upper limb led to a higher percentage difference between the upper limbs of the stroke individuals, compared to healthy controls.

PS32

Development of a Virtual Reality-based serious game for elderly impaired postural balance rehabilitation: A preliminary study using the game Virtualter

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Question: The use of stairs is commonly avoided by elderly for being cause of falls and restriction in functional mobility. Thus, it is recommended to insert step training associated with postural balance in rehabilitation programs using effective and safety environments, for example with virtual serious games. Serious games in neurogeriatric rehabilitation combine sensory, motor and cognitive elements relevant to treat postural balance regarding neurological approach, such as feedback, motivation, therapeutic adjustments and challenge. Thus,

the objective of this study is to describe the development of the serious game "Virtualter (VA)" as a tool to practice stationary walk, lateral reach and steps training of elderly with impaired postural balance by using a motion-capture device (Microsoft® Kinect).

Methods: VA was idealized by computer scientists and physiotherapists from Federal University of Rio Grande do Norte, Natal, Brazil. This study discusses the stages necessary for the development of VA: Therapeutic x game goal; Feedback; Limit of stability (LOS)-correlation between Kinect data and Lateral Reach Test of 20 healthy elderly; Preliminary game usability (System Usability Scale - SUS) assessed by 06 physiotherapists and 05 science and technology professionals.

Results: VA was designed regarding variability of practice, since the game was constructed under 03 levels with variation in landscapes and in the amount of step ups and down. Although the scenarios and the avatar were created respecting standards of ecological validation, we inserted abstract components to acquire therapeutic objectives by the "absence of the disease" during the game. In feedback aspects, VA offers continuous and terminal feedback and motivation to use intrinsic feedback due to the presence of real steps on the way. LOS for Lateral Reach Test was: right 23.2 ± 4.77 ; left 22.9 ± 4.86 and for Kinect capture: right 21.1 ± 5.47 ; left 22.7 ± 6.42 . Bland-Altman graph showed a bias of 0.19 for left and 2.02 for right side. SUS showed a satisfaction of 67.7%.

Conclusion: Although a wide affordance of serious games for rehabilitation purposes, VA raised the discussion of developing games in which all stages should be thought in a multidisciplinary accordance. In addition, VA is a good usability product, with low cost investment, supporting the access of innovative and valid technology for neurorehabilitation in countries with little investment in technology for health. Figure 1. Virtualter

Fig. 1



PS33

Intrathecal baclofen therapy in lower limb post stroke spasticity: a literature review

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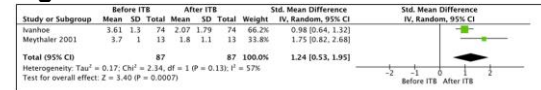
Question: One out of four stroke patients develops spasticity, complicating daily activities. Adequate treatment of spasticity after stroke is necessary. Intrathecal baclofen therapy (ITB) has been proven successful in treating spasticity as a result of multiple sclerosis, cerebral palsy and spinal cord injury. However, little is published about the effect of ITB on spasticity after stroke. The aim of this review was to summarise the evidence related to ITB treatment in stroke patients with spasticity of the lower limb.

Methods: Following databases were searched for randomised controlled trials (RCT): Scopus, PubMed, EMBASE and CINAHL. Search terms were "Intrathecal baclofen", "Stroke", "Antispasmodics" and "Spasticity". Outcome parameters included Ashworth Scale (AS), Functional Independence Measure (FIM), quality of life (QoL) and pain. Risk of Bias (RoB) was assessed by the Cochrane Collaboration modified tool for assessing RoB for RCT's and by the Newcastle Ottawa Scale for non-randomised studies. Meta-analysis was performed if possible.

Results: In total, four studies were included with a maximum follow-up period of one year. Due to heterogeneous methodology, the results of only two studies could be used for a meta-analysis of the AS. Meta-analysis shows a significant decrease of the AS after one year of treatment with ITB on lower limb spasticity after stroke. (Figure 1: Forest plot of the effect of ITB after 12 months of treatment. Two studies are included. ITB = Intrathecal Baclofen.)

Conclusion: This review shows evidence for treatment with ITB of spasticity after stroke in the lower limbs. There is need for studies with a large sample size and a long follow-up to determine the long-term effects of ITB on spasticity after stroke.

Fig. 1



PS34

The Effect of assistive force of rehabilitation robot on upper extremity function in stroke patients: a single blinded randomized trial

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Question: Recently, robot-assisted therapy has been reported to have beneficial effects on upper extremity function among stroke survivors. However, it lacks of studies about the differential effects according to the characteristics. We tried to explore whether assistive force of rehabilitation robot is beneficial or not, as assistive force has been regarded as important characteristics.

Methods: This study was a single blinded randomized controlled trial among chronic stroke survivors who showed upper extremity muscle strength above of Medical research council grade 3. Participants were randomly allocated to the robot supported by assistive force(SA) (Armeo® Power; Hocoma Inc, Zurich, Switzerland) or robot without assistive force(WOA) (Armeo® Spring; Hocoma Inc, Zurich, Switzerland). Each participant completed 20 sessions of 30-minute training with conventional therapy over 4 weeks. The primary outcomes were changes in Fugl-Meyer assessment of the upper extremity function (FMA-total and FMA-proximal) and Wolf Motor Function Test (WMFT-score, WMFT-time and WMFT-weight). Assessments were performed at baseline (T0), 2 weeks (T2), 4 weeks (T4) and 8 weeks (T8) after the baseline. Comparisons between two groups were performed using RM-ANOVA and p

Results: Among 20 randomized patients, 19 participants (10 in the the SA group, 9 in the WOA group) completed 4 weeks of intervention. There were no significant differences in baseline characteristics between the SA and the WOA group. Both groups showed improvements in most of outcomes over time ($P < .05$) except WMFT-weight. Both groups

showed no significant differences in WMFT-weight over time. ($P=.06$ and $P=.21$) There were no statistically significant time x group interactions for all outcomes including FMA-total, FMA-Proximal, WMFT-score, WMFT-time and WMFT-weight. ($p=.43$, $p=.68$, $p=.50$, $p=.46$ and $P=.69$, respectively)

Conclusions: In our study, both groups showed statistically significant improvement on upper extremity function after intervention. However, there were no statistically significant differences between presence or absence of assistive force. In the future, detailed kinematics study could reveal minor difference between two types of robot.

PS36

A self-management program to improve physical activity in ambulatory individuals after stroke: a pilot study

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Introduction: Physical inactivity is considered one of the main risk factors for stroke. The increase in life expectancy associated with higher survival rates after stroke reflect the need to focus on strategies that increase the level of physical activity, independence and adherence to exercise practice by stroke individuals. It is known that regular practice of physical exercises brings benefits, such as; improvement in mobility; balance; muscle strength; and quality of life; and decreasing dependence and mortality. However, even in the face of such benefits many stroke survivors remain inactive.

Objectives: to investigate whether self-management program in ambulatory individuals after stroke improves the physical activity levels, walking capacity, quality of life and depressive symptoms.

Materials and methods: A Phase I, single-group, pre-post intervention study was carried out. Inclusion criteria consisted of having had stroke for less than 6 months, walking speed $\geq 0.8\text{m/s}$, and medical release for physical

exercise. Exclusion criteria were cognitive impairment and aphasia. Participants were measured for physical activity level by using accelerometers for 7 days, self-selected walking speed, walking capacity, quality of life, and depressive symptoms. The self-management program consisted of six home-based sessions over 3 months, including health education, identification of exercise preference and barriers to exercise, and discussion on strategies to overcome the barriers to promote and increase exercise practice. The duration of each visit was set at up to 60 minutes. All participants were measured three times (before and at the end of the intervention and after 3 months of cessation of intervention). The study was approved by the Research Ethics Committee (CAAE: 65672517.6.0000.5149) and registered in REBEC (RBR-6bdmsk).

Results: At the end of the intervention the participants increased 47 steps/day ($p=0.90$); 120m of walking distance ($p=0.005$); 8 points out of 100 in quality of life ($p=0.13$) and decreased 2 points out of 15 on depressive symptoms ($p=0.007$). After three months of cessation of intervention, the improvements in walking capacity and depressive symptoms were maintained.

Conclusions: The present results indicate that, although the level of physical activity has not changed, this program may improve walking capacity and depression symptoms in individuals with mild disabilities in the sub-acute stage of stroke.

PS37

Efficacy of a virtual reality-based rehabilitation programs on the postural control of stroke patients

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Introduction: Stroke is currently one of the main causes of death and disability in Portugal. It provokes changes on postural control (PC) that interfere with the functional recovery of stroke patients [1,2]. Virtual reality (VR) and interactive videogames (IV) have been used in rehabilitation programs that intend to improve postural control on this population.

Objectives: This study aims to describe the different rehabilitation programs that use VR and/or VI with the main goal of improving PC on stroke patients, and to assess the efficacy of these programs on the PC of the target population.

Methods: A systematic search of Randomized Controlled Trials (RCT) was conducted on Stroke, Scielo, Liliacs, PEDro and Medline databases, between January 2008 and January 2018, with the terms: "brain injury", "stroke", "virtual reality", "video games", "balance" and "postural control". After applying the inclusion and exclusion criteria, 10 RCT were included in this study and its quality was assessed through PEDro scale.

Results: The heterogeneity both of the rehabilitation programs, the variables studied, and the assessment instruments did not enable a full analysis and comparison of the programs. Nevertheless, the majority of the studies reported significant improvements on both static and dynamic balance after the rehabilitation programs.

Conclusion: The use of VR and IV based rehabilitation programs seems to positively change the PC of Stroke patients. Despite that, the results of the experimental groups are close to the results found on active control groups, which suggests that these approaches may be used as an alternative to conventional physiotherapy.

Keywords: Brain injury; Stroke; Virtual Reality; Videogames; Postural Control; Balance.

PS38

The efficacy of a cognitive rehabilitation program based on an online platform in for acquired brain injury

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Introduction: Neurocognitive rehabilitation aims to stimulate cognitive functions affected by acquired brain injury (ABI), minimizing the associated deficits. Despite the existent scientific evidences, research in this field should

focus on create and/or improve intervention tools and on examining the impact of its implementation.

Objectives: This study aims to examine the impact of different tasks designed to rehabilitate executive functioning, through an online platform, in ABI patients.

Methods: Thirty-six ABI patients (18 female), aged between 27 and 73 years old ($M = 53.39$; $SD = 11.7$) participated in this study. All participants completed, at least, 4 years of formal education ($M = 9.92$; $SD = 4.70$; $Min = 4$; $Max = 17$). They were assigned into one of three groups, Experimental Group (EG), Active Control Group (ACG) and Passive Control Group (PCG). Participants were assessed before and after the intervention, through a neuropsychological battery of tests: Montreal Cognitive Assessment (MoCA); Institute of Cognitive Neurology Frontal Screening (INECO); Trail Making Test (TMT A/B); Stroop Neuropsychological Screening Test (SNST C/L); and Hospital Anxiety and Depression Scale (HADS).

Results: The neurocognitive rehabilitation program had a significant positive effect on the MoCA, IFS and SNST (C) in the EG, from pre- to post-intervention. The comparative analysis between the three groups after the intervention shows a significant difference in MoCA, with GE showing better results than the ACG and PCG; and between the EG and PCG the IFS and SNST, with the first having better performance.

Conclusion: These preliminary results highlights the positive effect of neurocognitive rehabilitation, delivered through an online platform. Further studies are needed to get additional evidence supporting the implementation of the new technologies in this field.

PS39

RTMS in subacute stroke patients improved motor function and showed change of brain SPECT

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Question: To objectively assess the efficacy of repetitive transcranial magnetic stimulation (rTMS) on motor function in upper limb and assessing correlation of regional cerebral blood flow using single-photon emission computed

tomography (SPECT) in subacute stroke patients.

