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# WCNR 2018 Oral Abstracts

## Postural and Gait Disorders in Subacute Stroke Patients: Lateropulsion is the Key

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**Objectives:** Recent researches suggested that postural disorders after stroke may be caused by a wrong referential of verticality, expressed by a lateropulsion behavior. The role played by lateropulsion in the postural and gait disorders after stroke remained to be investigated.

**Methods:** Retrospective cohort study (2012-2017) of 147 consecutive patients investigated in a neurorehabilitation ward in average at 32.7 days after a first hemispheric stroke: age 62.8±12.6 years, 41 females, 120 with infarction, 57 with right lesion. Trained physiotherapists assessed: lateropulsion with the Scale for Contraversive Pushing (SCP,0-6), Balance disorders with the Postural Assessment Scale for Stroke (PASS,0-36), and gait disorders with Lindmark Scale (0-6). Brain imaging were carefully checked (138 MRI,9 CT). Descriptive data are given in the form median (first-third quartile).

**Results:** One month post-stroke, postural and gait data were: SCP 0 (0-0.25), PASS 32 (25-35) and Gait score 4 (2-6). Fifteen patients were pushers (10%), among them 80% had a right hemisphere stroke. A first result was to confirm that lateropulsion was more severe in right hemisphere stroke than in left (right 46% vs left 10%, $x^2$=47.7; p<0.001). Postural disorder and gait disorder were also more severe after right hemisphere stroke. In patients with a right hemisphere stroke, lateropulsion explained 77% of the variance of postural disorders (p<0.001), and 76 % of the variance of gait disorders (p<0.001). Postural disorders explained 81% of the variance of gait disorders (p<0.001).

**Conclusions:** Lateropulsion, is a primary cause of postural and gait disorders at the subacute phase after right hemisphere stroke, explaining almost 80% of balance and gait disabilities. A greater attention should be focused on the assessment and the rehabilitation of the post-stroke lateropulsion.

## Correlation of fMRI and Growth Factor Upregulation After Stem Cell Infusion in Chronic Stroke

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**Objectives:** The emerging role of Stem cell technology and transplantation has helped scientists to study its potential role in neural repair and regeneration. The fate of stem cells is determined by its niche, consisting of surrounding cells and the secreted trophic growth factors. This study evaluates the functional potential of bone marrow derived mononuclear stem cells (BM-MNC) in chronic ischemic stroke through fMRI & growth factor upregulation.

**Methods:** Twenty (n=20) stroke patients with 3 months to 1.5 years of index event, MRC grade of hand muscles at least 2; Brunnstrom stage: 2−5 were recruited. These were randomized to one group receiving autologous BM-MNC (mean 60–70 million) and other receiving saline infusion/placebo in group 2. All patients were administered with neuromotor rehabilitation regime for 8 weeks. Clinical assessment (FM, mBI, MRC, Ashworth) & serum VEGF and BDNF estimation were done at baseline and 8 weeks. Block design with alternate baseline and activation task was used with a total of 90 whole brain EPI measurements (TR =4520 ms, TE =44 ms, slices =31, slice thickness =4 mm).

**Results:** No serious adverse events were observed during the study. There was no statistical significant clinical improvement between groups (FM:p=0.25; mBI:p=0.31). Laterality index of BA 4 & 6 was statistically insignificant between both the groups (95 % CI~ -0.45 to -0.12; p=0.45 and 95% CI~ -0.33 to -0.17; p=0.06 respectively). Mean VEGF and BDNF expression was found to be greater in one group compared to the other (VEGF: 442.1 vs. 400.3 pg/ml, p = 0.67; BDNF: 21.3 vs. 19.5 ng/ml).

**Conclusions:** Stem cell infusion is safe and tolerable by stroke. Stem cells and neurorehabilitation regime aids in functional recovery as demonstrated by fMRI & growth factor upregulation.

## A Randomized Double-Blind Study Assessing The Effect of Vagus Nerve Stimulation (VNS) During Rehabilitation on Post-Stroke Upper Limb Recovery

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**Objectives:** To assess long-term effects of VNS paired with upper limb rehabilitation.

**Methods:** This blinded, sham-controlled study was performed on subjects with chronic moderate-to-severe hemiparesis due to ischemic stroke. All were implanted with VNS and randomly assigned to receive either rehabilitation paired with real (VNS group) or sham VNS (control). Outcomes measured by the Upper Extremity Fugl-Meyer (UEFM) were assessed 3, 6 and 9 months post-completion of a 6-week therapy course, and for the control group at days 1, 30, and 90 *after crossover* to real VNS+rehabilitation. Wolf Motor Function Test (WMFT) and Beck Depression Inventory scores (BDI) were also administered.

**Results:** Seventeen participants were implanted. Average UEFM score improvement in VNS group at 1, 30, & 90 days post-implant were 7.6±4.8 (mean±SD), 8.0 ± 4.7, and 9.5±6.5, respectively, while average changes in controls were 4.9 ±3.1, 5.5±3.4, and 3.3±4.6. After crossover to VNS, control participants demonstrated additional improvement beyond the amount achieved during the rehabilitation+sham stimulation phase Average UEFM improvement after crossing over to VNS persisted at 6 months, with a 13.7 point mean improvement. Responder rates for each group are compared in Figure 2. WFMT time improved by 4.8 ± 9.8 seconds for VNS vs. 1.8 ± 2.2 for control.

**Conclusions:** Improvement in UEFM scores in those who received VNS persisted for at least six months after initial in-clinic treatment, despite lack of on-going in-clinic therapy. This suggests additional benefit to VNS pairing with rehabilitation.

## Post Stroke Review: Gender-Specific Influences on Long-Term Outcome (A Sino-Australian Study)

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**Objectives:** The focus of post stroke review has shifted to identifying the significance of individual risk factors that predict long-term disability. Overall, 30% of Australians report persistent disability after stroke. This study aimed to evaluate the influence of gender on long-term symptom presentation following stroke, using the Post Stroke Checklist (PSC).

**Methods:** The PSC (endorsed by the World Stroke Organization) identifies the incidence of 10 common sequelae after stroke with a focus on patient functioning and suggests appropriate courses of action. The study administered the PSC to 183 patients recruited from three acute stroke units in Australia and China at 6 months post stroke. To measure gender differences, logistic regression and chi-square analyses were employed.

**Results:** Participants comprised 122 (66.7%) males and 61 (33.3%) females with a collective mean age of 64.73 years (SD =13.8). Overall 82.5% patients reported at least one deficit at 6 months; with a higher incidence amongst females (86.9%) compared to males (80.3%), although non-significant. The pattern of symptoms between males and females however is similar. Females were more inclined to report long-term cognitive difficulties (59.0% compared to 36.9% of males) (chi-square = 8.07, $p<0.01$, Odds ratio = 2.46, 95% Confidence Interval (CI) = 1.31 - 4.62), mobility limitations (50.8% to 36.9%), pain (23.0% to 11.5% - trending towards significance; $p=.070$), difficulties performing activities of daily living (50.8% to 41.0%) and communication (29.5% to 23.8%). Cognition was the only significant predictor of symptom presentation differentiating between females and males.

**Conclusions:** In this study, the incidence of long-term sequelae of stroke had a gender bias. Females are over twice as likely to report long-term cognitive difficulties and had increased pain and difficulties with communication and performing activities of daily living.

## Building Effective Spasticity Pathway; Combined Neurorehabilitation and Hand Surgery Clinic, Outcome of Upper Limb Chronic Spaspicity Management Following UMN Syndrome

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**Objectives:** To determine outcome of surgical management of chronic spasticity unresponsive to physical therapy and pharmacological treatment.

**Methods:** Chronic spasticity arising from UMN syndrome of varying aetiology were treated and followed up over 20 years in a specialist combined clinic between Neurorehabilitation Consultant and a Consultant plastics/hand surgeon. Individualised decisions were made, matching best procedure with the appropriate patient. Goals and outcome measures were recorded pre and post procedure. Surgery completed as day case procedure, either under regional anaesthesia or rarely under general anaesthesia. Routinely patients were injected Botulinum toxin 3-4 weeks prior to the procedure. Patients are followed up in hand therapy clinic and subsequently in combined clinic. Other than standard procedures, extensor weakness in wrist required additional augmentation.

**Results:** Random sample of 20 patients seen from 2010-2017 were allocated with different aetiology like stroke, brain injury, subarachnoid

haemorrhage or cerebral palsy. The commonest indication was maintaining hand hygiene. 10 were treated surgically, either by single or staged procedures, 10 were treated conservatively. Selective fractional lengthening, tendon transfer and arthrodesis were the procedures undertaken, with significant long-term improvement. Selective fractional lengthening procedure were performed for wrist, finger flexors as well as for elbow flexor (step lengthening). Tendon transfer were performed for augmenting wrist extensor (FCU or FCR-ECRB) either in one stage or by staged procedures. Arthrodesis was done for first MCPJ thumb, but not for wrist fusion. Only one patient needed re-do lengthening after tendon transfer and one patient needed HDU admission following de-saturation after general anaesthesia.

**Conclusions:** Results indicate that surgery in addition to the standard neurorehabilitation management is not suitable for every patient with chronic spasticity but selected patients will benefit considerably over longer term with surgery. Earlier referral and achievable goal setting are key factors for success.

## Acoustic Analysis of Swallowing in Patients with Stroke

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**Objectives:** Acoustic analysis of swallowing focuses on assessment of duration of Laryngeal ascension sound, upper oesophageal sphincter opening sound and laryngeal descending sound. The present study aimed at comparing the acoustic features of swallowing among stroke patients with dysphagia and normal healthy individuals.

**Methods:** The subjects for this study included 20 males in the age range of 25 to 55 years. 10 stroke patients with dysphagia served as experimental group and 10 age & gender matched normal healthy individuals served as control group. All the subjects had undergone Manipal Manual for Swallowing Assessment (MMSA) evaluation. Followed by MMSA administration, all the subjects were provided with three consistency of liquids (I.e) thin liquids, honey thickened liquids and thick liquids for swallowing assessment. During swallowing, the swallowing sounds were recorded with the help of external digital microphone placed over the thyroid alae. The samples recorded were analysed with the help of PRAAT software. The analysis included the calculation of duration of laryngeal ascension, upper oesophageal sphincter opening and laryngeal descending sound.

**Results:** The results of the present study showed a statistical increase in duration of laryngeal sounds among stroke patients when compared to the normal individuals. The results can be correlated to the compensatory or faulty mechanism followed by the experimental group when compared to the normal individuals.

**Conclusions:** The acoustic analysis of swallowing sounds can be included as an assessment tool in the routine dysphagia assessment procedure, as it provides information about the pharyngeal phase of swallowing non invasively. It may also be used as a prognostic indicator.

## Clinical Scenario of Patients With Multiple Sclerosis (MS) in North India

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**Objectives:** To study clinical characteristics of MS in North Indian population.

**Methods:** Data was retrospectively analysed from the MS registry database of the department of Neurology, PGIMER from January 2013 to January 2017. The fields of the database were adopted from the MS base

**Results:** 175 patients were recruited in the study. Median age of onset was 30.66 (Range-1-60 years); females were 63.43 % and males 36.57%. Median duration of MS was 3 years. Mean EDSS at last visit was 3.82. The MS course at the time of admission were 69.71 % Relapse Remitting type, 2.86 % Secondary Progressive type, 1.14 % Progressive Relapsing and 2.86% Clinically isolated syndrome. Mean Relapse rates during entire period of follow up were 0.39. 72.00 % had no relapse, 19.43 % had 1 and 5.71 % showed >2 relapses. 17.71 % patients were on Avonex, 4.57 % on Azathioprine, 1.14 % were on Betaferon, 8% were on Copaxone, 4% were on Methotrexate, 1.14 % was on Novantrone, 5.71 % were on Rebif, 4.00 % patients were on Tecfidera and 3.43 % patients were Tysabri.

**Conclusions:** Our results showed similar trends as the Western MS population

## Effect of Early Use of AbobotulinumtoxinA on Time to Post-Stroke Spasticity Progression: Results of the ONTIME Pilot Study

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**Objectives:** While muscle tone changes may appear within 2 weeks post-stroke, limited data exist on effect of early botulinum toxin treatment on symptomatic (disabling) spasticity progression. The ONTIME pilot study aimed to assess if early post stroke (2–12 weeks) abobotulinumtoxinA (aboBoNT-A; Dysport®) injections delay upper limb symptomatic spasticity progression.

**Methods:** ONTIME pilot (NCT02321436) was a 28-week, phase 4, randomized (2:1), double-blind, placebo-controlled study. Primary endpoint was time between injection and meeting re-injection criteria (Modified Ashworth Scale [MAS] ≥2 and one sign of symptomatic spasticity: pain, involuntary movements, impaired active or passive function).

**Results:** In total, 42 patients (78.6% male; mean [SD] age, 59.8 [12.3] years; median [range] time post-stroke, 5.86 [2.3–11.7] weeks; 76.2% baseline symptomatic spasticity) from Malaysia, Philippines, Singapore and Thailand were randomized (n=28:14, aboBoNT-A:placebo). The most common symptom at baseline was impaired passive function (64.3%), followed by active function (57.1%), involuntary movements (47.6%) and pain (38.1%). Median time to meeting re-injection criteria was significantly longer for aboBoNT-A versus placebo (156.0 vs. 32.0 days, respectively; p=0.0176; Similar results were observed in symptomatic patients (130.0 vs. 32.0 days, respectively; n=32; p=0.0384). In asymptomatic patients (n=10; baseline MAS ≥2 only), first quartile time to reaching re-injection criteria was 114.0 days (aboBoNT-A) and 73.0 days (median, placebo; Table 1). No difference in motor function was observed between groups (Table 1). Safety was consistent with known profile of aboBoNT-A.

**Conclusions:** Symptomatic spasticity was prevalent at baseline (2–12 weeks post-stroke). Compared with placebo, early aboBoNT-A administration significantly increased time to reappearance and appearance of symptomatic spasticity.

## Bold Steps in Stroke Research: Recommendations from the First Stroke Recovery and Rehabilitation Roundtable

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**Objectives:** An international collaboration was established in 2015 to form consensus on how to develop and promote excellence in stroke recovery research.

**Methods:** Four working groups formed to address key hurdles across the stroke research pipeline: translation of pre-clinical studies, biomarkers of stroke recovery, development and reporting of interventions, and measurement in clinical trials. Relevant literature was reviewed and working groups implemented pre-specified methods based on decision making science to form priorities and recommendations. The first Stroke Recovery and Rehabilitation Roundtable was convened in Philadelphia, USA, in 2016 and included 60 working group members.

**Results:** A radical new radical vision of 'brain repair' emerged. New innovations were proposed to better align models of pre-clinical stroke and human stroke recovery, including the implementation of specific imaging techniques and selected biomarkers early after stroke, the collection of core measures, and the rigorous design and reporting of stroke trials. Detailed recommendation papers are available open access at http://journals.sagepub.com/page/wso/srrr.

**Conclusions:** The implementation of our recommendations is expected to result in game changing advances in stroke research. We are planning the Second Stroke Recovery and Rehabilitation Roundtable for late 2018.

## Tertiary Hospital Based Study of the Care and Cost of Acute Ischemic Stroke in Mumbai

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**Objectives:** To evaluate the current status of care and cost of acute ischemic stroke in Mumbai. The hospital based analysis at a tertiary emergency care hospital with a 24 hour neurology team and care unit.

**Methods:** During 6 month period of May 2017 to October 2017, consecutively hospitalized 54 patients with acute ischemic stroke data was collected. We examined the demographic data, in- hospital care, length of stay, outcome at discharge and hospital costs. The medical cost data were collected from official hospital medical costs charts, which calculated direct medical costs for beds, staff, radiological and blood examination, medications and rehabilitation.

**Results:** The mean age was 60.81 years, and 81.12% were male. The mean National institutes of health stroke scale score was 8.07 points on admission. All patients underwent MRI angiography of brain on admission. All Patient were treated with ischaemic protocol (Antiplatelet, Neuroprotector, LMWH and Statin and treatment of co morbidity). 52.72% patients were admitted to neurological intensive care unit. Overall, 100% patients received in-hospital rehabilitation; mean length of stay was 10.77days. In hospital mortality rate was 0.03%. The mean hospital cost per patient was 89,610 INR (8320.3INR/day). The mean ICU cost per patient was 13,495INR per day. Of which 44.03% was attributable to the costs for beds, doctor and staff, 9% for medicine, 3% for rehabilitation, 16% for imaging studies, 12% surcharge and 24% for laboratory examinations. National institutes of health stroke scale score on discharge were 4.07 points.

**Conclusions:** Despite the single Hospital- Based analysis, this study provided the current precise data on short-term inpatient care and costs of acute ischemic stroke in a tertiary care hospital in Mumbai. We can conclude that early effective and proper management of stroke leads to a better and cost effective outcome.

## Natural History of Mild Traumatic Brain Injury

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**Objectives:** Post-traumatic symptoms are frequent after mild traumatic brain injury (mTBI). About 30-80% of patients during 3-4 months and

20-30% after 6 months of injury have symptoms. The natural history of mTBI was studied longitudinally using clinical and imaging parameters.

**Methods:** Patients with mTBI, and normal brain imaging were recruited initially 2–3 weeks post injury. All patients were followed up at, 3-4 and 6-7 months. The patients were evaluated with neuropsychological test, post-traumatic symptoms, quality of life after-injury, and multimodal imaging including diffusion tensor imaging (DTI), and resting stage functional MRI (rsfMRI).

**Results:** Memory and executive domains improved partially until 3 months and completely after 6 months, but few facets of memory did not improve even at 6 months. The post traumatic symptoms decreased from baseline of 76% to 52% at 3-4months and further to 28% at 6-7months. The quality of life improved partially from baseline till 3-4months, and more by 6-7months. The improvement was correlated with imaging findings.

On rsfMRI within 3 months, the majority of the region of interest (ROI) pairs had decreased connectivity in mTBI population, which increased and became comparable to healthy controls at 6 months. On DTI eventual changes of tensor values of thalamus, frontal and temporal lobe had persistent and significant association with attention and memory. DTI detected natural recovery of brain regions affected by subthreshold force. The correlation between improvement in cognitive scores and changes in thalamic tensor and volume measures reflected the role of the thalamus in natural recovery after mTBI.

**Conclusions:** The results summarize that majority of post-traumatic symptoms recover after mTBI without any intrusions, but residuals are not uncommon. Imaging indicates that time varying brain connectivity changes as the brain recovers from injury.

## Long-Term Outcome and Prognostication in Severe Disorders of Consciousness (DOC): Results of a Large German Prospective Multicenter Study

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**Objectives:** Coma, unresponsive wakefulness syndrome (UWS), and minimally conscious state (MCS) are frequent consequences of severe brain injury, such as anoxic-ischemic encephalopathy (AIE), traumatic brain injury (TBI), or stroke. Prognostication of the long-term outcome of these patients is a challenge with only limited prospective data available. Current practice parameters for prognostication may carry the risk of too pessimistic assumptions, therapeutic nihilism, and self-fulfilling prophecies.

We present for the first time the final results of a large German study on the long-term outcome of acute-onset DOC-patients in inpatient early neurorehabilitation.

**Methods:** Prospective, observational multicenter study of acute brain injury patients, who presented in coma, UWS, or MCS upon admission to inpatient neurorehabilitation. Clinical scales (CRS-R, Barthel-Index, depression, QOL), EEG and SEP were elicited repeatedly up to 24 months post admission.

**Results:** 247 patients were enrolled (42% with AIE, 31% stroke, 22% TBI) and followed for 2 years. After 2 years, 13% of patient were in UWS, 9% in MCS, 20% had emerged from MCS (eMCS), and 58% were dead. 5% of AIE patients regained functional communication skills despite bilateral loss of cortical SEP potentials. Even after one year of follow-up, some patients progressed from UWS or MCS to eMCS.

**Conclusions:** Despite the frequent presence of strong negative prognostic markers, substantial proportions of severely-affected patients may experience a favourable outcome. We will present at the 2018 WFNR meeting for the first time in detail the final study data, including the likelihood of future recovery, depending on the individual patient situation and timeline. This will provide important information for medical decision makers and for counseling of families in the subacute situation.

## The Role of Resilience and Personality in the Psychological Adjustment of Family Members Supporting Relatives With Severe Traumatic Brain Injury

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**Objectives:** Recent evidence suggests that rather than being an inherent personality-based trait, resilience is instead an acquired skill. This study investigated the independent contribution of resilience to the psychological adjustment of family members supporting relatives with severe traumatic brain injury (TBI) beyond that accounted for by personality.

**Methods:** Family members (n=131) of relatives with severe TBI (post-traumatic amnesia, PTA>1day) were recruited from six specialist brain injury centres in Australia as part of an observational cross-sectional study. Participants completed the Connor-Davidson Resilience Scale, Eysenck Personality Questionnaire and 5 psychological adjustment measures (psychological distress, caregiver burden, positive mental health, positive affect and negative affect).

**Results:** Family members were predominantly female (106/131,81%) and parents or spouses (117/131, 89%) of the relative with TBI. The relatives had extremely severe TBI's (duration of PTA, mean 71.7±64.3 days). Psychoticism did not significantly correlate with any of the outcome measures and was therefore not included in further analyses. Five regression models were tested with scores on two personality dimensions (neuroticism and extraversion) entered in one block followed by resilience scores in the second block. All models were significant predictors of scores on the five psychological adjustment measures (p=.000) accounting for between 25.5-39.8% of the outcome variances. Resilience (β=0.314) significantly predicted positive affect scores ($R^2$=.353, $F_{(3,127)}$=24.691, $p$=.000) after accounting for personality scores, but did not predict scores on any of the remaining outcome measures. Higher levels of neuroticism were strongly associated with higher levels of psychological distress, negative affect, caregiver burden, and poor mental health.

**Conclusions:** This study recognises the importance of resilience and is among the first to investigate the contribution of personality to the psychological adjustment of family members supporting relatives with severe TBI.

## Functional Outcomes after Acquired Brain Injury in Childhood: Does the Type and Location of Injury Result in Different Outcomes?

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**Objectives:** Acquired brain injury in childhood can result in a wide range of physical and cognitive impairments, impacting upon the child's function. Severity of injury is a known prognostic indicator of functional outcome, but little is understood regarding how differences in ABI contribute to outcomes.

**Aim:** determine whether there are differences in functional outcomes of children who sustain different types or locations of brain injuries.

**Methods:** Analysis of routinely collected UK Functional Independence Measure and Functional Assessment Measure (UKFIM+FIM) for children over 8yrs in residential neurorehabilitation (2012-2016). Children classified by age (years), injury type (trauma, stroke, inflammatory, tumour, anoxia or 'other') and injury location (global/diffuse, cerebellar, right/left hemisphere, brainstem, frontal,'other'). Differences between groups total UKFIM+FAM, motor and cognitive subsection at admission, discharge and change scores analysed using ANOVA.

**Results:** n=128 (55 female), mean age at injury 12.3 years (range 7-17), mean length of stay 140.5 days (range 21-630).

At admission, only injury location presented different cognitive performance profiles (F= 2.62, p= 0.02) Motor performance or total UKFIM+FAM not statistically significant.

At discharge, injury type and location statistically different cognitive performance (type: F=1.97, $p \leq 0.05$; location F= 3.07, p=0.08) and total UKFIM+FAM score (F=2.48, p=0.027).

Ongoing analysis of data will examine relationships in further detail.

**Conclusions:** These preliminary findings indicate that the type and location of brain injury in children may have an effect on rehabilitation outcome, particularly cognition. Young people and their families seek information about potential progress and long term outcome following brain injury which is difficult to provide in this heterogeneous population. Knowledge of the outcome for different types of ABI could enable clinicians to have more honest conversations with families and target their interventions more appropriately.

## Depression, Anxiety and Quality of Life in Children Three Months After Traumatic Brain Injury

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**Objectives:** To compare depressive, anxiety and quality of life (QoL) between children with TBI three months after injury and control children in Mexico.

**Methods:** Forty-six children with TBI and 46 control children completed the Anxiety Scale for Children-Revised (CMAS-R), Children's Depression Inventory (CDI) and Pediatric Quality of Life Inventory (PedsQL). Groups were similar with respect to age, gender, and education (p's>0.05). The majority were boys (71%) with a mean age of 10.6 (SD=2.6) and 4.8 (SD=2.1) of education. TBI group have a Glasgow Coma Scale score of 10.3 (SD=2.7).

**Results:** MANOVA showed significant differences between groups in CDI, CMAS-R and PedsQL total scores (F=38.40; p<.001), so that children with TBI scored higher in CDI and CMAS-R, and lower in PedsQL than controls. MANOVA showed significant differences between groups in CDI subscales (F=30.47; p<.001). Compared to controls, children with TBI scored higher in negative self-esteem (F=29.5, p<.001) and dysphoria (F=58.45, p<.001). MANOVA also showed significant differences between groups in CMAS-R subscales (F=8.88; p<.001), so that children with TBI scored higher than controls in physiological anxiety (F=30.83, p<.001), restlessness/hypersensitivity (F=14.16, p<.001), and social concerns subscales (F=22.96, p<.001). No differences were found in lie subscale. Finally, MANOVA showed significant differences between groups in PedsQL subscales (F=38.75; p<.001). Compared to controls, children with TBI scored lower in physical (F = 21.25, p <.001), emotional (F=110.17, p<.001), social (F=24.96, p<.001), and scholar (F= 110.98, p<.001) subscales.

**Conclusions:** Longitudinal studies are warranted to determine long term persistence of these symptoms and impact on QoL.

## Management of Traumatic Brain Injury Patients

**Dr. Nitin Dange[1]**

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**Objectives:** To study the role of multidisciplinary management and analyze the outcome of appropriate intensive care and neuro-rehabilitation in severely traumatic brain injury patients.

**Methods:** Patients admitted in Lilavati hospital and research centre, Mumbai with severe head injury with GCS <8 on admission during the period April, 2010 to March, 2017, were analyzed in the parameters- GCS, cognition scales and MRS scale.

**Results:** Neuro-protective drugs, monitoring ICP, timely intervention to maintain normal ICP using various modalities of treatment like pharmacotherapy, ICU care, physiotherapy, bed sore prophylaxis and deep vein thrombosis prophylaxis, altogether significantly improve the outcome of severe traumatic brain injury patients in GCS, cognition and MRS scale.

**Conclusions:** Multidisciplinary tailor made approach with good coordination between the team of neurosurgery, intensive care unit, physiotherapy, speech therapy, neuropsychology and nursing care helps to improve the long term neurological and functional outcome of the severe traumatic brain injury patients.

## One Year Outcome After TBI; A Large Prospective Cohort

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**Background:** Global outcome studies after Traumatic Brain Injury(TBI) differ widely in terms of findings. This is mainly due to differences in outcome measure, attrition to follow-up and selection bias. Information on long-term outcome would help to inform patients, families and develop services.

**Aims:** to assess the global outcome and return to work after TBI in a large, unselected TBI cohort admitted to hospital and any relationships with other TBI and demographic features.

**Design, Subjects and Setting:** 1322 consecutive TBI admissions over 5 years, assessed within a specialist regional neurorehabilitation clinic at a University hospital.

**Methods:** All patients assessed at 10 weeks and 1 year. Main outcomes were Extended Glasgow Outcome Scale(GOSE), return to work, Rivermead Head Injury Follow-up Questionnaire, Rivermead Post-Concussion Symptoms and the Hospital Anxiety and Depression Score.

**Results:** 1194 (90.2%) of the cohort had follow-up data at 1 year. Mean age was 46.9(SD17.3) and median length of stay 2days (1-154) reflecting the preponderance of mild TBI(49.2% mild, 33.9%moderate and 16.9%severe). At 10 weeks only 24.6% made a good recovery with 52.6% and 22.7% in moderate and severe disability. This improved at one year to 38.8% good but only 22.6% were in the good upper or best grouping. For return to work, only 28.1% of individuals returned to normal pre-morbid level of work at 10 weeks, improving to 39.2% at 1 year. However 31.0% at 1 year were unable to make any return to work or study and 24.7% had a partial return.

**Conclusions:** In a truly representative TBI population including MTBI, there is still considerable disability at 1 year and many individuals are unable to make any return to pre-morbid vocation. Further analysis will be presented.

## A Predictive Model of Resilience Among Family Caregivers Supporting Relatives With Traumatic Brain Injury (TBI): A Structural Equation Modelling Approach

**Ms. Maysaa Daher[1], Dr. Malcolm Anderson[2], Prof. Grahame K Simpson[3]**

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**Objectives:** Family caregivers supporting relatives with TBI play a key role in their recovery and long term outcomes. Traditional research has focused on the negative impacts of caregiving; however a paradigm shift in the field of rehabilitation and family research from a deficits-based to a strength-based approach, incorporating resilience, is underway. The current study devised a model to examine the predictive and mediating relationships among resilience, personality, coping, self – efficacy, hope, social support and the outcomes caregiver burden and psychological adjustment.

**Methods:** Family members (n=131) of relatives with severe TBI (post-traumatic amnesia > 1 day) were recruited from six brain injury services across New South Wales and Queensland, Australia, in an observational cross sectional study. Participants completed a battery of questionnaires on the elements of the hypothesised model. The model was tested with Structural Equation Modelling (SEM).

**Results:** The SEM model fitted the data very well, as indicated by the goodness-of-fit indices ($\chi^2$ = 58.521; p = 0.166; NFI = 0.934, IFI = 0.989, CFI = 0.998 and RMSEA = 0.39). Self-efficacy, coping strategies (problem-focused coping), and personality traits (neuroticism, extraversion) jointly accounted for 63% of the variance in resilience. Resilience had a direct effect on positive affect and played the role of a protective factor in relation to two variables associated with caregiver vulnerability. It had an indirect association with caregiver burden mediated through social support. Resilience, in combination with self-efficacy, had a direct effect on hope, which, in turn, was associated with positive mental health among caregivers.

**Conclusions:** The results showed the usefulness of adopting SEM to study resilience in family caregivers supporting relatives with TBI. Resilience plays a key role in the psychological adjustment of family caregivers. These results have clinical importance in that a focus on building resilience may lead to improved caregiver outcomes.