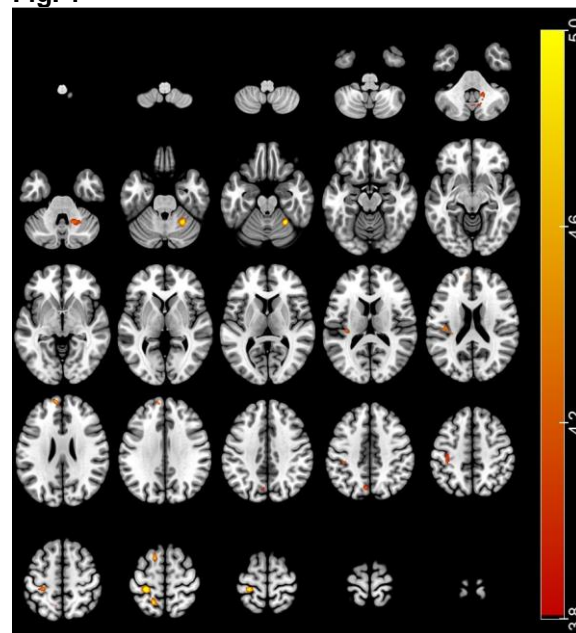
Methods: Seventeen subacute middle cerebral artery (MCA) infarction patients underwent standard occupational therapy (OT) and rTMS. Fugl-Meyer Assessment (FMA) scale and brain SPECT were performed before and after rTMS treatment. As secondary outcomes, the changes of Korean version of Modified Barthel Index (K-MBI), Functional Independence Measure (FIM) and Korean version of Mini-Mental State Examination (MMSE-K) scores in four weeks interval were assessed. SPECT brain scans were acquired with a dual-head gamma camera (Discovery NM630, GE Healthcare, Milwaukee, WI, USA) at the baseline and follow-up visits.

Results: After the OT and rTMS, FMA scores improved significantly from 12.5 ± 15.7 to 16.6 ± 18.7 . FMA improved from 12.5 ± 15.7 to 22.3 ± 22.6 . K-MBI, FIM and MMSE-K scores improved significantly too. Increase in regional cerebral blood flow (rCBF) was observed in contralesional postcentral gyrus, precuneus, parietal operculum, superior parietal lobule and superior frontal gyrus and ipsilesional cerebellar cortex area on brain SPECT.

Conclusions: Combined therapy of low-frequency rTMS on the non-lesional hemisphere and OT induced significant improvement of upper limb function in subacute MCA infarction patients. Brain SPECT could reflect clinical improvement.

Figure 1. Increases in cerebral blood flow at follow-up. Images are shown in neurological convention and the color bar represents voxel-level t-values. Images from patients with a left-sided infarction were flipped about the midsagittal plane in order to lateralize the infarction to the right hemisphere in all patients. The height threshold is $p < 0.001$ and the extent threshold is 100 or more contiguous voxels.

Fig. 1



PS40

Multicenter study of the access to rehabilitation after stroke in Brazil: study protocol

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Question: Studies in Brazil suggest that access to multidisciplinary rehabilitation after discharge from individuals with stroke is precarious. Thus, a project was constructed with the objective of evaluating the access of these patients to rehabilitation in different Brazilian cities. This summary provides a description of the multicenter study protocol designed for this purpose. Methods: Through the Scientific Directory of Neurological Rehabilitation, researchers from various locations in Brazil were contacted by e-mail and 20 confirming their participation (Figure 1). The group of researchers who proposed the first multicenter study on access to rehabilitation in Brazil was formed.

Results: In this retrospective study, 600 patients will be included between 6 months and one year after stroke, ischemic or hemorrhagic (30/public institutions). The following inclusion criteria will be adopted: age greater than or equal to 18 years-old; some neurological sequel of stroke (motor, sensory, speech); patient or familiar person with the ability to provide informed consent and respond to the questionnaire. Sociodemographic and clinical information will be assessed: type of stroke, date of stroke, whether it was confirmed by CT scan or magnetic resonance imaging. At each center, the researcher responsible will train the team on the application of the Brazilian versions of the Rankin Modified Scale and the NIH Stroke Scale. Patients will also respond to a questionnaire composed by the questions: 1. In the first 6 months after discharge from stroke, were you treated by Physiatrist / Physiotherapist / Speech / Neurologist / Psychologist / Occupational Therapist?; 2. Has a treatment program been established?; 3. Has this program been or is it being carried out?; 4. On discharge, have you been referred to any rehabilitation service?; 5. Did you look for any service on your own?; 6. Did you receive any guidance about stroke?; 7. Considering that rehabilitation would be indicated for its improvement, how would you like it to be carried out (hospitals, centers, home)? The questionnaire will be applied 6 to 12 months after the stroke, and will refer to the access obtained between the discharge and the sixth month after discharge. They data should be sent by e-mail to the coordinating center, monthly.

Conclusion: The results of this project will be relevant for the planning of strategies and creation of effective rehabilitation processes within the Unified Health System.

Fig. 1

Researcher	Centre	State
Adriana Bentes Conforto	Hospital Israelita Albert Einstein (São Paulo)	São Paulo
Alina de Souza Pagnussat	Universidade Federal de Ciências da Saúde de Porto Alegre	Rio Grande do Sul
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Eric Homero Albuquerque Paschoal	Hospital Ophir Loyola	Pará
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Natália Duarte Pereira	Universidade Federal de São Carlos/UFSCar	São Paulo
Nildo Manoel da Silva Ribeiro	Instituto de Ciências da Saúde da Universidade Federal da Bahia (UFBA)	Bahia
Octávio Marques Pontes Neto	Hospital das Clínicas da Faculdade de Medicina de Ribeirão Preto da USP - HCFMRP	São Paulo
Renata Viana Brígido de Moura Jucá	Instituto de saúde e gestão hospitalar - Fortaleza	Ceará
Roberta de Oliveira Cacho	Faculdade de Ciências da Saúde do Triângulo - FACSUA/UFRN (Santa Cruz)	Rio Grande do Norte
Rodrigo Bazzan	Faculdade de Medicina de Botucatu/UNESP	São Paulo
Suellem Mary Marinho dos Santos Andrade	Universidade Federal da Paraíba (UFPB) (João Pessoa)	Paraíba
Suzete Nascimento Farias da Guarda	UFBA - Hospital Edgard Santos	Salvador
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PS41

Self-management rehabilitation program in patients with Multiple Sclerosis (MS). A pilot study

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Multiple Sclerosis (MS) is an inflammatory, neurodegenerative disease, and represent the second most frequent cause of disability in young people. Rehabilitation is part of the therapy of MS. Evidence of self-management rehabilitation programs has been demonstrated. The World Health Organization in Europe has defined this "Therapeutic Patient Education" (TPE). Patient engagement in their own healthcare has been described as the "blockbuster drug of the century". Symptoms diversity and the different clinical forms limit standardized programs of self-care management, applicable to patients. The actual TPE programs proposed in MS were "generalist". Many sources of information on rehabilitations of MS exists but patients rests unaccompanied.

We proposed a personalized, easily implemented program of self-rehabilitation included 5 major components tailored to the patient's impairment and functional needs: flexibility, balance, stretching, strengthening and endurance. Professional instructions were provided by the kinesitherapist, on proper techniques, intensity and duration of rehabilitation exercises (individual session only). The goal of the program is to promote regular self-rehabilitation.

Methods: 12 patients (9 women/3 men) was included, aged 19 to 65, with mean EDSS score 4. Inclusion criteria was: ambulatory, no relapse during the past 30 days. Pre and post rehabilitation program, individuals completed self-reported questionnaires regarding MS

impact on their walking (MSWS-12), fatigue (MFIS), anxiety (HAD) and day-to-day physical and psychological health (MSIS-29) over past two weeks. Gait outcome measurements included: *Six-Minute Walk Test (6MWT)* and Timed 25 Foot Walk (T25FW). Each patient had 10 individual sessions of TPE.

Results: Means scores on the Modified Fatigue Impact Scale (MFIS), Multiple sclerosis Walking Scale (MSWS-12) and Modified Fatigue Impact Scale (MSIS-29) showed improvements. Mean scores of the pre-post TPE of the *Six-Minute Walk Test (6MWT)* was better.

Conclusion: Our self-management rehabilitation program decrease the impact of MS on daily activity, fatigue and walking. The current study provides positive effects of a tailored physical rehabilitation program in MS patients.

PS42

Assessment and therapeutic approach for unilateral spatial neglect in three-dimensional space using a virtual reality world

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Question: Patients with unilateral spatial neglect (USN) often experience problems attending to the left side. Furthermore, there are many kinds of neglecting symptoms such as a deficit of involuntary or voluntary attention and of far or near space attention. We developed a novel assessment and therapeutic method that removed the above restrictions by using virtual reality (VR). Before applying this method to a patient, we observed the change in reaction time after the intervention compared to that before the intervention in healthy subjects and measured the reaction time to set a reference value. We applied this method in a patient with USN as a trial.

Methods: We enrolled 16 healthy subjects aged 20–44 years and a patient with USN (67 years) due to cerebral infarction. Healthy subjects were divided into control and intervention groups. The subjects were asked to rupture the balloons that appeared randomly in the head-mounted display (HMD) by watching (sensing by movement of the head). For the

new therapeutic approach, we adopted balloon-burst training under conditions where the world presented by the HMD was biased by 10° downward and 10° leftward. For the assessment mode, the world presented by the HMD was not biased. In each condition, the target balloon was presented 32 times in a random manner. In the control group, the assessment mode was performed for three sessions consecutively. In the intervention group, the second of the three sessions was performed in the training mode. We measured the reaction times. For the patient with USN, we applied the same conditions as those in the intervention group.

Results: The patient with USN exhibited a significantly improved average reaction time from 4.64 s to 4.29 s. In the healthy subjects, the average reaction time for all trials was 1.95 ± 0.40 s (average \pm standard deviation). There were no significant differences between the control and intervention groups. In both groups, the reaction time tended to decrease for each session, and the time to the left target tended to be longer than that to the right.

Conclusion: Using this VR system, we found improvements in reaction time after the intervention compared to that before the intervention in the patient with USN. We clarified the reaction times of healthy subjects. Unlike the pseudoneglect of the line bisection test in the healthy subjects, it was suggested that there might be a delay in left-sided awareness.

PS43

Telerehabilitation services for stroke. A summary of current evidence based on the method "Evidence Map"

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Question: The first objective of this work was to summarize existing evidence on the effect of telerehabilitation (TR) in stroke patients by applying principles of an evidence map.¹

An evidence map should summarize evidence in a short and concise way (in a table), in order to make it easier for clinicians to access evidence. Subsequently, the second aim of this

study was to evaluate this table by conducting a survey among physiotherapists.

Methods: Included studies had to test the effect of TR compared to no or face-to-face training on activities of daily living, upper limb function or quality of life in a sample of stroke patients. Based on these inclusion criteria RCTs from a Cochrane Review on TR by Laver et al² and RCTs published in the Cochrane Library (using the search strategy of Laver et al) since 2013 were identified. Data were extracted in a pilot-tested table and peer-reviewed by the second author. Subsequently, an online-survey was distributed among the network of neuro-physiotherapists, registered within the Austrian physiotherapy association.

Results: The table includes data of 8 RCTs. Four RCTs showed no significant differences between groups, four RCTs showed significant better results for TR and the remaining RCT concluded that the control condition showed better results than TR. The questionnaire was sent to 58 therapists: 10 therapists completed the questionnaire. They indicated that detailed description of interventions, samples and the outcomes as helpful. Clarification of abbreviations within the table, names of the used software, cut-off scores and benchmarks for the used outcome measures, details on statistical analysis and an interpretation of non-significant results were mentioned to be missing. The order of the RCTs within the table and a consistent description of interventions and outcome measures should be improved.