## Effect Observation of Community Rehabilitation Model on Generic Set of ICF for Patients with TBI

**Dr. JIng He [1], Mr. Qingchuan Wei[2]**

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**Objectives:** To observe the effect of Community Rehabilitation Model on Generic Set of ICF for Patients with TBI

**Methods:** A total of 60 inpatients with TBI in conscious period were randomly divided into the intervention group and the control group when they were discharged from rehabilitation department of West China Hospital. The baseline of the general data were no difference between the 2 groups. The patients in intervention group received Community Rehabilitation Model while the control group received Family Rehabilitation Model(self-training according to discharge rehabilitation program). Both therapies were given or done 5 times a week and lasted for 3 months. Patients in both groups were followed up at 1,3,6,12,24 months after the patients discharged from West China Hospital. They were assessed by Generic Set of ICF(included b130, b152,b280, d230, d450, and d850.

**Results:** For b130 and b152, there were no statistical significant difference at each time point between the 2 groups (P>0.05). For b280, there were statistical significant difference at 1,3 and 6 months after discharge (P<0.05). For b230, there were statistical significant difference at 12 and 24 months after discharge (P<0.05). For d450, the difference were statistically significant at 3,6,12 and 24 months after discharge (P<0.05). Both groups showed no help on improving d850.

**Conclusions:** Both Community Rehabilitation Model and Family Rehabilitation Model are helpful on improving b130, b280, d230 and d450. However, Community Rehabilitation Model showed sooner and higher effects on improving b280, d450 and d230. Both models were no help on d850. It probably due to the included patients were all with severe brain injury

## TBI – The Indian Perspective; Its Clinical Management, Neuropsychological and Rehabilitation Aspects

**Dr. Keki E Turel**[1]

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**Objectives:** Spinal cord injury (SCI) is a highly morbid condition. It most commonly occurs after trauma. The most commonly affected age group is young; however, the number of old aged patients affected is increasing. The injury pathophysiology consists of a primary phase which disrupts the neural structures and a secondary injury in which further molecular changes at cellular level leads to progression of the primary insult.

**Methods:** Improved understanding of the pathophysiology of SCI forms the basis to know the factors which need to be taken care of to arrest further neuronal degeneration. The molecular basis has brought a hope towards more treatment modalities directed at promoting neuroprotection, axonal regeneration, and neuroplasticity. Some of these are in experimental stage.

A thorough clinical and radiological evaluation is necessary to diagnose the grade of SCI and start appropriate and optimum treatment including intensive care monitoring, hemodynamics maintenance, medical management with methylprednisolone and early surgery (decompression) and stabilization of an unstable spine.

**Results:** In its moderate to severe form SCI is currently incurable. Its treatment is limited to minimise its progression through the secondary injury phase and optimum rehabilitation. In the treatment of SCI, stem cells possess a good therapeutic potential in the treatment of acute and chronic cases of SCI. Bone marrow, adipose tissue, placenta, amniotic fluid and umbilical cord are the good sources for mesenchymal stem cells.

**Conclusions:** There is a high demand to bring the experimental treatments to clinical use. The possibility of reinstating the spinal circuits and its function might soon be within reach.

## Effect of Rehabilitation Robotics Controlled By sEMG Closed-Loop System, For The Recovery of Hand Function After Stroke

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**Objectives:** Functional improvement of paretic upper limb mainly depends on regaining of hand function, after stroke. Current therapeutic modalities are not yet able to promote satisfactorily the regaining of hand function, even when provided extensively.

**Methods:** The aim of this study was to evaluate the clinical effects of robot-assisted hand therapy using the Amadeo® (Tyromotion GmbH, Austria) when controlled by surface EMG (sEMG) instead of force signals. 42 patients suffering a stroke and with Box and Block Test (BBT) lower than 45 were enrolled, consecutively. Participants underwent 1 hour of sEMG active controlled Amadeo® hand therapy, in addition to 1 hour of conventional therapy every day, 5 days a week, for 3 weeks. The following clinical outcomes were assessed before and after therapy: Fugl-Meyer Upper Extremity (F-M UE), Functional Independence Measure (FIM), Reaching Performance Scale (RPS), Box and Blocks Test (BBT) and Nine Hole Pegboard Test (NHPT).

**Results:** Improvements were found for all clinical outcomes (F-M UE = 4.36±5.30, p = 0.00; FIM = 4.95±9.45, p = 0.00; RPS = 2.79±7.34, p = 0.00; B&B = 2.14±4.06, p = 0.00; NHPT = 0.01±0.03, p = 0.012), after treatment.

**Conclusions:** The lack of evidence on effective modalities to treat impairments of hand function after stroke requires a major effort for the development of innovative therapies. The proposed approach, based on sEMG control of robot-assisted therapy allowed patients, unable to produce detectable force at fingertips, to undergo active therapy. The absence of side effects and treatment withdrawals, together with improvements measured for hand function, support the possibility to include closed-loop sEMG approaches as a new tool for the recovery of severe hand impairments, after stroke.

**Approval:** Ethical Committee of Venice (Trial No. NCT03207490)

**Funding:** MYOSENS project (FP7-PEOPLE-2011-IAPP, G.A. 286208)

## Virtual Reality Training is Not Superior to Conventional Training – VIRTUES - A Multicenter RCT

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**Objectives:** To compare the effectiveness of upper extremity virtual reality rehabilitation training (VR) to time-matched conventional training (CT) in the subacute phase post stroke.

**Methods:** Randomised controlled single-blind phase III multicentre trial with five participating rehabilitation hospitals in three European countries. A total of 120 participants with upper extremity motor impairment within 12 weeks post stroke were consecutively included at the involved centers.

Participants were randomised by a centralized web-based system to either VR training or CT as an adjunct to standard rehabilitation and stratified according to severity of paresis. The training comprised of for four weeks of four to five training sessions / week of up to 60 minutes duration. The primary outcome measure was the Action Research Arm Test (ARAT), secondary outcome measures included Box and Blocks Test and Functional Independence Measure. Patients were assessed at baseline, post intervention and three-month follow-up. One hundred and two participants completed all assessments.

**Results:** There were no differences between VR and CT on any of the outcome measures. Improvement of arm motor function assessed with ARAT was similar at post intervention, (p = 0.714), and at follow-up assessment (p = 0.777). Patients in VR improved 12 (11) points from baseline to post intervention assessment and 17 (13), from baseline to follow-up, while patients in CT improved 13 (10) and 17 (13) points, respectively. Improvement was also similar for the subgroups with mild to moderate, and severe paresis.

**Conclusions:** Upper extremity VR training was as effective as CT in the subacute phase after stroke. VR may constitute an engaging training alternative as a supplement to standard rehabilitation. In most patients, even in those with initially severe paresis, arm motor function increased substantially, implying that improvement can be achieved by different training modalities.

**Trial registration:** ClinicalTrials.gov NCT02079103

## Multicenter Randomized Controlled Trial of Multi-Segmental Robotic and Technological Upper Limb Rehabilitation in Stroke

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**Objectives:** To assess the effectiveness of a robotic rehabilitation program targeting the whole upper limb in stroke patients, using a set of robotic/technological systems, compared with a traditional approach.

**Methods:** About 200 subacute stroke patients, aged 40 to 85 years, are currently enrolled in 9 centers of the Don Gnocchi Foundation and randomly assigned to a robotic group (RG) or a traditional group (TG). In the RG, patients are treated with four devices: Amadeo, Pablo, Diego and Motore, with a ratio of one therapist to three/four patients. In the TG, a ratio of one therapist to one patient is used. Rehabilitation treatment is performed daily for 45 minutes, for a total of 30 sessions. Evaluations are performed at baseline, after the treatment and three months later, using: Fugl-Meyer, Motricity Index, BMRC, MAS, ROM, Frenchay scale, ARAT, DN4, NRS, Modified Barthel Index, SF-36, test of verbal fluency and human figure test.

**Results:** The study is still ongoing. To date, 170 participants have been recruited. Mean age is 69±11 years, 56% of patients are male, 75% have an ischemic stroke and the mean latency from stroke is 42±24 days, 75% of patients have a right hemiplegia, 21% aphasic and 25% with hemispatial neglect. Preliminary results showed that: pain is higher in female, while spasticity in hemorrhagic patients. The probability of neuropathic pain is higher in patients with left hemiplegia. Latency is directly correlated with pain and spasticity, pain is inversely correlated with function and performance. No correlation among age, gender, site of lesion, aphasia and neglect were found.

**Conclusions:** These preliminary data showed that some anamnestic, clinical and disability characteristics are correlated with neuropathic and nociceptive pain, as well as with hypertonus. Data about the efficacy of robotic upper limb rehabilitation in subacute stroke will be reported.

## "Power of Belief" - A Game For Neuro-Motor Rehabilitation

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**Objectives:** To examine the influence of spirituality and religious experiences in neuro-rehabilitation exercises, a game simulating a famous pilgrim was developed. Considering that Post-Stroke Depression (PSD) has often been reported to impair recovery, religious faith is reported to have strong positive influence.

**Methods:** A game simulating a famous Hindu temple situated on a hill in south India was designed and developed on Unity3D platform. Devotional music of famous hymns was also included in the language of patient's choice. Another version of the game was implemented without the religious symbols as tourist game. A mechanical gym step_pedal exercise equipment was fitted with proximity sensors below each pedal. The strength of the signal indicates the force the patient has applied to push the pedal down. The signal from the sensors is the control to the game and translates to action of climbing the steps. Scoring is based on the number of steps climbed and the shrines visited. Physiological parameters for recovery estimate collected are the force/pressure applied by each leg and the finger pressure on the switches.

**Results:** From the pilot longitudinal testing on one participant, the main finding is the increase in motivation for exercising temple compared to tourist game. The immersiveness enhanced by the music and the belief-structure in human beings seems to influence the exercise time in each routine in comparison to the same game user-interface without religious connotations.

**Conclusions:** Post-stroke therapy concentrates on motor exercises to strengthen muscles and transfer of motor cortex signals to the peripheral nerves to induce lower/upper limb movement. A factor can be the emotional balance, of which belief plays a significant role, has not been explored comprehensively. That is, we need to examine the role of the belief-emotion-networks of the brain on recovery.

## Towards a Sensor Based Wearable Garment for Neurorehabilitation- The WearITmed Consortium

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**Objectives:** To develop a novel wearable sensor-integrated garment for continuous monitoring of physiological and movement related variables in epilepsy, Parkinson disease (PD) and stroke to monitor progression, tailor treatments and improve diagnosis.

**Methods:** In the first steps of the development process, sensor configurations relevant to the three targeted groups were defined. General perceptions regarding the use of wearables in clinical evaluation was investigated in a focus group study with persons with PD and epilepsy as well as in health professionals (n=40) using qualitative content analysis. The first prototype of the garment included design of the electronics, the garment itself, and sensor integration. The comfort and acceptability of the first prototype among healthy controls and patients was evaluated (n=11). Algorithm development and feature selection have been pursued in parallel for all targeted patient groups.

**Results:** Heart rate and movement data from accelerometers were prioritized as the primary measures of interest. The focus group study revealed that important facilitators were *to be well informed, have a continuous interactive communication and perceive an added value* from the monitoring. *Personal integrity issues, inconclusive recording and unclear information* were main barriers. The algorithms and movement features from sensors have shown to be sensitive for capturing variations in activity in PD and stroke. The detection algorithm for generalized tonic-clonic seizures demonstrated good sensitivity and precision. Evaluation of the first upper body garment prototype showed that the comfort was acceptable although improvement areas were identified.

**Conclusions:** The preliminary results show that the WearITmed prototype can be used as tool for diagnosis and treatment selection and provide added value for monitoring of seizures in epilepsy, fluctuations in PD and activity levels in stroke. Future work includes improvement of the algorithms, development of the garment and exploring the potential of including blood pressure and heart-rate variability in the evaluation.

## Rehabilitation Robotics of Hand Function, After Stroke: Diagnostic Criteria for Reference to Therapy

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**Objectives:** Stroke is the first cause of disability worldwide and recovery of hand function represents the hardest target for neurorehabilitation. Impairments limit many patients to eligibility of passive hand therapy only, while there is a strong demand for active patient participation. Robot-assisted therapy has been proved to be intensive and effective for recovery of upper limb, after stroke. The aim of this cross-sectional study was to identify which clinical features were predictive for referring stroke patients the most intensive robot-aided hand therapy modality.

**Methods:** A cohort of 144 patients was assessed with: Fugl-Meyer Upper Extremity (F-M UE), Functional Independence Measure (FIM), Reaching Performance Scale (RPS), Box and Block Test (BBT), Modified Ashworth Scale (MAS), Nine Hole Pegborad Test (NHPT). Moreover, patients were asked to perform 5 minutes of hand opening/closing with the robot Amadeo® (Tyromotion GmbH, Austria) using force and surface EMG (sEMG) control, independently. Ability to perform at least one hand opening/closing was considered successful active control, thus receivinf operator curve (ROC) curves were calculated to test which of the outcome measures were the best predictors of the event.

**Results:** 77 patients can actively control the robot both by sEMG and force, 15 by sEMG only, while 52 patients had no active force or sEMG control signal. The Fugl-Meyer was the best predictor of preserved ability to control the robot actively, with score over 23 points representing a probability of 90% to control the device by sEMG and 93% by force.

**Conclusions:** Results indicate that F-M UE is the best predictor for active control ability (i.e. sEMG, force) of a closed-loop robotic device for hand rehabilitation, with possibilities to personalise treatments on patients' characteristics.

**Approval:** Ethical Committee of Venice (Trial No. NCT03207490)

**Funding:** MYOSENS project (FP7-PEOPLE-2011-IAPP, G.A. 286208)

## Ultrasound (U/S) Versus Compound Muscle Action Potential (CMAP) Amplitudes Guidance for Neurolysis: Which One is Better?

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**Objectives:** To study the effect of Tibial neurolysis with 50% alcohol in water with ultrasound (U/S) versus compound muscle action potential (CMAP) amplitudes analysis guidance for post stroke ankle spasticity with objective measurement by 3D motion analysis and clinical evaluation.

**Methods:** An experimental single blinded (assessor) randomized controlled, crossover trial was done. Hemiplegic stroke patients with onset more than 3 months, age > 18 years, MAS of ankle ≤ 2 and Tardieu scale ≥

20 degrees were included and randomized into 2 groups. The crossover was done within 6 months. Group 1 did Tibial neurolysis with ultrasound (U/S) guidance in the first round and group 2 did Tibial neurolysis with compound muscle action potential (CMAP) amplitudes analysis guidance in the first round. 50 % alcohol in water 10 ml was the agent using for Tibial neurolysis.

**Results:** The efficacy compared within both methods revealed statistically significant improvement of dynamic surface EMG activities in both Gastrocnemius and Tibialis posterior muscles at first week and one month when compare to before neurolysis, and statistically significant improvement in PROM, MAS, Tardieu scale, ankle kinematics and spatiotemporal parameter at one month when compare to before neurolysis. When compare between methods, there was no statistically significant difference of the mean difference of motion analysis, clinical evaluation. However, pain during and after injection were significantly lower when using U/S guidance. The incidence of paresthesia and swelling were not significant difference. All the significances are at $p < 0.05$.

**Conclusions:** The efficacy and safety of neurolysis using U/S or CMAP guidance are not difference. However, the pain during and after neurolysis are lower with U/S guidance. Dynamic surface EMG is more sensitive than clinical evaluation in detecting the efficacy of neurolysis in chronic spasticity.

## Cost Effective Orthotic Management of Lower Limbs Paralytic Disorders

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**Objectives:** Paralytic poliomyelitis is still the commonest cause of locomotor disability in third world countries. These are treated with conventional orthoses, which are heavy in weight because contains metal and wood. These are attached to an old fashioned black leather shoe, cumbersome to use. Due to lack of swing phase knee flexion they increase energy consumption and are very tiring. Their rejection rate is unbelievably high.