Conclusion: The usage of TR should be considered wisely, as evidence is not conclusive and uncertainties remain. The produced table was useful for therapists; however, certain improvements have to be made in order to facilitate understanding of the information. However, the usability of the table among clinicians has to be tested among a bigger population.

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PS44

Validation of the Dymus Screening Questionnaire to assess dysphagia in Parkinson's Disease and Atypical Parkinsonian Disorders

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Introduction: Dysphagia is a common debilitating symptom in people suffering from extrapyramidal disorders. The DYMUS questionnaire, which has already been validated for the early screening of dysphagia in Multiple Sclerosis (Bergamaschi et al. 2008 e 2009), might also prove useful for screening dysphagia in parkinsonian syndromes.

Aims: Assessing the ability of the DYMUS questionnaire to identify, at an early stage, the presence of dysphagia in patients affected by Parkinson's disease (PD) and atypical parkinsonian disorders (APD).

Materials and Methods: This is an observational multi-centric study involving 145 patients affected by PD and ADP. All subjects filled in the DYMUS and the EAT-10 dysphagia scale and underwent a thorough clinical evaluation of dysphagia by the speech therapist. A subgroup of patients also fibroendoscopic evaluation of dysphagia.

Results: The DYMUS questionnaire showed a good level of internal consistency (Cronbach's alfa 0.77). We observed significantly higher Dymus scores in patients who were mildly (3.9 ± 2.3) or moderately (5.3 ± 2.8) dysphagic at the bedtest evaluation, as compared to non dysphagic subjects (1.5 ± 1.8), with a $p=0.001$ value for both. ROC curve analysis showed that a DYMUS score > 2 is the cut-off for detecting a potential swallowing impairment.

Conclusion: The DYMUS questionnaire proved to be a reliable screening tool to assess dysphagia in patients suffering from

extrapyramidal diseases. It is easy and quick to administer, which makes it adequate for widespread uptake in the clinical practice.

PS45

Exploring the potential role of physiotherapy in awake craniotomy surgery for tumours in the supplementary motor area

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Question: Is there a role for physiotherapy pre, intra and postoperative assessment in awake craniotomy surgery for patients with tumours in the supplementary motor area?

Methods: Emails were sent to UK neurosurgical centres requesting information on current physiotherapy involvement in awake craniotomy surgery. For the positive responses a further questionnaire was sent, detailing specific questions about assessment tools, strategies and outcome measures.

A literature search was conducted and evidence was reviewed for physiotherapy intraoperative assessment. The specific functions of the supplementary motor area (SMA) were also explored in order identify appropriate assessment tools that could be used pre and intraoperatively.

A pilot of preoperative physiotherapy assessment was carried out, including the use of specific functional tasks (9-hole peg test and rock paper scissors) which were used as baseline assessments and during transcranial magnetic stimulation (TMS) to inform preoperative mapping.

The physiotherapy team worked in collaboration with the neurosurgical team to explore the feasibility of awake craniotomy surgery for patients with SMA tumours.

Results: A total of 16 neurosurgical centres across the UK were contacted. 5 of these are currently involved in awake craniotomy surgery, 1 of which uses specific assessments for tumours in the supplementary motor area. 3 other centres use physiotherapy assessment as an alternative to intraoperative monitoring. 1 did not provide feedback.

Using current literature 2 functional assessments were chosen to be used in pre-

operative assessment and motor mapping; 9-hole peg test and rock, paper, scissors.

Over a 4 month period 3 patients were assessed pre and post operatively, including the use of functional assessments during TMS. All 3 patients presented with post-operative supplementary motor area syndrome.

Conclusion: Functional assessments such as the 9-hole peg test and rock, paper, scissors can be used to assess the functions of the SMA pre and post-operatively. Patients with SMA tumours may benefit from additional intraoperative assessment to optimise postoperative function. Once the feasibility of conducting awake surgery in this cohort has been established, there is potential for a joint neurosurgical and physiotherapy pathway.

PS47

Clinical results of the application of acupunctural hypalgesia during physiotherapy treatment

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Introduction: Acupunctural hypalgesia is a method known from Asian countries where it is mostly used for different surgical interventions. It is an electrical stimulation of introduced acupuncture needles. In Europe, it is sporadically used, e.g., in case of tonsillectomy, teeth extraction and other interventions when polyvalent allergy to anaesthetics is present in the patient.

Aim of the study: to assess the effect and practical applicability of acupunctural hypalgesia to the clinical practice.

Patients and methods: A group of the patients suitable for the application of acupunctural hypalgesia included hospitalized patients who experienced the pain of VAS 5 and more during physiotherapy of upper or lower limbs. We applied electroacupuncture to total 20 patients. We stimulated 8 individually selected acupoints in which acupuncture needles were introduced (see Fig.1) by two types of current. We used the frequency of 180 Hz in the places of local pain and the frequency of 2 Hz to stimulate acral acupoints. The interval of acupunctural hypalgesia was 30 minutes. Physiotherapy in

the form of individual physiotherapy followed within 10 minutes from the application and lasted 45 minutes. We considered the successful application of acupunctural hypalgesia the reduction of pain during physiotherapy by more than 50% assessed on the VAS scale. Results: Quality hypalgesia was achieved in 12 patients whose pain was reduced by more than 50% compared to the physiotherapy without acupunctural hypalgesia using conventional painkiller metamizol (Novalgine). Significant reduction of pain did not occur in 7 patients (less than 50%) which was considered as clinically unsuccessful induction of quality analgesia even though the analgesic effect was present. One patient experienced the application as subjectively unpleasant which led to the end of the acupunctural hypalgesia application.

Conclusion: Acupunctural hypalgesia of upper and lower limbs enables quality analgesia in patients who experience significant pain during physiotherapy of affected limbs. To perform it correctly, it is necessary to make a careful selection of acupoints and electrical currents. Acupunctural hypalgesia of upper and lower limbs belongs, when properly performed, to the efficient analgesic method which can be used during physiotherapy of upper and lower limbs. It enables quality analgesia which improves the targeted physiotherapeutic treatment in these patients.

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Fig. 1



PS48

Clinical Effect and Application of Upper Robot Rehabilitation Therapy in Spinal Cord Injured Patients

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In this study, we try to develop a protocol to determine which programs are more effective by applying different treatment software programs to the same type of robot.

This study is an RCT study in which subjects are randomly divided into experimental group and control group. Experimental group selection criteria are as follows; 1) Adults over 19 years, 2) Patients with minor injuries less than 2 years (C2-C8), 2) AIS A-D

We used Armeo Power's 'mobilization' program for the patients assigned to the experimental group. The program was a program that allowed the shoulder and elbow to move up and down, left to right. Control groups were trained using Armeo Power's high flyer, rain mug, plumber, and clean up programs. Both groups were treated 15 times for 5 weeks three times a week. The treatment time per treatment was 30 minutes. Both upper limbs were not able to carry out the experiment, so the upper manual robot test was given to the lower manual motor test score.

The results were analyzed by using a trakSTAR magnetic field analyzer to measure the real - time position and orientation of the reaching task before and after the experiment. Basically, the upper extremity MMT score was measured. In addition, patients were assessed subjectively using the capabilities of upper extremity (CUE) to question the functional limitations of upper extremities, and the Korean version of spinal cord independence measure-3 (KSCIM-3).

A total of 18 subjects were recruited to date, and the post - evaluation of 6 experimental groups and 7 control subjects was completed. Analysis of the time required for performing the reaching task with trakSTAR showed that the execution time was reduced in both the experimental and control groups. In the MMT results, there was no change in the experimental group and some improvement was observed in the control group. The results of the questionnaire evaluation CUE were mostly lowered, and the results of one control group were improved.

The 'mobilization' program of Armeo power and the existing program for spinal cord injured patients showed positive effects on upper extremity function in both protocols. This study is currently underway and it will be necessary to confirm the results by analyzing the results of more patients in the future.

Fig. 1

Experimental group					
ID	성별	연령	AIS	손상레벨	발병 기간
SCI-5	Male	58	D	C6	4mo.
Control group					
ID	성별	연령	AIS1	손상레벨	발병 기간
SCI-1	Male	43	C	C3	5mo.
SCI-3	Male	70	D	C3	7mo.
SCI-4	Male	59	D	C2	16mo.

Fig. 2

ID	C5		C6		C7		C8		T1		total	
	pre	post	pre	post	pre	post	pre	post	pre	post	pre	post
SCI-5	5	5	4	4	4	4	4	4	1	1	18	18
SCI-1	4	5	4	4	5	5	4	5	1	2	18	21
SCI-3	5	5	4	4	4	5	5	4	3	3	21	21
SCI-4	2	2	2	2	2	2	2	2	1	2	9	10

PS49

Efficacy of repetitive lateral truncal tilt balance training with a wedge on subjective postural vertical recovery after stroke -A randomized crossover trial-

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Question: Specific, truncal balance training with a wedge improved the verticality and ability to perform activity of daily living immediately. However, it is unknown whether repetitive truncal training would be effective.

The present study aimed to clarify the effect of repetitive lateral truncal tilt balance training with a wedge on subjective postural vertical (SPV), balance, and recovery in patients after stroke.

Methods: This randomized crossover trial involved a comparison of two groups (the Wedge group and the Control group) for 30 days. Eleven patients (seven men and four women, mean age 68.1 years, W group: six patients, C group: five patients) participated in this study, and all the subjects provided written informed consent; the study was approved by the ethics committees. For outcome measurements were SPV- Eyes Opened (SPV-

EO), SPV, Functional Balance Scale (FBS), Functional Independence Measure (FIM) and Trunk Control Test (TCT). We used an automatic vertical board (VB). The subject was seated on the VB and tilted to the right or left side in the frontal plane with the eyes closed or open. The mean value of orientation was calculated as the directional error and SD as the index of inconsistency. These outcomes were measured for 30 days after the intervention in the hospital.

Subjects asked to move their trunk laterally to the wedge (an inclined wedge of 10° to the paralyzed side) 60 times at 0.25 Hz for 14 days.

Results & Discussion: There were no significant difference in the baseline SPV-EO and SPV with and without a wedge. However, there was improvement outcomes at day 0, 14, and 30. Those were FBS (W: 18.8 → 31.0 → 34.2 points, C: 16.8 → 18.4 → 32.0 points), FIM (W: 67.5 → 84.6 → 88.6 points, C: 64.0 → 70.8 → 92.8 points) and TCT (W: 47.7 → 82.4 → 85.0 points, C: 51.6 → 67.2 → 90.5 points), $p < 0.05$. Therefore, this suggests that lateral truncal tilt balance training with a wedge stabilizes the postural verticality and improves balance.

Conclusion: Repetitive lateral truncal tilt balance training with a wedge improved balance and ADL after the 30-day protocol in the hospital.

PS50

Incidence and potential predictors of earlier onset of upper limb contractures after stroke

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Introduction: Contractures, defined as loss of passive joint range of motion, are the main secondary complications of stroke. As a result of inactivity and disuse, the maintenance of the paretic upper-limb muscles in shortened positions for long periods of time results in soft tissue changes, leading to increased stiffness and reduced joint range of motion.

Objectives: To investigate the incidence of upper-limb contractures three months after the stroke and its potential predictors.

Materials and methods: Prospective cohort study. Consecutive sample of individuals with hemiparesis due to stroke admitted to a hospital in Brazil. Contractures were measured by passive range of motion of lateral shoulder rotation, elbow extension, and wrist extension with a gravity inclinometer. Potential predictors of upper-limb contractures were muscle strength, spasticity of the upper-limb muscles, upper-limb function, dexterity, and pain. Measurements were obtained within four weeks and at three months after the stroke. A binomial regression analysis was employed.

Results: Out of the 76 individuals with hemiparesis, 28% developed at least one contracture in the paretic upper limb. The incidence of contracture varied across the joints from 6% to 16%. The wrist was the most affected joint. Individuals with moderate stroke showed higher incidence of contracture, in comparison to those with mild stroke. Dexterity (OR 0.009, 95% CI 0.00-0.19) and pain (OR 6.417, 95% CI 1.22-33.83) were significant predictors of shoulder, elbow, and wrist contractures.

Conclusion: Individuals with mild and moderate stroke developed upper-limb contractures three months after the onset of the stroke, with an incidence of 28%. The predictors for contracture were the presence of pain and loss of dexterity. These impairments should be targeted earlier during rehabilitation interventions.

Keywords: Contracture, Stroke, Dexterity, Pain

PS51

Experiences with a self developed accelerometer in early stroke rehabilitation

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Introduction: Neurological disorders usually manifest as disturbances to the amount or the quality of limb movements, e.g. post-stroke paresis. Another common problem in the daily routine is that assessing the progression of symptoms (e.g. paresis) or measure the effect of post-stroke rehabilitation is very subjective.

Objectives: The aim of this study was to develop and test a small triaxial accelerometer and validate its usefulness. Patients and methods: We tested the movement monitoring algorithm and had it registered with the local patent office. We collected data from 17 hemiparetic acute stroke patients and made comparisons using 22 control subjects. The devices were attached to the paretic and non-paretic limbs and any movements were registered (24h). The data were also evaluated against changes to National Institute of Health Stroke Scale (NIHSS), European Stroke Scale (ESS), modified Rankin Scale (mRS) scores and levels of consciousness. We also investigated healthy individuals with the accelerometer and a polysomnograph's surface EMG electrodes simultaneously. Accelerometer data were evaluated against changes in muscle tone during active movements of the upper limbs. Results: Controls used their upper limbs more frequently than stroke patients. The data showed a significant association with NIHSS scores: greater scores were associated with less intensive limb use. The movement data presented a significant association with mRS scores in the stroke patients. We found a correlation between patients' levels of consciousness and upper limb activity. Patients with severe consciousness disturbances used their limbs significantly less intensively. We found a correlation between muscle tone and movement data during active movement of the limbs.

Conclusion: The device sensitively detected absolute movements and movement differences between paretic and non-paretic limbs and can be used for the quantitative evaluation of patients' neurological status. Ideggyogy Sz. 2013 Jan 30;66(1-2):29-34.

Vision-assisted Interactive Human-in-the-loop Distal Upper Limb Rehabilitation Robot and its Clinical Feasibility

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Question: In order to deliver sufficient number of repetitions in stroke rehabilitation, clinically relevant simple structure and user-intent driven actuation are necessary to facilitate neuroplasticity.

Methods: A novel robotic treatment device for distal upper limb rehabilitation in stroke patients was developed, and usability test was performed to assess clinical feasibility. The rehabilitation robot was designed as a two-axis exoskeleton actuated by electric motors, consisting of forearm supination/pronation and hand grasp/release, which were selected based on a kinematic analysis of essential daily activities. Vision-assisted interactive human-in-the-loop algorithm was utilized for user-intent extraction. A usability test was performed on six physiatrists, five biomedical engineers, five rehabilitation therapists, two chronic stroke patients, and two caregivers of the patients. After sufficient instruction, all subjects tested the robot for a minimum of 10 min and completed the evaluation form using a 7-point Likert scale.

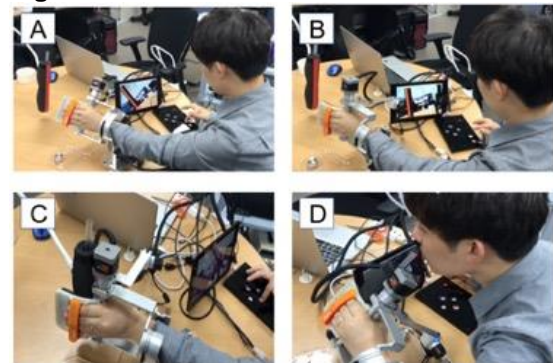
Results: The participants found the device interesting (5.7 ± 1.2), motivating (5.8 ± 0.9), and as having less possibility of causing injury or safety issues (6.1 ± 1.1); however, the appropriateness of difficulty (4.8 ± 1.9) and comfort level (4.9 ± 1.3) were found to be relatively low.

Conclusion: Further development of the current device would provide a good treatment option as a simple, low-cost, and clinically feasible rehabilitation robot for stroke.

Fig. 1. Main concept of the image-processing based user-intent driven distal upper limb rehabilitation robot is shown. (A) The user aims

the robot hand at the target (assumed as a water bottle with a straw) and confirms the target object shown in the display. (B) The robot recognizes the target object and the long axis, and automatically rotates the forearm supination/pronation axis to the appropriate orientation of the robot hand. (C) The user moves the robot to the object with the proximal muscle power (mainly shoulder). (D) The user rotates the axis with the controller so that he can drink water.

Fig. 1



Dysphagia in ischemic stroke: its impact on clinical outcome

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Introduction and objective: Dysphagia is a common complication of ischemic stroke and is related to aspiration, pneumonia resulting in mortality and morbidity. The goal of this study is to examine the impact of ischemic stroke on dysphagia and clinical outcome. Methods Patients with ischemic stroke showing signs of aspiration were retrospectively investigated between January 2014 and November 2018. Ischemic stroke was confirmed by MRI scan. Dysphagia was evaluated by using video fluoroscopy (VF). Findings of VF and ischemic stroke in association with patients' age, the occluded vessel, lesion locations were studied. Outcomes of dysphasic patients were evaluated using modified Rankin Scale (mRS) score at hospital discharge. Results: Forty-five patients were enrolled in the study (27 males and 18 females: mean age 85.2 years, range 64-99 years). Of the 45 patients examined by VF, moderate and severe dysphagia was found in 23 (51.1%) of 45 patients. 14 (60.9%) of 23 patients were 85 years old and over, and 13 (56.5%) of 23 patients presented with a main vessel occlusion (anterior circulation in 10, posterior circulation in 3). Lesion locations of

the 23 patients were cerebral hemisphere in 13 (56.5%), basal ganglia in 2 (8.7%), brainstem/cerebellum in 8 (34.8%). At hospital discharge, all of the 23 dysphasic patients needed either nasogastric tube feeding (n=8), percutaneous endoscopic gastrostomy tube (PEG) feeding (n=14), or central venous ports (CV ports) (n=1). Outcomes of these 23 patients were all unfavorable (mRS 5-6).

Conclusion: Dysphagic patients with ischemic stroke were strongly associated with older age, main vessel occlusion, hemispheric infarction, and unfavorable outcomes. Further studies with a large number of patients are needed to investigate the impact of dysphagic patients with ischemic stroke on clinical outcome.

PS54

Effects of mobilization within 24-48 hours after stroke on activities of daily living such as sitting balance and transfer

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Introduction: Stroke and its consequences are a leading cause of disability for adults. Paralysis or sensorimotor deficits create difficulties that make it almost impossible to manage everyday life independently. For this reason, physiotherapy after stroke is very important because early mobilization is one of the most effective treatments for patients with stroke. However, the period of time for the first mobilization is defined differently in the guidelines.

Objectives: The aim of this study was to use an observation to narrow down this period and determine within which timeframe patients are mobilized for the first time and how they subsequently benefit from performing activities of daily living such as sitting balance and transfer.

Patients & methods: In this pilot study nine patients with moderate strokes were included. In the baseline sitting balance (according to Trunc Control Test) and transfer (according to Berg Balance Scale) were determined and evaluated. The Follow-Up 1 took place after one week and the Follow-Up 2 after four weeks in which the same tests were repeated. Furthermore, the timing of the first mobilization of all stroke admissions during the time period of the study (n=45) was carried out.

Results: This pilot study shows significantly better results in terms of transfer comparing baseline and FU 1 ($p=0,045$) and baseline and FU 2 ($p=0,02$) in the group mobilized between 24 and 36 hours after admission to the stroke unit. Results also show that 40% of the patients with acute ischemic stroke were usually mobilized within 24 and 36 hours. The patients mobilized after 48 hours (20%) suffered severe strokes, which made an earlier mobilization impossible due to the reduced general condition. The data of the risk factors hypertension, diabetes and atrial fibrillation was examined for its frequency and correlations with NIHSS. Results show that hypertension has been diagnosed previous to the stroke in 70% of the patients. Further measurements could confirm significant correlation between the risk factor atrial fibrillation and the severity of the stroke. Patients with atrial fibrillation had a higher risk of severe strokes.

Conclusion: This study points out the importance of further research on early mobilization in patients with stroke. It should be examined in larger sample sizes whether patients mobilized between 24 and 36 hours achieve better results in the transfers according to Berg Balance Scale after one and four weeks.

PS55

Predictive Value of H-reflex in S1 radiculopathy using Fluoroscopy-guide Transforaminal Epidural Steroid Injection

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Introduction: H-reflex is routinely used in to electrophysiologically diagnose S1 radiculopathy. However, there are some cases in which the clinical symptoms and/or the findings of imaging studies suggestive of S1 radiculopathy do not correlated with H-reflex parameters.

Objective: Predictive value of H-reflex in patients with L5 and/or S1 radiculopathies due to disc herniation was analyzed using fluoroscopy-guide transforaminal epidural steroid injection (TFESI).

Patients and Method: A retrospective chart review was done on 85 patients (mean age 56.5 years) who complained of more than 3 months of low back pain and/or radicular pain to unilateral lower extremity. Of them, subjects who had polyneuropathy such as diabetes mellitus, previous spine surgery were excluded. Each subject underwent MRI of lumbosacral spine, electrodiagnostic study, and fluoroscopically-guided TFESI. Of the remaining 60 patients, no responses or delayed latency (more than 1.5 ms) of H-reflex were 34, thus given S1 TFESI (abnormal H-reflex group). Twenty-six patients with normal H-reflex were injected L5 TFESI (normal H-reflex group) (Table 1). Post-injection pain was compared with pre-injection one, and subjects were grouped as effective (more than 50% decrease of pain score) or not-effective group (less than 50%).

Result: Sensitivity of H-reflex in S1 radiculopathy was 51.43%, specificity 36%, positive predictive value 52.94%, and negative predictive one was 34.62%.

Conclusion: Predictive value of H-reflex in diagnosis of S1 radiculopathy confirmed by fluoroscopy-guide TFESI might have moderate validity, thus typical symptom and/or sign such as decreased ankle jerk also should be considered in diagnose S1 radiculopathy.

Fig. 1

Table 1. Patient Groups and Intervention Outcomes

	Abnormal ^{a)} H-reflex group (n=34)	Normal H-reflex group (n=26)
Pain		
Pre	5.8 ± 1.9	6.2 ± 1.0
Post	3.3 ± 1.4	3.5 ± 1.6
P value	0.000	0.000
Efficacy of intervention		
Effective (>50% pain relief)	18	17
Not-effective (< 50% pain relief)	16	9
Predictive value (%)	52.9 ^{b)}	32.6 ^{c)}

Data presented as mean ± SD, or n, or %.

a) Abnormal included patients with delayed latency (more than 1.5 ms) and no responses of H-reflex. Abnormal H-reflex group received injection in S1, whereas normal H-reflex group received in L5.

b) Positive predictive value

c) Negative predictive value

PS56

Extraspinal Bone and Soft Tissue Lesions causing Sciatica with an Emphasis on Radiologic Imaging and Early Diagnosis

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Introduction: Sciatica is defined as a pain along the course of the sciatic nerve or branches thereof, and is commonly caused by a lumbar disc herniation (LDH) or spinal stenosis. Because the sciatic nerve is long, the nerve can become compressed in different anatomical areas for various reasons. Extraspinal entrapment of the sciatic nerve along the course of the nerve within the pelvis or a lower extremity is infrequent and difficult to diagnose because the symptoms are similar to those of the more common causes of sciatica.