**Methods:** To overcome all these problems Dr. P.K. Sethi with his team in Jaipur worked for nearly 20 years and evolved several new designs of orthosis made up of polypropylene which are light weight, easy to use, low in energy demands and allows swing phase knee flexion.

Floor reaction orthosis for quadriceps paralysis, Lehneis KAFO for genu recurvatum are few such designs. For completely flail limbs AFO attached to quadrilateral top via two side bars and drop lock knee is prescribed.

Foot drop or flail ankle can be managed with simple solid AFO's.

All these were also tried in many other paralytic disorders affecting gait like cerebral palsy, stroke, spinal injury, transverse myelitis, pott's spine, meningocele etc.

With some modifications these design, were found to be extremely useful in many other musculosketal disorders like non union and delayed union of fractures, diabetic foot, club foot, osteoarthritis knee and ankle, avascular necrosis of talus etc.

**Results:** Freedom to use foot wear of choice with these designs was a major turning point. Some designs allowed swing phase knee flexion which reduced energy consumption and made the gait socially acceptable.

**Conclusions:** This revolutionized the orthotic management of locomotor disability by increasing walking distance.

This has given independent, functional life to the patients, raising their self esteem helping them to lead normal life as productive member of society.

Last year we made around 3000 such appliances.

## Ultrasound Guided Suprascapular Nerve Block in Post Stroke Shoulder Pain

**Dr. Navita Purohit**[1]

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Sub Category of Presentation: Treatment/Pharmacotherapy/PT

**Objectives:** Post stroke Shoulder pain (PSSP) is a distressing complication of hemiplegia and is one of the most common medical complications of stroke. The prevalence of PSSP ranges from 34% to 84%. It is associated with reduction in functional use of the arm, interference with rehabilitation and limitation to patient access to developing technological upper-extremity rehabilitation techniques.

**Methods:** Patients with Clinical and Radiological diagnosis of stroke were included with pain with a Numeric Rating Score (NRS) of more than or equal to 4/10. Patients with any fracture in and around shoulder, allergy to injectable agents (Depo Medrol, lignocaine and Bupivacaine) were excluded.

All patients were given ultrasound guided suprascapular nerve block (SSNB) with a mixture of 2 ml each of 2% lignocaine, 0.25% bupivacaine and methylprednisolone acetate. The range of motion, pain on NRS were primary outcome measures and quality of life on SF8 was secondary outcome measure

**Results:** 30 patients with PSSP were recruited in the study. Ischemic (65%) stroke was commoner than hemorrhagic (35%). Male: Female ratio was 1.8:1. Post stroke duration ranged from 2 to 24 months(mean- 9.6 months),motor recovery on Brainstorms staging was stage I(10), II(6), III(4), IV(5)and V(5). 19/30(65%)had shoulder subluxation. Average reduction in NRS was 1;2;2.5 immediately, at 1 and 6 months respectively. Improvement in Range of Motion was 90% and 85% at 1 and 6 months. Significant improvement was seen in quality of life.

**Conclusions:** SSNB has a potential role in Post stroke shoulder pain and needs a proper randomized control trial for establishing its efficacy.

## Dilemmas and Solutions in Neurorehabilitation

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**Objectives:** Explore the use of different modalities used in the world of Neurorehabilitation to help the health care professionals to improve recovery in patients who have suffered a significant neurological condition.

**Methods:** I would like to share my experience in dealing with the challenges we faced in managing patients using some of these techniques and how we were able to circumvent difficult situations. The modalities range from management of behaviour, tracheostomy, spasticity using ultrasound guided botulinum toxin injections, intrathecal baclofen, use of phenol, role of surgery and use of robotic devices.

**Results:** When these techniques are used judiciously it goes a long way in the management of difficulties of patients in the neurorehabilitation world.

## Time to Retreatment With Botulinum ToxinA in Upper Limb Spasticity Management:Upper Limb International Spasticity (ULIS)III Study Interim Analysis

**Dr. Lynne Turner-Stokes[1], Dr. Stephen Ashford[2], Dr. Jorge Jacinto[3], Dr. Klemens Fheodoroff[4], Dr. Pascal Maisonobe[5], Dr. Jovita Balcaitiene[6]**

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**Objectives:** The ongoing ULIS-III study aims to describe real-life clinical practice and assess patient centered goal attainment with integrated upper limb spasticity (ULS) management that includes repeated botulinum toxin A (BoNT-A) injections. This interim analysis evaluates BoNT-A reinjection rates within rehabilitation management.

**Methods:** ULIS-III is a 2-year longitudinal, prospective, observational, cohort study (NCT02454803), expected to involve 58 centers (14 countries) and to enroll >1000 adults with ULS receiving repeated BoNT-A injections. This analysis involved 44 centers (13 countries) and 335 patients (reflective of ULIS-III recruitment stage). Primary endpoint of ULIS-III is goal attainment, using Goal Attainment Scaling—Evaluation of Outcome for ULS to evaluate change following BoNT A and concomitant treatments. BoNT-A preparation type, total dose, number of injections, and injection intervals will be recorded, as well as physical treatments, economic and quality-of-life data.

**Results:** Recruitment began January 2015. Patients with data for ≥2 injections (N=335), had a mean (SD) time between first and second injections of 154.9 (58.6), 137.8 (60.5), and 124.4 (41.0) days for abobotulinumtoxinA (n=203), onabotulinumtoxinA (n=94), and incobotulinumtoxinA (n=38), respectively. Of these patients, 177 received ≥3 injections. Mean (SD) time between second and third injection was 146.4 (48.5), 131.8 (36.9), and 116.3 (32.3) days for abobotulinumtoxinA (n=110), onabotulinumtoxinA (n=48), and incobotulinumtoxinA (n=19), respectively. The mean (SD) change in time between first and second injection intervals for these 177 patients was −5.8 (68.1), 2.3 (37.9), and 0.9 (23.3) days for abobotulinumtoxinA, onabotulinumtoxinA, and incobotulinumtoxinA, respectively.

**Conclusions:** Initial ULIS-III injection-interval data suggest differences in time to retreatment with different BoNT-A preparations. Longer injection intervals may reduce patient and carer burden. However, the clinical significance and generalizability of the findings reported here are as yet undetermined and the current sample as well as other variables may influence reinjection. Further ULIS-III data will provide additional clarity to these preliminary analyses.

## Brain-Computer Interfaces for Post-Stroke Motor Rehabilitation: A Meta-Analysis

**Dr. Gangadhar Garipelli[1], Ms. María A. Cervera[2], Prof. Surjo R. Soekadar[3], Prof. Junichi Ushiba[4], Prof. José del R. Millán[5], Prof. Meigen Liu[6], Prof. Niels Birbaumer[7]**

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**Objectives:** Brain-Computer Interfaces (BCIs) are raising interest as a potential tool for neurorehabilitation post-stroke or spinal cord injury. BCIs enable stroke survivors to purposefully modulate ipsilesional brain activity, such as sensorimotor rhythms using closed-loop sensory feedback. Such training is particularly relevant for severely paralyzed stroke survivors, who have very limited options for rehabilitation as the traditional methods rely on some form of residual functions. Recent clinical studies indicate that repeated use of such BCIs might trigger neurological recovery and, hence, improvement in motor function. Here we provide a first meta-analysis on the clinical effectiveness of BCI-based post-stroke motor rehabilitation.

**Methods:** RCTs were identified using MEDLINE, CENTRAL and by inspection of references in several review articles. We selected trials that used BCIs for post-stroke motor rehabilitation and provided pre and post-intervention motor scores. A random-effects inverse variance method was used to calculate the summary effect size.

**Results:** Out of more than 500 articles initially identified, reports on nine upper limb clinical BCI studies that involved a total of 235 stroke survivors were included in the meta-analysis. While motor improvements after BCI-mediated training as quantified by the upper limb Fugl-Meyer Assessment (FMA-UE) exceeded the minimally clinical important difference (MCID=5.25) in six studies, such improvement was reached in three control groups only. In summary, BCI training was associated with a standardized mean difference of 0.79 (95% CI: 0.37 to 1.20) in FMA-UE compared to control conditions.

**Conclusions:** We found a medium-to-large effect size of BCI training compared to controls, suggesting that BCI technology might be an effective intervention for post-stroke upper limb rehabilitation. It is indeed an exciting time, as approximately 30 trials, some of them with larger sample size, are expected to conclude in a couple of years, which should bring more light on the reliability of this intervention.

## Peripheral Magnetic Theta Burst Stimulation to Muscles Can Effectively Reduce Spasticity

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**Objectives:** To test whether intermittent theta burst magnetic stimulation could reduce spasticity when applied directly directly on spastic muscles.

**Methods:** 33 patients were recruited in with a total of 96 spastic muscles studied. 8 daily sessions of intermittent theta burst magnetic stimulation: [3 pulses of stimulation are given at 50 Hz, where 2-second trains of pulses are repeated every 10 seconds for a total of 300 seconds (900 pulses)] given directly over spastic muscle with supra threshold intensity. Assessment was done by Modified Ashworth Score MAS and the calculated botulinum toxin dose, both obtained at baseline and after the 8$^{th}$ session.

**Results:** 27 patients (84 muscles) completed the study. MAS showed a highly significant reduction of spasticity in the follow up compared to baseline (mean= 2.23±0.72 and 2.95±0.72 respectively,). Similarly, the calculated dose of botulinum toxin needed was reduced in the follow up compared to baseline (mean= 56.03±42.15 and 83.27±49.76 respectively,). Also, the degree of improvement in MAS correlated positively with the baseline score i.e. higher baseline MAS showed better improvement at follow up (r= 0.42, p=0.000).

**Conclusion:** Intermittent theta burst magnetic stimulation applied directly on spastic muscles effectively reduced spasticity and decreased the required dose of botulinum toxin.

## Life Satisfaction and Return to Work Post Stroke. Preliminary Results from the SIN Stroke Study

**Prof. Birgitta Langhammer[1], Prof. Johan Kvalvik Stanghelle[2]**

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**Background:** Disability after stroke may impose severe consequences both for the individual and for their families. The physical and cognitive consequences may lead to a long term rehabilitation post stroke and a more or less disabled life. As a consequence, this may lead to inability work and, for the individual, a changed economic status and / or loss of income. This in turn may lead to increased dependence on family and / or social care support, which may also influence perceived life satisfaction.

**Methods: Method:** a prospective, descriptive study of disability after stroke and work related issues, in nine rehabilitation centers, in seven countries at six and twelve months' post discharge from specialized rehabilitation. To explore what influenced return to work, maintenance of financial situation and lifesatisfaction.

**Results:** In total, 230 persons with stroke were enrolled consecutively in the study, overall baseline disability was mean 3.7 (SD 0.8) Modified Rankin Scale (mRS), severity by mean 7.8 (SD 4.4) National Institute of Health Stroke Scale (NIHSS). Preliminary results indicate that a majority had not been able to return to work, the financial situation depended on existing health care insurance and family support and life satisfaction was low. Return to work at 6 and 12 months were significantly related to age (β coefficient 0.25, p=0.001) and maintenance of financial situation to life satisfaction (β coefficient -0.24, p=0.003) and age (β coefficient -0.20, p=0.009).

**Conclusion:** the majority of persons in need of specialized rehabilitation in this study did not return to work. They were dependent on family and / or existing private or public, insurances, depending on country. Age was main explanatory factor relating to return to work, and age and life satisfaction to maintenance of financial situation.

## Effect of Dual-Task Exercise in Conjunction With Fluoxetine & Transcranial Direct Current Stimulation on Postural Stability and Gait in Stroke Patients

**Mr. Baijnath Roy[1], Prof. Vasantha Padma Shrivastava[2], Prof. Rohit Bhatia[3], Prof. Nand Kumar[4], Prof. Sanjay Wadhwa[5]**

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**Objectives:**

**Primary:**

1. To determine the efficacy of combination therapy with drug, device, and exercise (Fluoxetine, tDCS, & DTT) for improving post stroke postural stability and gait.

**Secondary:**

1. To determine the effectiveness of Fluoxetine 20 mg for improving post stroke postural stability and gait.
2. To determine the effectiveness of Transcranial Direct Currecnt Stimulation (tDCS) for improving post stroke postural stability and gait.

**Methods:**

The target sample size N = 224. This is a single-centre, double blinded randomized controlled trial at the department of Neurology, AIIMS, New Delhi. Eligible patients who gave written consent were randomly allocated into 1 of 4 different treatment groups using a process of computer generated blinded random number & opaque and sealed envelopes.

**Study Arm:**

Group A: tDCS + Fluoxetine + DTT
Group B: Sham tDCS + Fluoxetine + DTT
Group C: tDCS + placebo drug + DTT
Group D: Sham tDCS + placebo drug + DTT

Twelve sessions of bihemispheric active/sham tDCS (2mA) with each session lasting for 20 minutes followed by 2 extra sessions every other week. 20 mg of Fluoxetine/placebo drug is given by mouth daily for 6 weeks.

Fluoxetine is being given two hours before the tDCS. Dual Task Training started within 1 hour after each bihemispheric tDCS session and last for 45 minutes.

**Outcome Measures:** At the baseline, 6 and 12 weeks

**Primary:**

1. Gait analysis variables
2. FMA-LE

**Secondary:**

1. NIHSS
2. mRS
3. MAS
4. BBS
5. TUG
6. FRT
7. mBI

**Results:** 225 subjects assessed for eligibility. 157 subjects excluded not meeting inclusion criteria. We included 68 subjects and randomly allocated into one of four treatment groups. 20 subjects allocated to Group A, 14 subjects allocated to Group B, 20 subjects allocated to Group C, and 14 subjects allocated to Group D.

**Conclusions:** Study is ongoing RCT, so conclusion is awaited.

## Prevalence of Sleep Disordered Breathing and Its Influence on the Functional Outcome in Patients With Subacute Stroke

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**Objectives:** The aims of this study were to elucidate the prevalence of the sleep disordered breathing (SDB) and to investigate its influence on the functional outcome in patients with subacute stroke.

**Methods:** We retrospectively analyzed 785 consecutive stroke patients admitted to a rehabilitation hospital from August 2011 to November 2013. The SDB was evaluated with a portable sleep monitor. We analyzed the prevalence of SDB and the relationship between SDB and functional outcome. The local ethics committee approved the protocol of the study.

**Results:** Among 785 patients, 433 patients (mean age of 66.5 years, 271 males) were received at least one successful sleep study within 4 weeks after the admission and enrolled for the analyses. On average, the duration from stroke onset to admission and the length of hospital stay was 35.8 and 86.9 days, respectively. The 87.3% (n=378) of the patients had apnea-hypopnea index (AHI) ≥5, and about half (46.4%, n=201) had AHI≥15. The median score of the functional independence measure (FIM) at discharge was significantly lower in patients with AHI≥15 than those with AHI<15 (75 vs. 89, $p<0.001$). However, a multiple regression analysis for discharge FIM adjusting for age, sex, past history of stroke, disease types, the degree of paresis, duration from onset to admission, the length of hospital stay, and the admission FIM revealed that the AHI value was no longer a significant factor related to the discharge FIM.