Objectives: The purposes of this study were to evaluate the characteristic clinical and radiologic findings of extraspinal bone and soft tissue lesions as causes of sciatica, and to formulate guidelines for early diagnosis.

Patients & methods: Thirty seven patients with sciatica, diagnosed as extraspinal causes, were evaluated retrospectively. Plain radiographs of the lumbar spine and pelvis were obtained from all 37 patients. All patients underwent lumbar spine MRI for evaluation of lumbar disc herniation and pelvic bone MRI to identify the extraspinal cause. Clinical presentation, symptom duration, lesion location, final diagnosis, and radiologic imaging characteristics were investigated.

Results: Mean symptom duration was 10 months. The locations of the lesions were included bone in 19 patients (pelvic bone in 14, sacroiliac joint in 3 and sacrum in 2) and soft tissue in 18 patients (piriformis muscle in 6, sciatic nerve in 5, hip bursa in 2, buttock in 4 and sacral nerve root in 1). There were 10 metastatic tumors, 3 ankylosing spondylitis, 3 fractures, 3 primary tumors in the bony lesions and 5 piriformis syndrome, 3 neuritis, 2 infections, 3 inflammations, 2 soft tissue tumors. 2 hematomas and 1 ganglion of sciatic nerve in the soft tissue lesions as causes of the extraspinal sciatica.

Conclusion: Sciatica can be caused by extraspinal bone and soft tissue lesions along the course of the sciatic nerve. Special attention should be given to pain characteristics, and a detailed physical examination is required. Selection of proper imaging modalities including routine plain radiography of the pelvis as part of the initial screening process, and coronal T2 fat-suppression or T2 STIR imaging as a routine protocol when L-spine MRI is performed, are recommended for early diagnosis.

PS57

A Case of Crowned Dense Syndrome: Investigation of Imaging Spectrum Focusing on Early Prediction and Follow-up

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Introduction: Crowned dense syndrome (CDS) is a rare disorder in the peri-odontoid space, but known cause of acute severe axial neck pain on rotation. For diagnosis, computed tomography (CT) scan is the technique of choice to detect calcified mass, crowned-like figuration around the odontoid process. Magnetic resonance imaging (MRI) is generally not sensitive to CDS diagnosis, however helpful in identifying spinal cord or around soft tissues.

Objectives: In this case report, the authors investigated the early prediction before occurrence of CDS and the change of calcification after symptom improvement.

Patients & methods (Case Presentation): A 68-year-old male veteran presented with a chief complaint of acute posterior neck pain for 1 week. Cervical range of motion was significantly reduced in the absence of focal neurological deficits. Laboratory investigations revealed raised erythrocyte sedimentation rate and C-reactive protein, while others including blood testing for systemic rheumatoid disease were unremarkable. CT scan revealed crown-like hyperintense calcific deposits peri-odontoid process and ligament with bony erosion of the odontoid process (Figure 1). MRI showed hypointense signal of retro-odontoid mass with bony erosion (Figure 2). Combination treatment with Prednisolone, non-steroidal anti-inflammatory drugs were commenced and a

Philadelphia collar was positioned for symptom relief. The patient's symptoms dramatically resolved within 1 week after initiating treatment, and the serum inflammatory reaction level decreased to within normal range. Follow-up CT scan and MRI 1 year later showed a similar sized and dense calcification remaining.

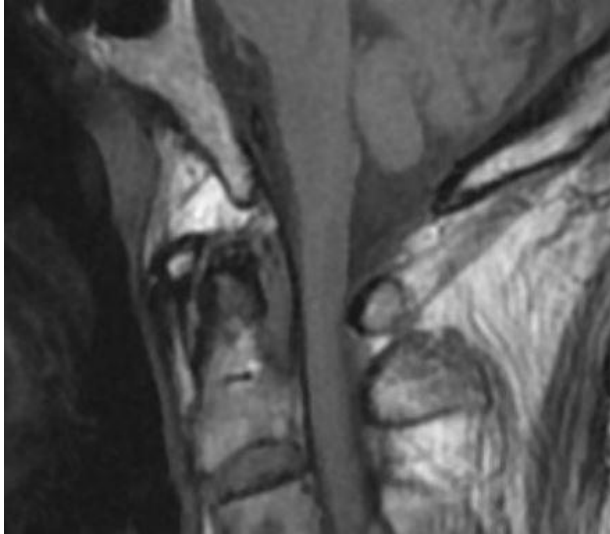
Results (Case Presentation): 15 years ago the patient was diagnosed as protruded C3-C4 intervertebral disc according to MRI. 6 years ago he diagnosed as L3-L4-L5 spinal stenosis via MRI, also he wanted a follow-up cervical spine MRI. The former MRI due to neck pain showed unremarkable to the odontoid process, lack of discrete lesion on C1-C2 spine to account for his neck pain. However, the later MRI without neck complaint revealed slightly hypointense signal of retro-odontoid mass with bony erosion.

Conclusion: Even though MRI is not gold standard for the diagnosis of CDS, it may offer the aid of prediction in this under-recognized disease. Also calcified mass surround the odontoid proves developed slowly over a long period time, it was not absorbed quickly regardless of symptom improvement.

Fig. 1



Fig. 2



PS58

Botulinum toxin block with cervical traction as a treatment for dropped head syndrome of Parkinson disease

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Background: Dystonia can occur as one feature of a more complex syndrome in atypical idiopathic Parkinson disease (PD). Possible manifestations of dystonia in PD are blepharospasm, camptocormia, and anterocollis which is called as "dropped head syndrome". Dropped head syndrome, the incidence of which is reported 6.0% in Japan, is characterized by the forward flexion of the head and neck. Although it is treated by using dopamine agonist, muscle afferent block and deep brain stimulation, it is usually difficult to treat successfully. Botulinum toxin block is one of treatments of dystonia, therefore we tried it to treat dropped head syndrome of PD.

Material and Methods: We selected two patients who were diagnosed as PD showing typical dropped head syndrome in our hospital. Patients were treated with botulinum toxin block to their neck muscles with cervical traction.

Results: Case 1: 74-year-old male has shown mask like face, bradykinesia, left-sided cogwheel rigidity, Parkinson gait and visual hallucination. He has treated with L-dopa/carbidopa/entacapone, zonisamide, amantadine and donepezil for 10 years. His dropped head syndrome showing dystonic posture to left downward was observed at his

73-year-old. Although this symptom was difficult to be treated by antiparkinsonian drugs and rehabilitation, we injected botulinum toxin into left sternocleidomastoid and anterior scalenus muscle using cervical traction. His dropped head syndrome improved after this protocol several times. Case 2: 69-year-old female has shown, bradykinesia, left-sided cogwheel rigidity and resting tremor, Parkinson gait and retropulsion. She has treated with L-dopa/carbidopa, zonisamide for 5 years. Her dropped head syndrome to downward was observed at her 68-year-old and has not improved by antiparkinsonian drugs and rehabilitation. Injected botulinum toxin into bilateral sternocleidomastoid and anterior scalenus muscles using cervical traction improved her neck symptom.

Conclusion: These two cases could be successfully treated by botulinum toxin with cervical traction. Although dropped head syndrome of PD is difficult to treat by usual antiparkinsonian drugs and rehabilitation, injection of botulinum toxin to the flexor muscles of neck using cervical traction could successfully improve. The supplementary role of cervical traction in this treatment is unknown, however sensory trick which is various maneuvers that can ameliorate dystonia may partly explain such effectiveness.

PS59

Treatment of Central Hyperthermia with Sub-acute Pontine Hemorrhage

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Introduction: Central thermoregulation dysfunction is a very rare symptom that may occur after subarachnoid hemorrhage, brain damage, and stroke. If the temperature is higher than 41°C, or if there is fever more than 39°C within 6 hours after stroke, or if there is severe fluctuation within 1 month, the mortality rate is 70%. Therefore, early diagnosis and treatment of central hyperthermia are important after brain damage, and are discussed in a few case reports. However, there are no reports of patients with central thermoregulation dysfunction persisted until the sub-acute phase. In this case report, we report the pattern and treatment of central hyperthermia in a patient with sub-acute phase after pontine hemorrhage.

Case Results: A 37-year-old man was hospitalized with acute pontine hemorrhage. The size of hemorrhage was 3.8x1.5x2.0cm in brain computed tomography (CT). The fever developed on the day of the cerebral hemorrhage and prolonged despite of the termination of treatment for the infectious disease. Two months after pontine hemorrhage, he was hospitalized again with a recurrent intermittent fever over 38°C. Body temperature changed from 36.3 to 40.3°C. He had alert consciousness at normal body temperature but showed drowsiness at high temperature. All infectious diseases were excluded and diagnosed as central thermoregulation dysfunction. The over 38.3 degrees of body temperature persisted despite taking the medication as follows; acetaminophen 3600 mg, naproxen 1000 mg, baclofen 60 mg. So, bromocriptine 5 mg was added and after 3 days the dose was increased to 10 mg. After adding bromocriptine, the body temperature was maintained within the normal range, and baclofen was reduced to 10 mg over 10 days. Hyperthermia again occurred and baclofen was increased to 20 mg. Thereafter, his body temperature remained normal range and he was able to participate in rehabilitation program. His K-MMSE score was improved to 13/30, and simple communication was possible.

Conclusion: It is known that high fever is highly likely to cause neurological deficits and deterioration of cognitive function. In this case, the patient's participation in rehabilitation program was limited due to low consciousness accompanied with high fever and after control of thermoregulation, his neurological recovery could be expected. The possibility of central thermoregulation dysfunction should be considered in patients with recurrent hyperthermia also in the sub-acute phase after stroke, and the treatment may have an impact on prognosis.

Fig. 1

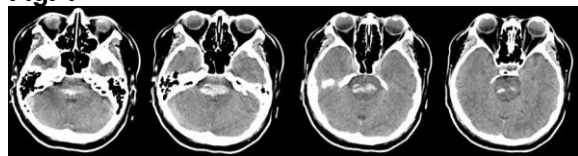
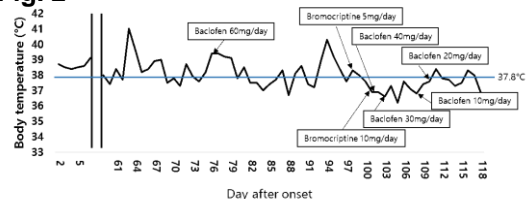


Fig. 2



PS60

The Therapeutic Effect and Complications of Oro-esophageal Tube Training in Stroke Patients

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Question: Acute stroke patients with severe dysphagia are usually fed by using nasogastric tube. The oro-esophageal (OE) tube has been used as an alternative parenteral feeding method in patients for whom safe oral feeding is impossible. The aim of this study was to evaluate the therapeutic effect and complications of OE tube in stroke patients with dysphagia.

Methods: This study was designed as a retrospective medical chart review. The authors reviewed the medical records of dysphagic stroke patients who were recommended to use OE tube feeding. Thirty-eight stroke patients were recommended to use OE tube feeding based on their videofluoroscopic swallowing study (VFSS) findings. Of these, 17 patients received OE tube feeding training and conventional dysphagia therapy. Follow-up VFSSs performed sequentially, based on the patients' condition. If a patient could swallow therapeutic foods with certain viscosities during the VFSS, oral feeding was considered initiated. Patients were divided into two groups according to the final feeding methods.

Results: Seventeen patients attempted OE tube feeding. Among them, 11 (64.7%) patients could change full oral feeding on their follow-up VFSS evaluation. 70.6% patients showed gastroesophageal reflux disease regardless of changing to the oral feeding.