**Conclusions:** The prevalence of SDB was high in patients with subacute stroke. However, the degree of the SDB at admission was not a significant factor related to the functional outcome. A further study with a longer follow-up will explore how the SDB affect on the long-term outcomes such as mortality and recurrence.

## Poststroke Energy Consumption and Cost During Walking With Different Modalities of Assistance: A Systematic Review

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**Objectives:** To provide an overview of the literature examining poststroke oxygen consumption (oxygen uptake, mL/kg/min or J/kg/min) or cost (oxygen uptake per meter walked, mL/kg/m or J/kg/m) during steady-state walking with different assistance modalities (e.g. handrail or body-weight support).

**Methods:** PubMed and Web of Science were searched on October 31st, 2016 by two independent reviewers, using key words related to stroke, oxygen consumption and walking. Three reviewers screened titles and abstracts, and subsequently full texts, independently and blinded. Reference lists of related reviews were screened. Relevant information on patient characteristics, description of walking and outcome were extracted. Applicable domains of bias were rated.

**Results:** 43 studies were included (760 participants): 4 studies involved subacute stroke patients (< 3 months, 67 participants), 35 studies chronic (> 3 months, 581 participants) and 4 studies subacute and chronic (112 participants). Assistance modalities comprised: no assistance (28 studies, 549 participants), daily aids (8 studies, 106 participants), ankle-foot orthoses (6 studies, 76 participants), handrail support (4 studies, 58 participants), robot-assistance (5 studies, 51 participants), and several other modalities (7 studies, 120 participants). Seventeen studies examined overground walking, 22 studies treadmill walking, and 4 studies overground and treadmill walking. Oxygen consumption (mL/kg/min) varied between modalities and walking surface (no assistance: overground: 9.58-15.5, treadmill: 8.6-11.0; daily aids: overground: 9.7-12.8, treadmill: 9.6-9.9; robot-assistance: treadmill: 4.9-8.1). Oxygen cost (mL/kg/m) was also variable (no assistance: overground: 0.24-0.77, treadmill: 0.25-0.58; daily aids: overground: 0.63-0.69, treadmill: 0.23-0.24; robot-assistance: end-effector: 0.31-0.42).

**Conclusions:** Poststroke energy consumption and cost seems variable across walking surface and assistance modality. However, patient characteristics (e.g. time poststroke) and walking exposures (e.g. speed) were heterogeneous across studies.

## Immediate Effect of Computerized Dynamic Posturography Versus Over Ground Balance Training on Timed Up and Go Test in Patients With Post Stroke Hemiparesis

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**Objectives:** The objective is to assess immediate effect of overground balance training versus computerized dynamic posturography on dynamic balance measured by timed up and go test

**Methods:** 24 Patients with single hemisphere stroke (post stroke interval of 3-6 months) were recruited and randomly allotted to either of the 2 groups (Conventional or Computerized Dynamic Posturography). At baseline, patient's medical and radiological records were reviewed; timed up and go test was also recorded. Patients underwent 20 minutes of balance training sessions in both groups. Balance training protocol in computerized dynamic Posturography included anterior-posterior, lateral and diagonal weight shifts, midline stability with and without support and surround moving, limits of stability. In the conventional therapy group, patient was standing in front of the mirror and performing anterior-posterior, lateral, and diagonal weight shift, romberg eyes/eyes closed on firm surface and airex, stride standing with head movement. Timed up and go test was measured immediately post-intervention in both groups. Our study was assessor blinded study.

**Results:** Independent sample t- test and paired t- test allowed for comparision between the pre treatment and post treatment test results between group and within groups respectively. Statistically significant difference was found in TUG scores within CDP group (pre training score 53.13±27.43, post training score 42.04±21.64, $p<0.015$).

**Conclusions:** Authors concluded that training on Computerized Dynamic Posturograpy has significantly better results in improving dynamic balance as measured by time up and go test in stroke patients when compared to overground balance training.

## AbobotulinumtoxinA Injections in Shoulder Muscles: Results From a Real World (ULIS-II) and A Phase 3 (AUL) Study

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**Objectives:** Shoulder spasticity after stroke or traumatic brain injury (TBI) may cause pain and restrict joint range of motion (ROM). Few studies have investigated botulinum toxin injections into shoulder muscles for spasticity treatment. Here we present data for sub-populations of patients receiving shoulder injections of abobotulinumtoxinA in two international, multicentre clinical studies: phase-4 ULIS-II (Upper Limb International Spasticity Study-II; post-stroke spasticity; NCT01020500) study, and phase-3 AUL open-label (Adult Upper Limb; post-stroke or -TBI spasticity; NCT01313299) study.

**Methods:** We present data for abobotulinumtoxinA shoulder-injected subpopulations. ULIS-II: selection and achievement of patient-centred primary goals. AUL study: Tardieu scale for passive ROM ($X_{V1}$), angle of catch ($X_{V3}$) and spasticity angle (X) for shoulder muscles; and Modified Frenchay Scale (MFS) for active function.

**Results:** In ULIS-II, 82 patients received abobotulinumtoxinA in shoulder muscles. Patients with shoulder injections selected the pain treatment goal twice as often as those without. Goal achievement for pain was 85.7%. In AUL study, 96 patients received ≥1 abobotulinumtoxinA injection in shoulder muscles, 60 of whom received ≥2 injections. Improvements in shoulder muscle spasticity were identified after first injection: mean change from baseline at Week 4 was +8.1° and +15.4° for $X_{V1}$ and $X_{V3}$, respectively, and -7.3° for X . Patients with ≥2 shoulder injections showed greater improvements in $X_{V3}$ and X Improvements were also observed in active function (Week 4 Cycle 4: MFS: +0.62 [0.48]).

**Conclusions:** These studies consistently showed positive outcomes for patients receiving abobotulinumtoxinA shoulder muscle injections. Patients in ULIS-II reached a high level of achievement of the most-selected patient-centred goal (pain), and in the AUL study patients had decreased shoulder spasticity on all parameters of Tardieu scale, and improved active function (MFS).

## High Sensitivity CRP – A Novel Prognostic Indicator for Functional Recovery in Ischemic Stroke

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**Objectives:**

**Background:** Stroke is the most common debilitating illness that has a longer duration of recovery phase. Previous studies have demonstrated that initial NIHSS stroke scale has a strong correlation with functional recovery in patients with stroke. High sensitivity CRP (hsCRP) is a novel marker for assessment of severity of stroke.

**Objective:** To study the correlation of hs- CRP with NIHSS stroke scale in predicting functional recovery in patients with stroke

**Methods:** 69 patients with a clinical presentation of acute ischemic stroke (48hrs of onset) without radiological evidence of intracerebral

bleed were included in the study. NIHSS stroke scale was calculated for all patients. hs – CRP was analysed at the time of admission. Using chi square test of association, relationship between hs- CRP and NIHSS stroke scale were assessed. Quantification of functional impairment was done using NIHSS stroke scale and were categorized into 3groups Mild stroke (1-15), Moderate to severe stroke (16 – 20), Severe stroke (21-42).

**Results:** 49(33.8%) patients in group 1 had mean hsCRP value 2.9 ± 2.25, Group 2 includes 11(7.59%) patient had mean value of hsCRP 7.32 ± 2.8. Group 3 with 9 (6.21%) patients mean hsCRP value 8.7 ±1.2. All the 3 groups were showed positive correlation between higher hsCRP level had higher NIHSS score (correlation coefficient=0.6) with significant p value of <0.01.

**Conclusions:** It was observed that high initial hs – CRP correlated with the high NIHSS score and there is a strong positive correlation. This novel marker hs- CRP hence can be used as a prognostic indicator for functional recovery.

## Indian Semi-Classical Kathak and Bharatnatyam Movements for Balance Confidence and Quality of Life in Parkinson's Disease: Pilot RCT

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**Objectives:** Individuals with Parkinson disease (PD) show poor quality of life and decline in balance confidence. Indian semi-classical dance movements in PD might benefit their balance capacity. The objective of this study is to determine the effects of Indian semi-classical dance therapy on balance confidence and quality of life in individuals with PD.

**Methods:** This pilot randomized controlled trial was conducted in outpatient rehabilitation centres. Twenty-five individuals according to Hoehn and Yahr stage 1.5 to 3 with ability to follow simple commands and capacity to walk independently participated in Indian classical dance therapy (N=12) and standard physiotherapy (N=13). The dance movements were choreographed in sitting and standing positions and progressed by challenging their dynamic balance system such as standing on one leg and weight shifts with body rotations. Various hand gestures i.e. 'mudras' were incorporated through enacting stories. Control group underwent standard therapy including balance, strength and relaxation exercise in functional positions. Both groups performed 1-hour session per day, 3-session a week over 6-week duration. Outcomes measures were Unified Parkinson's Disease Rating Scale-Part-I (UPDRS), Activity Specific Balance Confidence (ABC) Scale and Parkinson's Disease Questionnaire-39 (PDQ-39), respectively. Comparison of within and between groups was done using paired and independent t-tests respectively.

**Results:** All the measures showed statistical significant improvements ($p < 0.05$) and mean changes are noteworthy in ABC (11.3), eight domains of PDQ-39 (7.2) and UPDRS part-I (2.3) favouring the dance therapy as against control group. The changes of outcomes in the Indian dance therapy and standard physiotherapy following intervention are as follows: PDQ-39, (54-61; 62-62); UPDRS-part I (8-4; 6-4) and ABC (44-61; 49-55).

**Conclusions:** Indian semi-classical dance therapy is beneficial in improving non-motor symptoms such as enhanced balance confidence during daily functioning in turn allowing for better quality of life in individuals with PD.

## The Use of Telerehabilitation in a Developing Country

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**Objectives:** To describe the use of telerehabilitation in neurorehabilitation using the International Classification of Functioning, Disability and Health (ICF) conceptual framework.

**Methods:** A retrospective descriptive study was conducted from January till October 2017 at the acquired brain injury (ABI) ward, Hospital Rehabilitasi Cheras, Kuala Lumpur, Malaysia. All written communications using WhatsApp, short message service (SMS), multimedia messaging service (MMS) and emails amongst the multidisciplinary team (MDT) members involved in the inpatient care plan were included in the study. Audio, verbal and written communications in the patients' clinical notes were excluded from the study. The contents, reasons, advantages and disadvantages for using telecommunication during the patients' hospital stay were classified using the ICF conceptual framework. Patient-confidentiality was maintained by limiting the access to the information by the Whatsapp group administrator and the number of correspondents.

**Results:** The most common mode of telecommunication between the MDT members was WhatsApp group, followed by SMS, MMS and email. The majority of the contents were related to body function and body structure (medical issues, treatment plan and assessment and progress reports), activity limitation (progress report), participation restriction (avocational and vocational activities; reports and summaries of home or school visits, family meetings, work and interdisciplinary conferences), personal factors (psychological issues, level of education, knowledge and attitude) and environmental factors (equipment prescription, issues related to funding, transportation). The advantages of using telecommunication as a rehabilitation tool include low cost, effective communication within a closed environment, increased access to MDT members, efficiency, fast delivery of service and decision-making and reduced cost of transportation. The advantages include difficulty to limit the confidentiality and ownership of data and information.

**Conclusions:** Telerehabilitation may be used as an efficient low cost tool in providing neurorehabilitation services in a developing country with limited resources.

## Community Based Rehabilitation in Children with Epilepsy and Associated Comorbidities – An Occupational Therapy Action Research

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**Objectives:** To understand role of Occupational Therapy Action Research in community based rehabilitation of children with epilepsy and associated co morbidities in rural areas of Maharashtra.

**Methods:** The patients attending the "Free epilepsy detection and treatment camps" during the years 2011-2015 were evaluated and appropriate treatment was provided to them during the camps. The Measure of Process of Care Scale (MPOC) was used to evaluate the quality of care being provided.

**Results:** Over the years 2011- 2015 there was an improvement in the process of care in areas of 1) Enabling Partnership 2) Providing general information about the child 3) Providing specific information about the child 4) Coordinated and comprehensive care for the family 5) Respective and supportive care.

**Conclusions:** Action research involves actively participating in a change situation, often via an existing organization, whilst simultaneously conducting research. Over the years 2011-2015 a number of changes that have been made to the Occupational Therapy evaluation and intervention methods and these helped in improving the quantity and quality of occupational therapy services provided to children with epilepsy and associated co-morbidities.

## SWOT Analysis of Neuro Rehabilitation in SAARC Countries

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**Objectives:** To make an analytic report of the strengths, weakness, opportunities and threats (SWOT) of neuro rehabilitation at South Asian Association for Regional Cooperation (SAARC) countries.

**Methods:** Information of this analytic study based on selected published articles, conference proceedings, online special reports and special communication with regional rehabilitation leaders.

**Results:** Because of the religion, language and cultural similarities, the region has good potentials of supports, exchange of ideas and developing common programs related to neuro –rehabilitation. Spinal cord injury Rehabilitation, Stroke care and World's Disaster medical rehabilitation is mostly governed by the leaders from the region. Most of the neurological disorders are admitted under cardiology and medicine specialist, poor facilities for team working for neuro rehabilitation services and timely referral for rehab team is unusual. SAARC countries are burdened with huge population, poverty, political unrest, regular visiting by the disasters both natural and manmade with estimated added burden of neurological disabilities. PWD with Rehab team ratio is very poor. Maldives, Bhutan and, Srilanka don't have a physiatrist (rehab team leader), Nepal has one, Bangladesh has150 almost same like Pakistan and India has some 500+ ; which is true for the skilled therapy personnel. Pakistan has number of good Neuro rehab centers but mostly run by military. SAARC has collaborations and supports in allied fields including SAARC Rehab Forum, ASCoN, Autism Spectrum disorder Forum with promising impacts on networking and information exchange, awareness development among the government, NGOs and patient –families.

**Discussion:** Patients with neurological disabilities are of complex nature requiring very specialist rehabilitation services that is to be developed in SAARC region.

**Conclusions:** SAARC has excellent potential for regional cooperation for improving medical rehabilitation services. Developing a collaborative data bank, exchanging knowledge, developing low cost common service delivery system for a continuum of care is required.

## Mirror Therapy Versus Modified Constrained Induced Movement Therapy in Upper Extremity Function Among Persons with Hemiplegic Cerebral Palsy

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**Objectives:** Mirror therapy (MT) (affected limb is masked inside the mirror box) and modified constraint induced movement therapy (mCIMT) (unaffected limb is constrained during therapy hours) are well established effective therapies in the upper extremity functioning of children with Cerebral Palsy(CP).The aim of this study was to compare the effectiveness MT with mCIMT in the rehabilitation of persons with hemiplegic CP post orthopaedic selective spasticity surgery (OSSCS).

**Methods:** A prospective clinical trial was conducted among 80children with CP, who were selected and randomly assigned into two groups. All the children underwent OSSCS of forearm flexors and pronators of affected upper limb and were undergoing rehabilitation with a sequenced protocol based physical and occupational therapy. Group A (n=40) received MT (6 weeks-1 hour/day), Group B (n=40) received mCIMT (6 weeks-1 hour/day) and both the groups received regular intensive physical and occupational therapy apart from the above interventions. The primary outcome measures included were the Besta scale and Melbourne assessment of upper extremity function (MAUULF). Outcomes were performed at baseline, 6 weeks after the treatment and follow ups at 1 month and 3 months later.