Among individual items of FDS, both group showed significant improvement on triggering of pharyngeal swallow, residual amount, and pharyngeal transit time. These functions were more improvement in the patients who could change to oral feeding than who could not. And both group showed significant aggravation on nasal penetration.

Conclusion: OE tube feeding itself could facilitated swallowing and assisted stroke patients to transition to oral feeding. Our study quantitatively shows the therapeutic effect and complication of OE tube training and these results implicating the rationale for a proper

treatment strategies for severe dysphagia after stroke.

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Fig. 1

Table 1. Demographic factors of Patients according to the feeding methods (N=17)

	Patients who could change to oral feeding (n=11)	Patients who could not change to oral feeding, OE tube only (n=6)
Age (year)*	56.3 ± 21.7	72.2 ± 15.4
Gender (M/F)	7/4	4/2
Stroke type (ischemic/hemorrhagic)	8/3	2/4
Stroke lesion	Lateral medullar (n=5) Bilateral pons (n=2) Bilateral MCA infarction (n=2) Basal ganglia (n=2) Thalamus (n=1)	Lateral medullar (n=4) Bilateral pons (n=1) Pons, cerebellum (n=1)
Initial FDS	47.7 ± 18.6	49.1 ± 15.9
Initial PAS	8.0	8.0
OE tube duration	14.1 ± 7.6	54.8 ± 38.5
Complications	GERD (n=7) Aspiration pneumonia (n=1)	GERD (n=6) Aspiration pneumonia (n=3) GI bleeding (n=1)

Values are mean ± SD. FDS: functional dysphagia scale, PAS: penetration aspiration scale, MCA: middle cerebral artery, GERD: gastroesophageal reflux disease, GI: gastrointestinal. *: p<0.05

Fig. 2

Table 2. Changes of Swallowing function

	Patients who could change to oral feeding (n=11)			Patients who could not change to oral feeding, OE tube only (n=6)		
	Initial VFSS	Final VFSS	p-value	Initial VFSS	Final VFSS	p-value
FDS (total)	47.7 ± 18.6	28.5 ± 19.4	< 0.01	49.1 ± 15.9	44.8 ± 25.3	0.753
FDS (oral)	6.1 ± 3.3	3.4 ± 3.6	0.02	8.7 ± 5.6	8.1 ± 4.9	0.521
FDS (pharyngeal)	38.9 ± 12.8	25.7 ± 16.2	< 0.01	40.2 ± 18.4	35.8 ± 20.3	0.03
PAS	8.0	4.7 ± 1.3	< 0.01	8.0	7.7 ± 0.5	0.936

Values are mean ± SD. FDS: functional dysphagia scale, PAS: penetration aspiration scale *: p<0.05

PS61

The effect of Nordic walking in hemiplegic patients with chronic phase stroke

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Question: Nordic walking is a form of physical exercise that uses two poles (stocks) to assist the walking movement and increase the exercise effect. In recent years, Nordic walking has been gradually used into the medical field as part of rehabilitation. There are several reports showing the effects of Nordic walking for some diseases. However, there are few reports of Nordic walking in stroke hemiplegic patients, and the effect of Nordic walking for these patients is not clarified. The objective of this study was to examine the effect of Nordic walking for motor functions and cardiorespiratory responses in hemiplegic patients with chronic phase stroke.

Methods: The subjects were 9 hemiplegic stroke patients (5 males, 4 females; mean age 55.3±10.5 years) living at home who could walk outdoors by using T-cane and ankle foot orthosis. The period from the onset of stroke was 47.2±28.7 months. The pole length was determined by multiplying each subject's height in centimeter by 0.68. Our physiotherapists gave them the guidance on Nordic walking and instructed 1 hour Nordic walking 3 times a week for 8 weeks. Six-minute walk test was conducted for the patients at the start of Nordic walking training and after 8 weeks of training. We compared the 6-minute walk distance, metabolic equivalent, and Borg scale between before and after 8 weeks of training.

Results: The 6-walk distance and metabolic equivalent increased in all patients except only one. The mean increasing rates of 6-minute walking distance and metabolic equivalent were 16.5% and 10.1%, respectively. In contrast, Borg scale after 8 weeks training increased in only one patient, and was nearly flat in the other patients.

Conclusions: Our study suggested that Nordic walking improved the walking ability without increasing fatigue in hemiplegic patients with chronic phase stroke.

PS62

A pilot study of the effect of botulinum toxin type A injection on changes in musculotendinous length and dynamics of hamstring muscles during gait in children with spastic cerebral palsy walking with excessive knee flexion

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Objective: To investigate the effect of botulinum toxin type A (BTX-A) injection on changes in musculotendinous length and dynamics of hamstring muscles during gait in children with spastic cerebral palsy (CP) walking with excessive knee flexion.

Design: prospective study

Setting: University hospital pediatric rehabilitation clinic

Participants: Twenty-nine children with spastic CP (Gross Motor Function Classification System I-III)

Interventions: BTX-A (Dysport®, abobotulinum toxin-A) injection into the semitendinosus and semimembranosus muscles under the guidance of ultrasonography.

Main Outcome Measures: Assessments included Gross Motor Function Measure (GMFM), Modified Ashworth Scale (MAS), Modified Tardieu Scale (MTS), 3-dimensional computerized gait analysis and calculated semimembranosus (SM) muscle-tendon length and lengthening velocity during gait using musculoskeletal modeling and inverse kinematic analysis at baseline and post-injection weeks 4 and 16.

Results: Significant improvements in GMFM, MAS and MTS were recorded at week 4 and 16 compared to those at baseline. Kinematic data showed a decrease in knee flexion during stance phase at week 4, and decreased hip internal rotation at initial contact. The length of SM muscle-tendon was unchanged after BTX-A injection, while mean lengthening velocity during swing phase was increased at week 16 after injection compared to baseline data. The

subgroup analysis showed the hip rotation angle had significant changes only in the hip internal rotation subgroup at initial contact.

Conclusions: This study revealed significant benefits of BTX-A injection into medial hamstring muscles for flexed knee gait in children with spastic CP.

PS63

Determination of Treatment Preferences of Physiotherapists in Chronic Pain Related Fibromyalgia

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Question: There are different physiotherapy alternatives in the treatment of chronic pain related fibromyalgia, which is one of the important clinical findings of fibromyalgia patients. The aim of this study was to determine of treatment preferences of physiotherapists" in chronic pain related fibromyalgia.

Methods: Total of one hundred sixty-two physiotherapists were participated who worked for three year or more and agreed to participate in the study were included in the study. The mean age was 29.30±6.86 and mean working time 6.64±7.18 years. The physiotherapists were asked open-ended questions about which methods they preferred to evaluate and treat the pain over an imaginary patient scenario associated with fibromyalgia.

Results: According to the scenario, preferred methods by physiotherapists are manual therapy techniques 94.4%, electrophysical agents 88.9%, therapeutic exercise approaches 88.9%, aquatic physical therapy 38.3%, dry needling 30.2% respectively.

Conclusion: As a result, the most preferred methods by physiotherapists" in the treatment of chronic pain are; manual therapy techniques, electrophysical agents, therapeutic exercise approaches, aquatic physical therapy and dry needling methods.

Key Words: Fibromyalgia Syndrome, Chronic Pain, Physiotherapy Modalities

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PS64

Prediction of clinical assessments of quality of daytime resting periods in patients with severe acquired brain injury

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Introduction: Patients undergoing rehabilitation after severe acquired brain injuries (sABI) are offered several daytime resting periods (DRPs) each day. DRPs are supposed to consolidate the patient's motor and cognitive learning processes and to counteract fatigue. These potential effects depend on the quality of the rest achieved during DRPs.

Therefore, it is of interest to assess whether quality of rest is measureable in patients who cannot express themselves. To date, no clinically feasible systematic measure of quality of rest has been documented for use in patients with sABI.

To evaluate quality of rest, this study explores the possibilities of using staff assessments and objective measures, such as heart rate (HR), measured by electrocardiography (ECG), and motor activity, measured by accelerometer (ACC).

Objectives: Our aim is to develop a statistical model based on ECG and ACC measures to predict quality of rest as assessed through staff observations.

Patients & methods: This is an observational study. Patients are recruited from a subacute rehabilitation ward and screened for eligibility according to set criteria: 1st admission to the rehabilitation hospital, referred due to sABI, ≥ 18 years old, ≤ 7 on the levels of cognitive function

scale, closest relative noted in record, not terminal ill, no spinal lesions and absence of paroxysmal sympathetic hyperactivity.

Subjects are monitored for 20 days during DRPs. We have implemented a simple staff-administered clinical assessment (CA) for assessing quality of rest. The CA is an ordinal scale containing the categories of quality "Very good", "Good", "Bad", "Very bad" and "Insufficient information to assess quality of DRP". The staff document the CA's after each DRP. The predictive value of the independent variables is analysed. The independent variables are patient characteristics and objective measures of ACC and ECG recorded during the DRPs. From ACC, the motor rest ratio is derived as the percentage of time resting during a DRP. From ECG, the mean HR, HR/Resting HR and selected HR variability estimates from the time domain and the power spectrum are calculated.

Results: Results are pending. Status per April 15th 2019 is that 21 subjects have been included.

Discussion: Models that allow evaluating the quality of rest in patients with sABI could be an important contribution to document overall improvement and furthermore guide rehabilitation staff in regards of timing of the DRPs.

PS65

Feasibility of a health education self-management program to improve physical activity in ambulatory individuals after stroke

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Introduction: One of the main problems for low adherence to the practice of exercises after stroke may be related to the exercise preferences of the individual (contextual factors). Self-management interventions have been recommended as a method of supporting changes in habits and as a way of dealing with illness through strategies to encourage people to become independent and manage their

health issues. Thus, the implementation of interventions that take into account the preference of the individual may reflect in the adherence to the treatment and to the continuous practice of exercise.

Objective: To investigate the feasibility of a self-management program to improve physical activity in community ambulatory individuals in the acute phase after stroke.

Materials and Methods: A Phase I, single-group, pre-post intervention study was carried out. Twenty individuals with mild disability after acute stroke were recruited from the Stroke Unit of a metropolitan hospital in Belo Horizonte, Brazil. A self-management program consisted of six home-based sessions over 3 months. The sessions included health education, identification of exercise preference and barriers to exercise, and discussion on strategies to overcome the barriers to promote and increase exercise practice. Feasibility of the intervention was determined measuring adherence, time spent in each session; distance and cost of transportation to the participant's home; and presence of adverse factors. The study protocol was registered in REBEC (RBR-6bdmsk).

Results: A total of 20 individuals, 16 men, mean age 64 (SD11) years and mean time after stroke of 4 (SD 0.6) months participated. After three months, 2 participants had withdrawn from the study (health issues and return to work). At 6 months, 5 additional participants had withdrawn (health issues, loss of contact and refusal to reevaluation). The mean distance from the university to the participant's house was 13.7km (SD 5.66), and the mean fuel expense per travel was R \$ 2.75 (SD 1.1). 93% of sessions was delivered. There were eight missing sessions and 17 re-scheduling. Mean time spent in each session was 57 minutes. None of the participants had adverse effects due to intervention.

Conclusion: This self-management program for individuals with mild post-stroke disabilities seems feasible in terms of adherence, cost and time spent with home session. A randomized phase II study is warranted.

PS66

Etiological characteristics of recovery phase spinal cord injury rehabilitation in the public rehabilitation center in Japan

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Background and aims: Our rehabilitation center is the major rehabilitation hospital for severe spinal cord injury by highly emergency care hospital in our prefecture. The purpose of this study is what is the role of our rehabilitation center for the spinal cord injury patients. Thus, we investigated the recent database of our spinal cord rehabilitation center and compared with our whole prefecture data.

Methods: Patients were recovery phase spinal cord injury patients who admitted our rehabilitation center from Jan. 2014 to Dec. 2017. Total number of patients was 102. We compared this data with our whole prefecture data (total number 247). Evaluation items were gender, age at injury, cause of injury, injury level, ASIA impairment scale (AIS).

Results: Male percentage was 88.5% in our center data vs 76.3% in whole prefecture data. Mean age at injury was 57.1 vs 63.6, our center data was younger than whole prefecture data. Fall was the most cause of injury, then jumping from the higher place, traffic accident in both data. Injury level were 73.2% in cervical level, and 26.8% in thoracic and lumbar level in our center data vs 89.7% and 10.3% in whole prefecture data. AIS A and B were 24.1% in our center data vs 7.8% in whole prefecture data. AIS A and B were 25.2% in our center data vs 7.8% in whole prefecture data.

Conclusions: Characteristics of our center data versus whole prefecture data was younger, more thoracic and lumbar lesion, and more complete paresis. This result suggests that our center is expected social recovery rehabilitation in our prefecture.

PS67

Effect of botulinum toxin A in spinal cord injury associated neuropathic pain

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We report substantial improvement of neuropathic pain related to traumatic SCI in one patient after subcutaneous administration of type A botulinum toxin.

A 51-year-old man with C3 AIS B tetraplegia (American Spinal Injury Association Impairment Scale B) visited our outpatient clinic due to severe ongoing neuropathic pain and associated allodynia and dysesthesia of the lower limbs. He had suffered a traffic accident two years ago and the neuropathic pain appeared one day after trauma onset. He had no past history that would imply possible underlying peripheral neuropathy. The pain was a below level neuropathic nature and was both spontaneous and evoked. The spontaneous neuropathic pain occurred continuously in the lower limbs with paroxysmal bursts below the ankles. The intermittent bursts of pain occurred on an average of 3-6 times a day randomly. Temporal variations were present with neuropathic pain worsening nocturnally. Pain qualities of the spontaneous neuropathic pain included a combination of "burning", "sharp", "tingling" and "cold" sensations.

He had previously tried combinations of pregabalin, gabapentin and oxycontin but all failed to alleviate his neuropathic pain. He was treated with subcutaneous injections of clostridium type A botulinum toxin into 10 most painful sites of each sole. Type A botulinum toxin (200 units) was diluted in 2ml of normal saline. Each site was injected with 0.2ml of the mixture, which was ~10 units of type A botulinum toxin. The patient was reassessed at four and eight weeks after his injection with botulinum toxin with significant improvement of his neuropathic pain.

Main analgesic effects of botulinum toxin may be attributed to decreased sensitization of nociceptive pathways through inhibition of glutamate. Glutamate is an excitatory neurotransmitter that has been implied in neuropathic pain generation. Botulinum toxin's inhibition of excitatory neurotransmitters such as glutamate may also stabilize neuronal excitability and suppress central sensitization of

spinal cord neurons to stimuli. Botulinum toxin also impairs sympathetic transmission by inhibiting preganglionic cholinergic sympathetic fibers and thus may act through sympathetic inhibition.

Subcutaneous injection of type A botulinum toxin was effective without side effects, on one case of refractory neuropathic pain due to spinal cord injury. Further randomized control trials are needed to confirm type A botulinum toxin's effect on centrally acting neuropathic pain.

PS68

Pan-European PEPSCI study for pediatric and adolescents spinal cord lesions in Greece

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Introduction: Pediatric onset spinal cord lesions are less well studied compared to corresponding adult's lesions. The functional deficits of paralysis, sensory dysfunction, as well as neurogenic bladder and bowel dysfunction have a significant impact on the child's and their caregiver's well-being.

Objectives: As part of a European collaboration (PEPSCI- Pan-European Pediatric Spinal Cord Injury survey), the correlation of Quality of Life (QoL) of children and their caregivers" was analyzed from data derived from Greece.

Patients and Methods: Children with Spinal Cord Lesions and their parents were surveyed from May 2018 till February 2019 in a cross sectional study, part of a multi-centre, international survey designed by the PEPSCI Collaboration. These children attended during the survey period as outpatients to rehabilitation programs of pediatric outpatient rehabilitation facilities in Athens.

Results: The total of 13 children, with an average age of 9,06 (+/- 5), consisted of 6 males and 7 females. The aetiology was mainly due to congenital lesions. The children PedsQoL in average was 75,4%. The parents perceived PedsQoL was lower being 63,03%. Research priorities for parents and children were outlined in 3 categories, distinguishing between importance, least satisfaction and average of the former two categories.

Conclusion: Our final results have hereby been presented while the PEPSCI study is still ongoing throughout the countries of this collaboration. The need for nationwide data is underlined, not only prioritizing research but most importantly depicting the need for interventions that would also facilitate a smooth transition towards adulthood. Research priorities in parallel with quality of life data are depicted for the first time in the Greek cohort. Our results could be both a basis for international correlations as well as further interventions.

PS69

Cranioplasty after Acquired Brain Injury: Timing, Complication Rate and Outcome

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Question: Decompressive craniotomy is a neurosurgical method for the management of increased intracranial pressure after traumatic brain injury and intracranial hemorrhage. There is a general agreement in literature that, after acquired brain injury, early cranioplasty decreases the incidence of late complications and improves global outcome. Cranioplasty should be performed within 3 months from the acute injury unless complications occur (persistence of the edema, clinical instability, acute infections, altered liquor circulation). In literature, the complication rate is between 10% and 40%.

Methods: We analyzed data from 20 patients that underwent cranioplasty starting from January 2017 until March 2019. The material used for the prosthesis was PALACOS LV, a polymethylmetacrylate(PMMA)-based radiopaque bone cement with a slow hardening. The custom made three-dimensional template for the prosthesis was obtained with the computer software CAD 3D. Also the time between injury and cranioplasty, the surgical

technique and the complication rate were analysed.

Results: 9 of 20 patients underwent surgery within 6 months from craniectomy, 2 patients received bilateral cranioplasty. The incidence of complications was 40% (8 patients) and in 4 patients the prosthesis had to be removed. The more frequent complications were infections (4 patients) followed by hematoma (3 patients) and 1 case in which prosthesis was mobilized.

Conclusions: Although our results are congruent with data from literature, a further decrease in the incidence of complications should be achieved, especially for infections. We believe that it is crucial that the patients have a good nutritional state prior to surgery, the surgical technique reduces intraoperative time and an optimal post-operative management is guaranteed. We are currently monitoring further 7 patients who are still waiting to undergo surgery.

PS70

GioCAAndo: Accessible games with augmentative alternative communication (AAC) and digital learning methodologies. This paper presents our experiences with children who have special communication needs and motor and cognitive disabilities

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The paper describes an approach of how communicative peer experiences can live through an accessible activity and games as to increase the communicative initiative, the ability to communicate, express needs autonomously as well as increase the use communication aid. Games were reconstructed and redesigned respecting the principles of universal design and adapted to the cognitive levels of the participants maintaining a low cost of materials, including technological ones. Through gaming activities, the patients can improve cognitive functions such as executive, praxis and visual functions and language functions such as semantic and lexical systems. The children were grouped based on age performance; Group A: 3 children affected by Cerebral Palsy (no verbal) and Group B: 4 children with variable neurological diseases (able to pronounce

certain words) and use at least one alternative communication system.

Objectives: Evaluation of the increase of autonomous communicative acts and of basic communication skills through group activities among peers thanks to accessible games and communication aids.

Methods: Parents questionnaire to investigate skills, frequency and communication methods of the children. Evaluation in Oct 2018(T0), March 2019(T1) and July 19(T2). Digital dice were created using Scratch (free software), the communication is conveyed through the use of the AAC free app, and / or communication tables or with the aid already available and with VOCA. The types of games range from cooperative games, serious games, facilitated coding, board games and society games (suitably adapted). The methodology used in the sessions provide reinforcement of already known procedures (repetition of games) but with at least one proposal for a new activity that will be resumed in the following sessions.

Results: Comparing and analyzing the results obtained from the questionnaires administered at T0 and T1 can already observe an increase in communicative acts from 25% to 50% in all children and an increase in the use of aids emerges. Doctors observe the increase in attention times and the increase in listening skills; only qualitative level data is reported (no specific neuropsychological scales).

Conclusion: We observed that stimulation of communication through accessible play and the digital learning methodologies directed by a multidisciplinary team stimulates communication, respect for communicative shifts and a better use of aids in children with complex communication needs.

PS71

Rehabilitation program in a patient with complex traumatism in the left forearm-case report

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Background: Complex trauma in the upper limb is increasing over the years, especially in young adults. Men are more frequent involved

and trauma by cutting with flex, cutting in the glass are the most often causes. The need to restore the function of the affected limb is high, especially for patients who are in professional activity. One of the most important steps in obtaining the functionality of the affected segment is that the patient starts as soon as possible the rehabilitation program of the remaining functional deficits.

Material and method: 52 years old patient was evaluated in our clinic for sequela of left forearm following a cut with flex. 6 weeks before the presentation in our clinic, he sustained a complex traumatism in the 1/3 medium of left forearm, by cutting and he was presented at the Emergency Department of the University Hospital Bucharest and was admitted in the Plastic Surgery unit. There was performed, radial artery suture and of median nerve, long flexor thumb tendon, deep flexor of fingers 2,3 tendon, superficial flexor of fingers 2,3,4,5 tendon, flexor carpi radialis tendon. He was immobilized 21 days in splint. At evaluation in our clinic he was assessed from clinical and functional point of view and presented pain and functional impairment of left forearm, wrist, hand and fingers, profound and superficial sensibility alteration in median nerve territory, decrease in muscular strength. He underwent a complex and comprehensive rehabilitation program of electrotherapy, kinetotherapy and occupational therapy for 10 days.

Results and conclusion: After 10 days of rehabilitation program there was observed improvement in muscular strength, range of motion and sensibility. The patient needs further rehabilitation therapy. The particularity of this case is that our patient has alcoholic hepatic disease, alcohol consumption being a negative factor in rehabilitation prognosis and future injuries.

Comparison of high intensive and low intensive robot-assisted gait training with Exowalk in chronic stroke patients

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Introduction: Exowalk® (HMH Co., Ltd) is an electromechanically assisted gait-training device. It has a unique design of an exoskeleton and actualizes stroke patients to walk. Recent meta-analysis has revealed that electromechanically assisted gait training is effective in acute and subacute stroke patients (Mehrholtz J,2017). This study was conducted to assess the effect of intensiveness in robot-assisted gait training with Exowalk on gait ability of chronic stroke patients.

Methods: 1. Data acquisition: Data of each experimental group(gait training with Exowalk) of two randomized controlled trials with equal protocol except robot-assisted gait training time. We divided the data into low intensive training group (LI) from the study 1 of 2016 and highly intensive group (HI) from the study 2 of 2017-2018.

2. Participants: The stroke patients with onset over 3 months were participated.

3. Interventions: LI gait training was performed by Exowalk assisted gait training for 30 min a day, 5 days, 4 wks. HI gait training was performed for 60 min a day, 5 days, 2 wks. Total gait training times were 600 minutes each group.

4. Main Outcome Measures: Functional ambulatory category (FAC) before and after gait training. Walking speed (10MWT), walking capacity (6MWT), balance (BBS), leg muscle strength (MI), mobility (RMI) and daily activity (MBI) were secondary outcomes.

Results: Average age in LI group was lower than HI group (Table 1). Therefore, we adjusted the data using the analysis of covariance method (Table 3). All secondary outcomes in LI group were improved after gait training (Table 2). The changes of FAC were not different statistically between two groups (Table 3). The

changes of balance, leg muscle strength and mobility in LI group were significantly greater than those in HI group (Table 3).