**Results:** After six weeks of treatment, the mCIMT group showed significant improvements than the MT groups in both Besta ($p<0.01$) and MAUULF ($p<0.01$) scores for hemiplegic upper extremity who underwent OSSCS. The obtained outcomes were maintained at 1 month and 3 months follow up also.

**Conclusions:** Modified CIMT showed greater improvement than MT in the upper extremity function of persons with hemiplegic CP. However both the groups improved in their outcomes compared to baseline.

## Disability Identification: Functional Mapping Versus Disability Mapping

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**Objectives:** With the adoption of the UNCRPD and the ICF, the concept of defining disability has changed and disability is no longer defined from a purely medical perspective, rather it is defined as emerging of the person's interaction with their environment.

This study aimed at exploring the concepts of *"functional mapping"* as opposed to *"disability mapping"* through a field study. The aim was to locate children who were out of school (OOSC) due to their functional limitations.

**Methods:** The methodology followed a two step process; Mapping/ Screening was conducted for 500 randomly selected children from a population of 7000 households who were administered the 12 domain questionnaire. This helped to identify OOSC with their functional limitations along with the severity levels of difficulties across these 12 domains. Secondly medical assessments were conducted for the children testing positive to confirm the true positives and rule out false positives. A random sample of 30 children who had tested negative also underwent medical assessments to rule out false negatives.

**Results:** Of the random sample of 500 children, 35 children (7 %) were identified as having a functional difficulty in at least one domain. Twenty-eight children underwent medical assessments where 22 (4.4%) of them were confirmed to have a disability. This showed an increase in the % of children with disabilities identified using functional mapping as compared to 2.1% using the disability mapping approach.

**Conclusions:** This field study has shown that the current methodology for identifying children with disabilities through surveys in India is extremely lacking, and a move towards functional mapping is essential if we want to really achieve the goals of the UNCRPD. However, more such field studies need to be undertaken to further improve the implementation in order to bring it up to the accuracy levels that have been achieved other places around the world.

## The Role of Hyperbaric Oxygen Therapy as an Adjunct for Neuro Rehabilitation in Neurosurgical Disorders

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**Objectives:**
**Introduction:** Hyperbaric Oxygen Therapy (HBOT) is a procedure in which a person is exposed to increased pressure, allowing greater absorption of oxygen throughout the body's tissues. In acute setting it is supposed to reduce cerebral edema and improve blood flow in ischemic penumbra. Hence we have studied the response of the patients operated for different neurosurgical disorders when subjected to HBOT treatment.

**Aims and objectives:** To study the effects of hyperbaric oxygen therapy in patients operated for different neurosurgical disorders and evaluate its role in neuro rehabilitation.

**Methods:** It was a prospective study including 240 patients operated for various neurosurgical pathologies .170 patients were subjected to hyperbaric oxygen therapy and 70 were taken as controls. The HBOT group patients received 10 sessions of HBOT daily for 45 min in postoperative period. Clinical recovery in these patients were assessed and compared with recovery of patients in control group.

**Results:** Most common age group was 20-40 years with male preponderance. Commonest pathology was glioma followed by meningioma. Decision for the surgery was taken based on clinical evaluation and CT / MRI scan findings. Postoperative patients were subjected to HBOT after stabilization. Significant improvement in GCS,Neurodeficit and functional outcome was noted in HBOT group as compared to non HBOT group reducing the duration of hospital stay.

**Conclusions:** HBOT does have a role as an adjuvant treatment in neurosurgical disorders.

However more clinical studies are needed to evaluate the effect of HBOT on the outcome.

## Quick Fall of Deglutition Disorder in Lateral Medullary Syndrome

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**Objectives:**
**Background:** Dysphagia is an impairment of swallowing function, commonly occur following acute stroke. It is most common and primary factor in Lateral Medullary syndrome which is caused by the Brainstem stroke.

**Objectives:** To Investigate the impact and recovery pattern of dysphagia in relation with lateralization based on their site of lesion in patients with Lateral Medullary Syndrome.

**Methods:** The sample was comprised of 72 patients with Lateral Medullary Syndrome after stroke. Later, they have been divided based on their site of lesion, age and gender factors. All patients have received clinical Bed side swallow evaluation on day 5 of their admission and graded accordingly based on National Outcomes Measurements Systems (NOMS) along with Fiberoptic Endoscopic Evaluation of Swallowing Test (FEEST) on the same day/ on the next day of initial swallow evaluation. All patients have received Intensive Traditional and Combined Vital stim Electrical Therapy for 60 mins for five consecutive days with two days off. Re-Swallow Evaluation was done after every 5-6 days and graded accordingly based on NOMS. The outcomes measures were assessed on changes in NOMS and the duration of the therapy sessions until they reached L-5/L-6 based on their NOMS.

**Results:** However, Dysphagia is most common factor after stroke. Among 391(100%) stroke patients there are 72 (18.41%) dysphagia patients were selected .Among which 60(83.3%) males and (16.6%) females were present. Statistically there was no significant difference was noted in relation to their age, gender and in lateralization of brain. But Statistically significant difference was noted in recovery of dysphagia from Level-1 to Level-6 and in clinical predictors of swallowing before andafter therapy p-value(<0.001).

**Conclusions:** Combined swallow therapy has the greater impact on recovery of Dysphagia in patients with Lateral medullary syndrome. However, large sample of LMS is required to co-relate with the site and size of lesion to make more effective.

## Bladder Rehabilitation in Neurological Disorders

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**Objectives:** To study the different bladder dysfunction associated with neurological disorders and the beneficial effect of bladder rehabilitation in these patients.

**Methods:** 50 patients who were admitted with Parkinson disease (PD) (22), stroke (6), spinal cord injury (SCI) (2), Neuromyelitis optica (NMO) (6), Multiple sclerosis (MS) (2), Cauda equina syndrome (2) and Diabetic neuropathy (10) with urinary bladder dysfunction were studied in the Institute of Neurology, Chennai. Detailed history, clinical examination, routine blood investigations, imaging, ultrasound, uroflowmetry, nerve conduction studies were done for all patients. Patients with previous bladder dysfunction were excluded. Bladder diary was assessed for all patients.

**Results:** Patients with PD and stroke presented with incontinence, increased frequency, urgency, weak urine stream with normal flow in uroflowmetry and post void residual (PVR) urine < 100ml suggestive of suprapontine lesion. Patients with SCI, MS and NMO presented with urgency, frequency, urge incontinence, interrupted stream with interrupted flow in uroflowmetry with PVR urine < 100ml suggestive of infrapontine-suprasacral lesion. Patients with cauda equina syndrome and diabetic neuropathy presented with hesitancy, interrupted stream, urgency, loss of bladder sensation with poor flow in the uroflowmetry with PVR urine > 100ml suggestive of infrasacral lesion. Among 28 patients with suprapontine lesions 16 had storage dysfunction, 6 had voiding dysfunction and 6 had both. Among 10 patients with infrapontine-suprasacral lesions 3 had storage dysfunction, 5 had voiding dysfunction and 2 had both. Among 12 patients with infrasacral lesions 8 had voiding dysfunction and 4 had both. All the patients were treated with appropriate pharmacotherapy and bladder rehabilitation.

**Conclusions:** Bladder rehabilitation methods were found useful in all these patients in improving their bladder symptoms, better quality of life and preventing complications. Highly neglected area in neurology is bladder rehabilitation and hence this study.

## A New Generation in Aphasia Therapy - Tablet-Based Rehabilitation of Speech And Language

**Prof. Tobias Nef[1], Mr. Patric Wyss[2], Mr. Stephan Gerber[3], Ms. Sandra Perny[4], Ms. Corina Wyss[5], Dr. Prabitha Urwyler[6], Mr. Sinan Uslu[7], Ms. Nadine Schmidt[8], Mr. Alvin Chesham[9], Prof. Klemens Gutbrod[10], Prof. René M Müri[11]**

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**Objectives:** A recent Cochrane intervention review revealed evidence for the effectiveness of using speech and language therapy (SLT) for people with aphasia following stroke. Findings particularly highlight positive effects of higher training frequency. An aphasia tele-rehabilitation application (Bern Aphasia App) was developed to increase training frequency and duration for patients. With the Bern Aphasia App, patients can train independently under the surveillance of the therapists.

**Methods:** The Bern Aphasia App consists of a patient, a therapist and an admin interface. The patient interface contains 10 different exercise types (>11'000 exercises). New exercises can be created by therapists using a web-based admin interface. The therapist interface allows therapists to assign tailored exercises to individual patients needs and monitor the statistics. The usability and acceptance were tested in 25 healthy participants and 10 aphasia patients with the System Usability Scale (SUS).

**Results:** More than 134 aphasia patients trained for 197.2 hours. Preliminary studies revealed average SUS scores of 94.5 for healthy participants and 93.2 for patients (maximum 100).

**Conclusions:** The Bern Aphasia App is accepted and currently used in a clinical context. By using tele-communication technologies, therapists can adjust the task categories and the difficulty level, which should ensure patients' motivation and participation even with high frequency trainings. Hence, the application serves a possibility to increase patients' language skills and quality of life. The benefits of high frequency tele-rehabilitation in aphasia outpatients is being evaluated in an ongoing clinical trial. In Switzerland aphasia outpatients receive less therapy than recommended in guidelines, hence positive results in the clinical trial would have a great socioeconomic impact.

## Role of Transcranial Direct Current Stimulation in Improving Hand Function in Post-Stroke Hemiplegia – Preliminary Report

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**Objectives:** To study the effectiveness of Neurodevelopmental Technique (NDT) in functional outcome with and without Trans cranial Direct Current Stimulation (tDCS) in sub-acute post stroke hemiplegic patients.

**Methods:** Post stroke hemiplegic patients of either side of disease duration 2 months to 6 months and age below 70 years were included in the study. The study is conducted from July, 2016 and still ongoing. One group received only NDT and the other group received NDT with tDCS. NDT of upper limb and lower limb movements and transfer was done using reflex inhibitory positions (RIP). This form of treatment was demonstrated to suitable care-giver during hospital stay empowering the family members to do at home. tDCS session lasting for 2 weeks was given in the hospital. The results were assessed using Scandinavian Stroke Scale (SSS) and Jebsen Taylor Hand Function Test (JTHFT) was used. Assessment was done at 0, 1month, 3 month and 6 months of the initiation of treatment.

**Results:** 42 patients with 28 males and mean age of 58±7.2 were included. 22 (52%) of them had only NDT and 20 had NDT with tDCS. SSS Scores improved in both groups; from initial mean score of 16.2 ± 8.1 to final mean score 31.4 ± 9.5 in NDT only group; and in NDT + tDCS group from 15.6± 9.4 to 38.9± 8.4. JTHFT score also improved in NDT group from initial mean std score of 10.4+/- 5.8 to final mean score 6.2±4.8; in NDT+ tDCS group improvement was from 11.1±5.6 to 4.8±3.2.

**Conclusions:** Addition of tDCS to traditional NDT training in post-stroke hemiplegia has beneficial effect in improving hand function.

## The Influence of the Inspiratory Muscle Training for Stroke Patients with Upper Limb Muscle Tension Induced by Associative Reaction

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**Objective:** To analyse the effect of respiratory muscle training on stroke patients with upper limb muscle tension induced by the associative reaction due to the dysplasia of respiratory muscles.

**Methods:** There were 40 stroke patients with Brunnstrom staging of II-IV enrolled from July 2015 to May 2016. The brain CT and MRI confirmed that the patient was the first stroke, aged between 18-70 years of age, duration of less than 3 months, ignorance dysfunction, improved Ashworth spasticity scale score 1-3. All the participants were randomly allocated into treatment group and control group. In the control group, 20 cases were treated with nutrition therapy, exercise therapy, nerve therapy technique and occupational therapy. In the treatment group, 20 patients underwent routine training adding respiratory muscles training. There was no significant difference in baseline information. Fugl-Meyer (FMA-U) was used to evaluate upper limb motor function before and 1 month after treatment. The modified Ashworth Spasticity Scale, Surface Electromyography was used to measure the muscle tension of the upper limb. Power breathe® was used to test the Inspiratory peak velocity and respiratory muscle strength index.

**Results:** Compared with the control group, the treatment group had a significant increase in the inspiratory peak flow rate and a significant increase in the muscle strength index of the respiratory muscle and FMA-U score ($P < 0.05$); the score of the improved limb ischemic Ashworth spasticity score in treatment group is lower ($P < 0.05$); and the surface electromyography also lower ($P < 0.05$).

**Conclusions:** Breathing training can improve the motor function of respiratory muscle, enhance the ability of respiratory muscle control in the respiratory process, and improve the affected upper limb muscle tension caused by respiratory muscle abnormalities, respiratory muscle compensation caused by the associative reaction in stroke patients.

## Walking Activity and its Factors in Free-Living Ambulatory People in a Chronic Phase After Stroke: A Cross Sectional Study

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**Objectives:** As a result of stroke, functional limitations occur and research indicates that free-living walking activity is lower in people after stroke compared to healthy controls. Balance and gait speed are related to walking activity measured in clinical settings. However, the level of free-living walking activity and its contributing factors in ambulatory chronic post stroke people is poorly investigated.

**Objective:** Evaluate free-living walking activity levels in daily living and to identify factors which are related with free-living walking activity in the chronic phase after stroke.

**Methods:** In this cross sectional study, 40 participants wore an accelerometer for 7 days to measure their level of walking activity. Also, they completed the Berg Balance Scale (BBS) and the Timed-Up and Go test (TUG) for functional balance and the 10 Meter Walk Test (10MWT) to measure gait velocity. Linear regression analyses were performed to investigate a relation between the performance tests and free-living walking activity.

**Results:** Chronic post stroke people took on average 3114.2 ± 1955.7 steps per day, walked 33.1 ± 18.0 minutes per day and took 122.4 ± 60.5 of walking bouts per day. The multivariate analysis showed that only the BBS is a significant predictor for free-living walking activity with an adj. $R^2$ of 0.14.

**Conclusions:** Free-living walking activity levels in ambulatory chronic post stroke people are below those of healthy controls. Furthermore, the BBS is an independent significant predictor for free-living walking activity. Balance should be considered to include in rehabilitation programs to improve walking activity. However, further research is needed to investigate more factors of daily free-living walking activity.

## The Brain Symphony for Post-Stroke Rehabilitation – A Pilot Randomized Controlled Study

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**Objectives:** Music therapy has come a long way in assisting the medical world to improve the condition and quality of life of stroke patients. Research has shown that this is especially effective in supporting stroke patients who suffered from physical to mental disabilities. However, the music played were already pre-set and packaged. Thus, this research aims to explore and compose the best music for effective rehabilitation through studying the effects of music therapy during rehabilitation on post-stroke patients using songs by P. Ramlee. This investigation is divided into three phases: 1) exploring the different composition of music that helps enhance the neuroplasticity of the brain, 2) finding the effect of the music used in

phase one on stroke patients during their rehabilitation through augmenting patients brain neuroplasticity by measuring the mean evoke potential (MEP) using Transcranial Magnetic Stimulation (TMS), and 3) comparing the effects of brain neuroplasticity between lesion and non-lesion areas in the patients.

**Methods:** A cross-over design with music therapy is used on a small sample of 30 participants made out of stroke patients and healthy individuals, whereby the neuroplasticity of their brains are compared and analysed

**Results:** The results suggest that the music therapy produces positive changes in neuroplasticity leading to the improvement of the subjects' motor performance.

**Conclusions:** With this, it is possible that using P. Ramlee's songs can accelerate the rehabilitation for post-stroke patients which proves that music therapy has equally significant benefits as an adjuvant therapeutic tool in a wide variety of clinical settings.

## Opportunistic Oral Pathogen Among Stroke Survivors

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**Objectives:**

**Background and aims:** Oral hygiene is compromised following stroke and the oral cavity serves as a reservoir for opportunistic pathogens. Poor oral hygiene not only results in oral health problems, but also life-threatening events such as aspiration pneumonia and bacteremia. Thus, this study aimed to evaluate the effectiveness of an oral health care intervention in decreasing oral opportunistic pathogens in patients after stroke.

**Methods:** This multicentered randomized controlled trial was conducted among 52 hospitalised stroke patients. The patients were randomized into: i) Test group: a powered toothbrush and antimicrobial gel [1% *chlorhexidine gluconate*], or ii) Control group: conventional oral care (a manual toothbrush and a standardized toothpaste). Oral rinse specimens of patients were aseptically collected at baseline (before intervention), 3-months and 6-months follow-up. Identification of microbial species for prevalence assessment were performed using selective media. The growth of *Staphylococcus aureus*, aerobic and facultative anaerobic Gram-negative bacilli (AGNB) and yeast were determined.

**Results:** More than half of the patients harboured *S. aureus* (63.5%), anaerobic AGNB (65.4%) and most harboured yeast (88.5%). There were significant decreased in *S. aureus* ($P<0.01$) and AGNB ($P<0.05$) prevalence over time, and from baseline and 6-months ($P<0.01$ and $P<0.05$) respectively. There was a significant difference between the prevalence of yeast between the control and test group at 6-months ($P<0.05$), but no significant difference over time was noted. *Candida albicans* was the dominant yeast, while *Klebsiella pneumonia* and *Enterobacter sp.* were the prominent AGNB that was observed in the study.

**Conclusion:** A decrease in the prevalence of *S. aureus*, AGNB and yeast in the intervention group was evident in this study. Oral hygiene intervention is thus, effective in reducing the prevalence of oral opportunistic pathogens among stroke patients

## Outcome of Human Peripheral Nerve Repair Interventions: A Systematic Review

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**Objectives:** Peripheral nerve injury is very common but repair is a challenging medical problem. Road traffic accidents are the most common cause which most frequently affects young to middle aged men. The young people in their productive age undergo nerve injury due to accidents and other occupational hazards. Though these injuries may not threaten the life of the patient, they causes heavy social burden by rendering healthy individuals physically and socio-economically handicapped. Advances in medical sciences and technologies have however made tremendous breakthroughs making this a fascinating area in neurotherapeutics. The aim of the study is to review existing literature in nerve repair studies in human beings and analyse outcome systematically.

**Methods:** A detailed search was made from PubMed Scopus Cochrane library CINAHL PEDro databases and National knowledge network of India and also from scanning through various conference abstracts published in the last 10 years and from important thesis publications from universities including unpublished good data. The studies were categorized based on the age of the patients, type of injuries, type of intervention and also the minimal follow up period. The quality of included studies was assessed using criteria recommended by the Cochrane Handbook for Systematic Reviews of Interventions and the data were extracted by two reviewers independently. Studies satisfying these criteria were segregated and were subjected to a homogeneity test. Those without acceptable homogeneity were excluded. Remaining studies were subjected to a meta-analysis. Outcome parameters such as the functional improvement, sensory and motor recovery parameters were analysed. Meta-analysis will be conducted by RevMan 5.1 software.

**Results:** 535 nerve repairs conducted on 410 patients were analysed from 8 studies. After checking the inclusion criteria, 350 repairs from 280 patients from 6 homogeneous studies fitted the inclusion and exclusion criteria.

**Conclusions:** Human peripheral nerve repair using conduits is safe and effective.

## The Effects of Motor-Points Warm Acupuncture on Reducing Triceps Surae Spasticity in Post-Stroke Patients

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**Objectives:** To investigate the effects of motor-point warm acupuncture therapy on reducing spasticity and tone of triceps surae muscle and improving gait in patients with stroke.

**Methods:** Sixty patients with stroke with Modified Ashworth spasticity scale (MAS) rating 1+ or above and Clinical Spasticity Index (CSI) no less than 7 points, were randomly divided into warm acupuncture (WA) and conventional rehabilitation group (CR). Based on conventional rehabilitation, WA group received warm acupuncture by 0.45*75mm needle heated by fired moxa cone. There were seven motor-points were located by electrical stimulator in triceps surae muscle. Warm acupuncture treatment lasted for 20 minutes per time, 3 times one week, totally 4 weeks. MAS, CSI and gait time-space parameters were adopted to evaluate muscle tone, spasticity and gait.

**Results:** After 4 weeks treatment, MAS and CSI index scores of WA group were decreased significantly than those before treatment ($P<0.05$), the CR group which had no significant differences before and after treatment ($P>0.05$). Compared with CR group, the scores of MAS and CSI in WA group reduced significantly after treatment ($P<0.05$). The cadence and step length were increased distinctly in WA group after treatment, furthermore better than CR group ($P<0.05$).

**Conclusions:** The warm acupuncture can reduce the spasticity and tone of tricpes surae muscle of the affected side in patients with stroke and improve the walking performance.

## Contralaterally Controlled Functional Electrical Stimulation Improves Wrist Dorsiflexion and Upper Limb Function in Patients with Early-Phase Stroke

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**Objectives:** To investigate the effectiveness of contralaterally controlled functional electrical stimulation (CCFES) on wrist dorsiflexion (WD) and upper limb function in patients with early-phase stroke.

**Methods:** Eligible patients were randomly assigned into two study groups. Patients in the CCFES group were treated with routine rehabilitation combined with CCFES while those in the neuromuscular electrical stimulation (NMES) group were treated with routine rehabilitation combined with NMES. Electrical stimulation was performed once a day over two weeks and the duration was 20min for each section. The time intervals from the onset of stroke to the appearance of WD and from the onset of treatment to the appearance of WD were recorded. The functional assessments, including active range of motion for WD, strength of extensor carpi, Fugl-Meyer assessment (FMA) for upper extremity, Jebsen Hand Function Test (JHFT), modified Barthel Index (mBI) and ICF Generic Set, were performed at baseline and endpoint.

**Results:** Twenty-one patients in CCFES group and 20 patients in NMES group participated in this trial. Nineteen patients (90.48%) in CCFES group and 12 patients (60%) in NMES group were observed to obtain the active WD during the treatment period. The time interval from the onset of stroke to the appearance of active WD was significantly earlier in CCFES group (18.33±7.01 days) as compared to that in NMES group (40.95±20.02 days). For inter-group comparison, statistical differences were observed for all the items except JHFT at the endpoint. Changes between baseline and endpoint for each parameter were significantly different between groups. For intra-group comparison, the scores obtained at the endpoint were significantly higher than that of baseline.

**Conclusions:** CCFES was superior to NMES in either shortening the course of WD appearance and the recovery of upper extremity function in patients with early-phase stroke.

## Relief of Spasticity-Related Pain with Botulinum Neurotoxin-A (BoNT-A) in Real Life Practice. Post-Hoc Analysis from a Large International Cohort Series

**Dr. Lynne Turner-Stokes[1], Dr. Stephen Ashford[2], Dr. Jorge Jacinto[3], Dr. Klemens Fheodoroff[4], Dr. Pascal Maisonobe[5], Dr. Jovita Balcaitiene[6]**

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**Objectives:** Pain is a common treatment goal for upper limb spasticity (ULS). Whilst clinical trials of BoNT-A show variable results in the treatment of spasticity-related pain, here we describe its use in real-life clinical practice. This post-hoc analysis compares patients whose primary treatment goal is pain relief, with those who had primary goals in other areas.

**Methods:** The Upper Limb International Spasticity (ULIS) programme is a series of observational cohort studies across >30 countries, examining local clinical practice and patient-centred outcomes in ULS treatment with BoNT-A/concomitant therapies. ULIS-II (NCT01020500) examined a single treatment cycle in stroke patients. ULIS-III (NCT02454803) examines repeated cycles in all neurological conditions. Baseline data are recently available. Outcome Measures include primary goal achievement; goal attainment scaling (GAS), Neurological Impairment Scale, Modified Ashworth Scale.

**Results:** In ULIS-II, pain was the primary goal in 61/456 (13.4%) patients (pain group), whilst 395 (86.6%) had primary goals in other areas (function, mobility, contracture prevention etc). At baseline, both groups were largely similar for demographics, severity impairment and spasticity. However, the pain group was older with more severe contractures. The pain group was more likely to receive injections around the shoulder girdle.

The pain group did somewhat better in primary goal achievement (83.6% vs 78.9%) and mean (standard deviation) GAS-T score (54.3 [9.4] vs 52.5 [9.5]). Goal attainment for the pain group was significantly associated with improvements in pain visual analogue scale (Spearman rho 0.65, $p<0.001$), proximal spasticity (rho=0.40, $p=0.002$) and patient-reported global benefit (rho=0.41, $p=0.001$), but was unrelated to duration of spasticity.

From ULIS-III baseline data, pain is now the primary goal for 348/975 (25%) patients.

**Conclusions:** Pain reduction is an important goal in management of spasticity, irrespective of chronicity or the presence of contractures. It is increasingly identified by clinicians and patients as a primary target for treatment.

## Research on Effect of iTBS And 1Hz rTMS on Recovering Upper Limb Function of Stroke Patient

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**Objectives:** The paper aims To observing the curative effect of iTBS and 1Hz rTMS on recovering the movement function of upper limb of stroke patient.

**Methods:** 41 cases of patients for hemiplegia after stroke in the recovery period are selected and divided into three groups :14 cases of iTBS group,13 cases of 1Hz rTMS group,14cases of control group at random using single blindness method. All the three groups receive comprehensive rehabilitation treatment. In addition, the LF group receives 1HZ rTMS in contralesional M1, and the iTBS group also receives iTBS in ipsilateral M1.Before treatment and after treatment,the U-FMA,ARAT,MBI are evaluated. For Each patient,the ipsilateral thumb extensor should receive MEP inspection before and after treatment and the MEP latency and peak-peak should be recorded.

**Results:** ①After treatment period, the scoring of all the three groups of patients in FMA, ARPT and MBI improved before treatment ($P<0.05$) ②After treatment,the scoring of both treatment groups in FMA and MBI is improved than that of control group ($P<0.05$); and the score of iTBS in ARPT treatment is improved than that in control group ($P<0.05$).③ The ipsilateral MEP cortical latency in both treatment groups is reduced and peak-peak of the ipsilateral MEP increases. Compared with that before treatment, the difference has statistical significance ($P<0.05$) .Moreover, the difference in the control group aslo has the statistical significance.

**Conclusions:** Both treatment groups are beneficial for recovering the movement function of upper limb of patients than the control group, but there is no significant difference for the treatment effect. iTBS promotes the recovery of arm function on affected side better than other groups;Both treatment groups can enhance the excitability of motor cortex on the affected hemisphere and promote the recovery of movement function of upper limb.

## Functional Electrical Stimulation (FES): The Science is Strong, The Clinical Practice Not Yet-A Review of Evidence

**Dr. Gad Alon**[1]

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**Objectives:** The mechanisms that govern the application of non-invasive functional electrical stimulation (FES) have been delineated and clearly described in numerous evidenced-based research publications. The aim of this review is to summarize the primary, multi-system effects of non-invasive FES on the musculo-skeletal system, the peripheral vascular system, and the central nervous systems. The presentation will relate these effects to multiple efficacious clinical studies in neuro-rehabilitation. The presentation will include discussion of the latest technological advancement in wearable FES systems and their critical role in achieving functional recovery following damage to the brain. The presentation will also offer an advanced practice model guided by the latest trend in the medical field focusing on patient-centered, personalized intervention.

**Methods:** Review of Evidence-based clinical studies

**Results:** Not applicable

**Conclusions:** Wearable FES systems have entered the clinical practice allowing FES to become part of the continuum of care in neurorehabilitation. Using adequate screening of candidates and combining FES with task-specific and functional training is likely to help millions of patients world-wide with damage to the brain regain functional independence.

## The Influence of Type of CVA on Planning and Outcomes in a Post-Acute Community Rehabilitation Setting

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**Objectives:** People with an acquired brain injury (ABI) present to post-acute rehabilitation with complex disability. Therefore, it is important to accurately identify potential for rehabilitation on initial assessment to optimise client outcomes and use of health resources, and provide clients with the opportunity to reintegrate into the community. Type of ABI can have a large influence on severity of injury and the areas in which rehabilitation gains can be made. This study assessed and compared the functional and cognitive gains made by clients with left, right, haemorrhagic, ischaemic CVA diagnosis 6 months after entering a community based post-acute rehabilitation service.

**Methods:** Mayo-Portland Adaptability Inventory-4 (MPAI4) client assessments at admission, 3 monthly review and discharge were analysed using STATA statistical software. The retrospective de-identified data from 60 clients was stratified into primary diagnosis groups, being: CVA; haemorrhagic right (n equals 8), haemorrhagic left (n equals 12), ischaemic right (n equals 16) and ischaemic left (n equals 24). Non-parametric statistical analysis compared MPAI4 scores on admission to 6 months post admission.

**Results:** Clients with an ischaemic right CVA presented with the highest impairment level with no significant gains. Clients with a haemorrhagic right CVA had the most improvement over the 6 month period making significant gains in participation (p equals 0.0136), adjustment (p equals 0.0348) and total (p equals 0.0294). Those with ischaemic left CVA had the lowest impairment levels and made significant gains in total (p equals 0.0097) and ability (p equals 0.0149). Clients with haemorrhagic left CVA made significant gains in participation (p equals 0.0042).

**Conclusions:** Type of CVA can inform rehabilitation planning for clients entering post-acute rehabilitation. This enables insight into what areas of rehabilitation to target to allow clients with ABI to successfully reintegrate into the community with and without support.

## AbobotulinumtoxinA Injections in Patients with Upper and Lower Limb Spastic Paresis and Impaired Function Following Stroke or Traumatic Brain Injury

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**Objectives:** Management of spastic paresis often requires both upper (UL) and lower limb (LL) treatment. However, limited data exist investigating simultaneous treatment of both limbs with botulinum toxin A. This post-hoc analysis evaluates walking speed (WS) in hemiparetic patients administered abobotulinumtoxinA (Dysport®, aboBoNT-A) in both UL and LL simultaneously.

**Methods:** Phase-III, open-label (OL) study (NCT01251367) performed at 52 centres (11 countries) worldwide. Eligible patients had previously completed the double-blind (DB) placebo-controlled study (NCT01249404). DB study patients received aboBoNT-A 1000U or 1500U in LL for one treatment cycle (TC). OL study consisted of repeated injections (up to 4 TC) over ≤18 months. Patients received aboBoNT-A 1500U in LL for TC1/TC2; from TC3, patients could receive ≤500U in UL (total dose ≤1500U). Here we report the 10-meter comfortable barefoot WS.

**Results:** Of 352 patients, 63 received co-injection in LL+UL at both TC3/TC4, and 64 received injection in LL only. Mean (SD) aboBoNT-A doses in LL at TC3 and TC4 were 1380U (210) and 1360U (220), respectively, in patients injected in LL only, and 1000U (50) and 1000U (50), respectively, for patients injected in LL+UL. At baseline, 10-meter comfortable barefoot WS (mean [SD]) was similar in patients injected in LL+UL (0.42 [0.20]) and LL only (0.42 [0.20]). At TC3 Week 4, both subgroups had improvements from baseline (mean change [SD]: LL+UL: 0.063 [0.131]; LL only: 0.078 [0.114]), which further improved to TC4 Week 4 (LL+UL: 0.086 [0.166]; LL only: 0.086 [0.123]).