Conclusion: When we applied both high and low intensive gait training with Exowalk, we could expect the same improved walking function. Because The robot can provide unlimited accurate and repetitive motion, gait training duration can be shorten by applying high intensive gait training in chronic stroke patients. However, for improve the muscle strength and mobility in chronic stroke patients, we need enough treatment duration over 2 weeks.

Table 1. The baseline characteristics of LI and HI group

Table 2. The changes of outcome measures between pre and post-training

Table 3. The changes of outcome measures between pre and post-training of two group

Fig. 1

Table 1. The baseline characteristics of LI and HI group

		Low intensity(LI)	High intensity(HI)	
		Training Group (n=18)	Training Group (n=18)	p
		4Weeks_600min	2Weeks_600min	
Sex	male	11(61.1%)	8(44.4%)	0.505
	female	7(38.9%)	10(55.6%)	
Age(years-old)		48.33±15.56	60.00±11.48	0.015*
Duration(days)		491.11±389.21	545.67±295.95	0.639
Type	ischemic	10(55.6%)	13(72.2%)	0.489
	hemorrhagic	8(44.4%)	5(27.8%)	

T-test, binary data using χ^2 test

Table 2. The changes of outcome measures between pre and post-training

	Low intensity(LI)			High intensity(HI)		
	Training Group (n=18)			Training Group (n=18)		
	Pre	Post	P	Pre	Post	p
FAC	3.22±1.31	3.78±1.44	0.004*	4.00±1.46	4.33±1.37	0.010*
10MWT	0.48±0.78	0.73±1.49	0.007*	0.45±0.28	0.51±0.30	0.001*
6MWT	90.57±69.22	110.36±77.01	0.006*	130.33±64.19	152.44±100.23	0.000*
BBS	28.00±13.29	35.00±14.56	0.000*	36.39±18.73	39.28±17.79	0.001*
MI	43.83±16.99	50.22±16.88	0.001*	59.56±19.59	60.78±17.63	0.438
RMI	5.72±2.91	7.11±2.89	0.001*	9.06±4.17	9.22±3.93	0.531
MBI	60.00±18.21	65.83±17.93	0.001*	71.61±23.41	80.44±16.26	0.012*

Wilcoxon Signed Rank tests

FAC, Functional Ambulation Category; RMI, Rivermead mobility index; 10MWT, 10 meter walk test; 6MWT, 6 minute walk test; MI, motricity Index; BBS, Berg balance scale

Fig. 2

Table 3. The changes of outcome measures between pre and post-training of two group

	Low intensity (LI)	High intensity (HI)	p
	Training Group (n=18)	Training Group(n=18)	
FAC	0.56±0.62	0.33±0.49	0.154
10MWT	0.25±0.74	0.06±0.06	0.272
6MWT	19.79±29.58	22.11±20.31	0.499
BBS	7.00±5.18	2.89±3.05	0.015*
MI	6.39±6.36	1.22±5.15	0.031*
RMI	1.39±1.38	0.17±0.71	0.004*
MBI	5.83±4.89	8.83±17.09	0.925

The analysis of covariance of age between control and experimental groups.

PS73

Effects of Square-Stepping Exercise Training on Attention and Dynamic Balance: A Preliminary Report

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Question: Square-stepping exercise (SSE) training is a new and low-cost aerobic exercise designed to improve cognition and balance training. This study was conducted to determine the effects of SSE training on attention and dynamic balance in sedentary young subjects.

Methods: A total of forty-two sedentary young subjects aged between 20-25 years who had not been engaged in regularly exercise in the past six months and no contraindication for exercise were included in the study. Eligible subjects were randomly assigned to either the SSE group (SG; n:21; 9 females-12 males) or control group (CG; n:21; 13 females-8 males). SSE is performed on a thin felt mat(250x100 cm) divided into 40 small squares (25x25 cm). The exercise technique includes forward, backward, lateral, and oblique steps. Step patterns become progressively more complex. SSE consists of quick, multidirectional movements, heel lifts, and smooth transfers of weight, all of which contribute to dynamic balance and cognition. The SG performed SSE together in groups five times a week for three weeks, while the CG received no treatment. The subjects' attention was evaluated with the Stroop Test (ST) which was accepted as the gold standard for attention, and the dynamic balance with Four Step Square Test (FSST). All measures were performed at the baseline and the end of the study.

Results: Initially the mean age, dynamic balance and attention scores were similar in both groups($p>0.05$). It was observed that dynamic balance scores of SG increased after training ($p=0.0001$). In terms of attention functions, a significant improvement was found in the 1st($p=0.0001$), 3rd($p=0.0001$), and 4th($p=0.0001$) sub-tests of ST in SG after training. When the groups were compared, significant improvements were observed in FSST, and all subtests of ST in favor of SG at the end of the study ($p<0.05$).

Conclusion: The results showed that SSE training improves attention and dynamic balance in sedentary young subjects.

Keywords: Attention, Dynamic Balance, Four Step Square Test, Square-Stepping Exercise, Stroop Test

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PS74

Timing of initiation of rehabilitation after stroke

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Question: Cerebrovascular disease is a common cause of mortality and morbidity in Portugal. There has been a 39% reduction in stroke deaths, among the last 5 years, due to an investment on the prevention and acute treatment. Post-stroke rehabilitation is part of the treatment and therefore should be given the same attention and should undergone successive assessments in order to improve strategies. The assessment of the early rehabilitative therapy should focus on the initiation of the therapy, type and the intensity of it. The aim of this study was to evaluate the time spend until the initiation of the rehabilitative therapy after a stroke.

Methods: A retrospective and observational study was made, we included patients with cerebrovascular disease who were admitted in the Neurologic department at a level I hospital in Portugal between January and June 2018.

Results: 105 patients were included; the mean age was 73 years and 58% were female. The average length of stay was 32 days, 100 patients were seen by a physiatrist at the second day of stay. 22 patients didn't receive rehabilitation treatment and the main reasons were: short-term discharge ($n=7$), medical complications ($n=16$) or absence of deficits ($n=3$). On average, the patients waited 7 days to start the rehabilitative therapy and 36% of the patients were discharged without performing in-hospital treatment.

Conclusion: Rehabilitative therapy should begin in the acute-care hospital after the patient's condition has been stabilized, often within 24 to 48 hours after the stroke. We are planning a new strategy to reduce the days from stroke onset to the initiation of rehabilitative therapy, since fewer days are associated with better outcomes.

PS75

Importance of classical rehabilitation programs in early neurorehabilitation

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Question: Haemorrhagic stroke (HS) is the second most common cause of stroke, occurring more frequently among male, Asian, advanced age and among middle-and low-income countries. Rehabilitation after HS occurs early in the first few months. Recognizing the importance of medical rehabilitation from the early stages, the question is "Will current classical rehabilitation programs remain actual in the early neurorehabilitation?"

Methods: A 70-year-old patient from the rural area with no significant pathological history suffered a capsulo-lenticular HS with left sided hemiparesis. Due to the low financial resources of the patient, rehabilitation programs were initiated late and with a reduced frequency, programs that aimed improving motor and sensory functions, adaptation to environmental conditions, preservation of joint mobility, spasticity inhibition techniques, reeducation of transfers and walking. In spite of these facts, he arrived to Romanian National Institute of Rehabilitation, four months after the event, accusing a left-sided hemiparesis with 4/5 BMRC in all upper muscle groups, Ashworth grade 1 spasticity, despite these good performances, the patient was not able to perform any task with the affected part, walking with a metal frame, Barthel scale 55/100, ADL 6/6, iADL 1/8. In the acute rehabilitation phase, the patient did not follow the posture techniques (maintaining the affected limbs in the patient's visual field, positioning the patient with the affected side of the edge of the bed). At the moment, even if the motor function has been recovered, the patient is not capable of using the affected hemipart at the maximum recovered capacity. During hospitalisation, the patient underwent physical-kinetic treatment to maintain joint mobility, to

improve motor and sensory functions, to inhibit spasticity, training transfer and walking, and ergotherapy.

Results: Upon discharge from our department, the patient presents a functional improvement, objectivated by Barthel score 90/100, ADL 3/6, iADL 4/8, increasing his ability to feed, to dress, to self-administer medication, to use the toilet, to move independently on short distances, managing to identify and involve the affected limbs in daily activities, which gives the patient a much easier social integration improving his quality of life.

Conclusion: In conclusion, neurorehabilitation has to be accompanied by the classical methods of rehabilitation, which express their usefulness on the long term.

PS76

Use of the Orpington Prognostic Scale as a reliable prognostic indicator for patients with subarachnoid haemorrhages: A feasibility study

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Question: Is the Orpington Prognostic Scale (OPS), an outcome measure reliably used as a prognostic indicator following ischaemic stroke, feasible for use within the subarachnoid haemorrhage (SAH) population?

Method: The OPS was administered to all patients diagnosed with SAH that were admitted to the King's College Hospital London neurosurgical wards over a 4 month period from February to May 2019 and documented within an Excel spreadsheet including; age, gender, location of aneurysm, admission and OPS completion date, variances if over 72 hours, surgery, grade and GCS.

Results: 21 patients (7 male, 14 female) between the ages of 33 and 79 (mean age of 54) were diagnosed with SAH. A higher proportion of less severe grade 1 SAH was apparent with ten patients, two grade 2, one grade 3, five grade 4 and three grade 5. All patients presenting with grade 1 to 3 were assessed as mild on the OPS, with those diagnosed as grade 4 and 5 presenting as either moderate or severe.

Conclusion: Although feasible to be used in grade 1 and 2 SAH, it was deemed of no benefit and supported the therapist's clinical reasoning not to routinely assess this patient group. Unfortunately during this time, we only had exposure to 1 patient diagnosed with a grade 3 SAH so would require further testing. The OPS could however be feasible and beneficial for use in grade 4 to 5 SAHs as the study highlighted a variation of moderate to severe within these categories, suggesting the World Federation of Neurological Surgeons (WFNS) classification does not necessarily determine or indicate rehabilitation needs. The patients with WFNS Grade 4 to 5 presented with moderate and severe scores on the OPS indicating greater neurological impairment and therefore may be useful in determining patients' prognosis, rehabilitation needs and discharge destination. Further work however is required to determine if the OPS is a reliable prognostic indicator in grade 4 and 5 SAHs in patients medically fit for assessment.

PS77

Astasia-abasia syndrome a challenge in neurological rehabilitation

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Astasia-abasia syndrome is an inability to stand (Greek: astasia) and walk (Greek: abasia). This term is regularly used when no focal neurological deficit is found, which is responsible for this severe function disorder. The syndrome was first described in 1888 by Paul Blocq in psychiatric patients who showed a normal function of the legs in the bed during the examination, but were not able neither to stand nor to walk.

The term "Astasia-Abasia" is also used by some authors in organically induced disorders, such as severe polyneuropathies, cerebellar diseases or severe paralysis after stroke, Parkinson's disease and multiple sclerosis. Descriptions of the syndrome in the literature are almost exclusively in the form of case reports with partly very heterogeneous basic diseases. The findings of some studies of patients with conversion disorders suggest that alterations in regional brain perfusion may accompany these conversion symptoms.

In addition to these heterogeneous case descriptions of dissociative movement disorders, we find in the literature a further group of cases with different lesions of the central nervous system. We report of a case of postoperatively occurring astasia-abasia syndrome in a patient with left frontal localized glioblastoma multiforme and infiltration of the anterior parts of the corpus callosum. Before and directly after operation there were no focal neurological deficit, motor function (muscular strength, coordination) and the depth and surface sensibility were completely inconspicuous, no abnormalities in the orientated neuropsychological examination (mini-mental state), affect, no signs of content or formal mental disorders.

Early rehabilitation was carried out from the second postoperative day onwards, without any effect to the symptoms. The patient died on the 8th day after operation by pulmonary embolism.