**Conclusions:** In patients with spastic paresis requiring concurrent treatment of UL and LL, it was possible to split 1500U total dose of aboBoNT-A between both extremities, while still improving WS similarly to that observed in patients injected in lower extremities only. This provides important information for the treatment of LL and UL simultaneously with aboBoNT-A in adult patients with hemiparesis.

## A Pilot Randomized Controlled Trial of Constraint-Induced Movement Therapy Combined with Transcranial Direct Current Stimulation and Peripheral Neuromuscular Stimulation

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**Objectives:** Constraint-induced movement therapy (CIMT) is an evidence-based effective treatment for upper-extremity motor deficits in stroke hemiplegia. On the other hand, transcranial direct current stimulation (tDCS) has recently been used for several brain impairments. Moreover, peripheral neuromuscular electrical stimulation (PNMES) has been reported to prolong the effect of tDCS. The objective of this multicentre, randomized, controlled study is to determine the effectiveness of combined therapy of CIMT, tDCS and PNMES vs. conventional CIMT on upper-extremity paralysis in chronic stroke patients.

**Methods:** The inclusion criteria were age 20–90 years and more than 180 days from stroke onset. The exclusion criteria were bilateral or brain stem lesions, voluntary extension ≤10° in the MP and IP joints, or ≤20° in the wrist, severe balance or walking disorder, severe cognitive disorder etc. Participants were randomized into the control group (CG; conventional CIMT) or the treatment group (TG; CIMT plus tDCS and PNMES). TG received tDCS set at 1 mA for 20 mins, followed by PNMES with trains of stimulation at 1 Hz for 10 mins, and then 2 h CIMT, in the morning and afternoon, respectively, for 10 days.

**Results:** Twenty patients were randomized into two groups. After one patient in the CG refused, 19 patients completed the study. Within each group, all motor performance indicators showed significant improvement from baseline. Patients in the TG showed significantly higher improvement than the CG in terms of Fugl–Meyer score (9.20 [4.64] vs. 4.56 [2.60] for treatment vs. control, respectively; $P < 0.01$) and Motor Activity Log Amount of Use score (1.10 [0.65] vs. 0.62 [0.85]; $P = 0.02$).

**Conclusions:** Compared to conventional CIMT, combined therapy of CIMT, tDCS and PNMES improves motor recovery and daily use in the affected upper extremity in chronic stroke.

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## Botulinum Toxin A in Upper Limb Spasticity Management: Baseline Data from the Upper Limb International Spasticity (ULIS)-III Study

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**Objectives:** ULIS-III is a large international study to describe real-life clinical practice in upper limb spasticity (ULS) management using licensed botulinum toxin A (BoNT-A) products and concomitant therapies. ULIS-III will assess long-term impact on patient-centred outcomes and identify best practice strategies according to patient needs. Recruitment has

recently completed. Here, we present baseline data for patients enrolled by June 2017.

**Methods:** In this longitudinal, prospective, observational, cohort study of integrated spasticity management in adults with ULS (NCT02454803), patients are followed for 2 years to examine the impact of repeated BoNT-A injections. Person-centred outcomes are assessed using the Upper Limb Spasticity Index, combining individual goal setting with targeted standardised measures, selected according to patient's chosen goal areas. Details of BoNT-A injections and physical treatments are recorded, alongside economic and quality-of-life data.

**Results:** Baseline data were analysed for 975 patients (mean age, 54.1 years; male, 57%) enrolled at 57 sites (14 countries; 5 continents). Baseline characteristics are presented in Table 1. 82% of patients had spasticity following stroke; two-thirds had received previous BoNT-A for ULS, of which 46% had received <5 previous injections and 28% received >10 injections. The median time from diagnosis to first BoNT-A injection was 1.0 years, and to enrolment was 3.4 years. While arm and forearm muscles were most commonly injected at baseline, 40% received injections around the shoulder and hand/fingers. The most commonly selected primary goal areas. were passive function (31%) and pain (25%), followed by active function (16%), range of movement (14%) and involuntary movements (12%).

**Conclusions:** ULIS-III will improve understanding of treatment and outcomes for longer term ULS management. Final data will be available in 2019.

## The Adult Spasticity International Registry (ASPIRE) Study: 1-Year Results

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**Objectives:** OnabotulinumtoxinA treatment for spasticity is individualized, variable, and dependent on numerous factors. Findings from ASPIRE will help guide onabotulinumtoxinA treatment strategies in patients with spasticity, in order to optimize outcomes. Here we evaluate the interim onabotulinumtoxinA safety, effectiveness, and treatment utilization data from the ASPIRE study.

**Methods:** This is a multicenter, prospective, observational study across 54 North American, European, and Asian sites (NCT01930786) examining adult patients with spasticity treated with onabotulinumtoxinA at the treating physician's discretion. Follow-up assessments include utilization (each treatment visit) and patient and physician satisfaction (5±1 weeks post-treatment).

**Results:** At the 1-year assessment, 731 patients received at least 1 onabotulinumtoxinA treatment; 214 and 251 patients received treatment for upper or lower limb spasticity, respectively, and 265 patients received treatment for both upper and lower limbs. Most commonly treated upper and lower limb presentations were clenched fist (n=368) and equinovarus foot (n=400), respectively. The most frequently used localization technique was electromyography (39.5%–61.5% of treatment sessions). Across all treatments, 91.1% of physicians and 82.3% of patients reported being satisfied/extremely satisfied that treatment helped manage spasticity; 84.6% of physicians and 74.8% of patients reported that the treatment benefit was sustained, and 97.4% of physicians and 89.8% of patients would definitely/probably continue onabotulinumtoxinA treatment. A total of 211 patients (28.9%) reported 559 adverse events (AEs) of which 23 events in 17 patients (2.3%) were considered treatment-related. Serious AEs (136 events) were reported by 75 patients (10.3%); 5 serious AEs in 2 patients (0.3%) were considered treatment-related. No new safety signals were identified.

**Conclusions:** One-year results demonstrate the safety and effectiveness of onabotulinumtoxinA for spasticity in clinical practice. Further analyses will explore clinical and burden outcomes as well as differences across etiology and presentation.

## Microvascular Decompression - Trigeminal Neuralgia

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**Objectives:** Treatment for Trigeminal Neuralgia can be tricky and demanding, and is based on several vital factors:

1) Correct clinical diagnosis
2) Customizing the right treatment modality for each patient
3) Flexibility to change over from one mode of therapy to the other when demanded, and finally
4) Safeguarding against any complication that may arise in the treatment of this benign disorder.

Being the most excruciatingly painful condition mankind can suffer, patients often accept any form of treatment that a particular practitioner offers.

**Methods:** However, any procedure that relieves the pain at the cost of ablating the nerve would only be the last resort. Hence, when drug therapy fails, MVD seems to be the most reasonable treatment. Though the operation has been simplified, to be done through a keyhole microsurgically or endoscopically, it is not necessarily free of risk. Hence, a very rigid protocol is essential to prevent any complication and successfully promote surgery vis-à-vis other less effective (albeit less invasive) procedures. This paper specially emphasizes on the role of veins as the sole or an additional offending agent in a sizeable number of patients. The other point of emphasis is transpositioning or mobilizing the arterial loop off the nerve, passing a sling of teflon around it to pull it away from the nerve and fixing it to a neighboring anatomical location using fibrin glue, as against intterpositioning Teflon between the vessel and the nerve.

**Results:** Above methods minimises any possible close contact with the nerve there by improving immediate and long term results. The procedure is short, bloodless and visually enjoyable but needs extreme caution and gentleness for it to achieve enduringly successful results without inflicting any neurological deficit.

**Conclusions:** The technical considerations of MVD and its potential hazards and pitfalls shall be discussed based on a personal experience of nearly 1045 cases.

## Disability Assessment Schedule 2 Can Reliably Quantify Disability in Epilepsy

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**Objectives:**

**Background**: Epilepsy is the most common neurological disorder that affects 6.5 million people in India. Epilepsy can lead to substantial disability in people with epilepsy. About a third of them may continue to get frequent seizures in spite of optimal pharmacotherapy. Early onset of epilepsy in childhood often leads to unwanted drop out from schools and lost opportunities in life. Seizures or fear of potential seizures can lead to withdrawal from social responsibilities and ultimately add to disability. Perceived and enacted stigma of epilepsy is another pathway that leads to disability. Regrettably there is no validated scheme to quantify disability due to epilepsy. Measures of seizure burden or quality of life do not quantify disability in epilepsy comprehensively. Disability Assessment Schedule version 2 is a generic instrument that can quantify disability in health and disease states across both genders. The normative data on the disability burden for different continents are available. However DAS 2 had never been used to quantify disability in epilepsy.

**Objective**: To assess the utility of DAS 2 to quantify disability in epilepsy.

**Methods:** We interviewed 300 adults with epilepsy attending to the outpatient epilepsy services of this Institute. Those with other significant co morbidities such as mental subnormality, stroke, significant motor deficits or orthopedic problems were excluded.

**Results:** The mean (and SD) score for 300 adult persons with epilepsy (aged 20 – 60) years for the DAS 2 was 9.61 (9.04), range 0 – 50, 95% CI 8.59-10.64). The mean score for Quality of Life in Epilepsy 10 was 16.62 (3.7), and WHO well being Index was 13.44 (4.83). There was good correlation ($p<0.001$) between the scores on DAS 2, QOLIE 10, anxiety and depression scores of the HADS and WHO well being index.

**Conclusions:** DAS 2 is a reliable and accurate instrument to quantify disability in epilepsy and the results can be compared across different medical conditions and different communities.

## Yoga and Epilepsy : Methodological Issues and Review of Existing Studies

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**Objectives:** The purpose of this controlled and outcome study was to evaluate Acceptance and Commitment Therapy and Yoga in the treatment of epilepsy.

A second objective would be to evaluate methodological issues in similar studies on Yoga for epilepsy based on web review published by Cochrane group

**Methods:** The design consisted of a RCT with repeated measures (N=18). All participants had an EEG verified epilepsy diagnosis with drug refractory seizures. Participants were randomized into one of two groups ACT or Yoga. Therapeutic effects were measured using seizure index (frequency x duration) and quality of life (SWLS, WHOQOL-Bref). The treatment protocols consisted of 12 hours of professional therapy distributed in two individual sessions, two group sessions during a five-week period and booster sessions at 6 month and 12-month post treatment. Seizure index was continuously assessed during the 3-month baseline and 12-month follow up. Quality of life was measured after treatment and at 6 month and 1 year follow up.

**Results:** The results showed that both ACT and Yoga significantly reduced their seizure index and increased quality of life over time. The ACT group reduced seizure index significantly more as compared to the Yoga group. Participants in both the ACT and the Yoga group improved their quality of life significantly in one of two life quality instruments. The ACT group increased the quality of life significantly as compared to the Yoga group at the WHOQOL-Bref and the Yoga group increased their quality of life significantly as compared to the ACT group at the SWLS.

**Conclusions:** Results of the overall efficacy analysis show that yoga treatment was better when compared with no intervention or interventions other than yoga (postural exercises mimicking yoga). There was no difference between yoga and Acceptance and Commitment Therapy,similar to Cochrane group concusions-larger, methodologically better designed studies are needed to confirm this.

## Effectiveness of Occupational Therapy Focussing on Upper Extremity Training in a Temperature Controlled Pool Versus Land

**Dr. Deepak Sharan**[1], **Dr. Joshua Samuel Rajkumar**[2], **Dr. Mariappan Nagaiah**[3], **Dr. Rajarajeshwari Balakrishnan**[4]

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**Objectives:** Aquatic therapy (treatment in a temperature controlled pool) is an integral part of rehabilitation for children with Cerebral Palsy (CP) because of the unique properties of water. The aim of this study was to assess the effectiveness of occupational therapy focussing on upper extremity functional training in a temperature controlled pool versus land.

**Methods:** A prospective clinical trial was conducted in a single rehabilitation centre on 40 children with CP. The participants who fulfilled the eligibility criteria were randomly allocated into 2 groups: Experimental Group A (n=20; 8 boys, 12 girls) with mean age of 7.26±3 years and Control Group B (n=20; 11 boys, 9 girls) with mean age of 7.96±2.5 years. Participants in both the groups underwent a programmed set of activities focussing on gross and fine motor activities of the upper extremities with group A in a temperature control pool and group B in land for 1 hour per day for 6 days per week for 6 weeks. The tools used for measuring primary

outcomes are Quality of Upper Extremity Skills Test (QUEST) and Melbourne Assessment of Unilateral Upper Limb Function (MAUULF).

**Results:** Significant differences were seen on all the outcomes in both the groups at the end of 6 weeks programme when compared to baseline values. But, compared to group B, the children in group A, showed better results in the primary outcomes of QUEST ($p<0.001$) and MAUULF ($p<0.001$). The observed progress were also maintained in the follow-ups of group A's QUEST and MAUULF scores after 1 month and 3 months.

**Conclusions:** This study showed that the occupational therapy focusing on upper extremity functional training in a temperature controlled pool can be included in the rehabilitation of children with CP with the use of water as a medium of training.

## Multidisciplinary Team Approach in Primary Headache Disorders

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**Objectives:**
**Background:** Patients with frequent/chronic migraine may have several co-morbidities that require a multidisciplinary team approach.

**Objectives:**

1. To identify various systemic and psychiatric co-morbidities, and neck pain in patients with migraine.
2. To study the effect of multidisciplinary team approaches on treatment outcome and headache disability at 3 months.

**Methods:** Migraine patients (as per ICHD3beta) were evaluated for psychiatric co-morbidities [patient health questionnaire (PHQ), Hamilton rating scale for depression, generalized anxiety disorder scale (GAD-7), Yale-Brown obsessive-compulsive scale (Y-BOCS), anxiety sensitivity index -3 (ASI-3) and Mood disorder questionnaire]; autonomic function [blood pressure response to sustained handgrip, R – R variability and sympathetic skin response (SSR)]; cardiovascular risk factors [blood pressure, ankle brachial index (ABI), body mass index(BMI) & waist hip ratio, serum lipid profile, hs-CRP, and carotid intima media thickness (IMT)] and neck pain. Headache disability by HIT-6 and treatment outcome (>50% decrease in headache days) at 3 months were measured.

**Results:** Of 230 patients (mean age 27.1± 10.19 yrs; M: F 42:188), 60.9% of patients had one or more psychiatric comorbidities. Depression (49%), somatization disorder (24%), anxiety (22%), and panic attacks (10%) were present. Presence of psychiatric co-morbidities had an impact on headache related disability ($p= 0.002$). BP response to sustained handgrip was abnormal in abnormal in 25.2% and SSR was not recordable in 9.6%. 17.4% had hypertension. Dyslipidemia (86.9%) raised hs-CRP (29.6%) and increased carotid IMT (12.6%) were seen. 44.4% patients complained pain and restriction of neck movements. Following multidisciplinary approach, 75.6% patients had >50% decrease in headache days from baseline at 3 months.

**Conclusions:** Significant somatic and psychiatric co-morbidities, atherosclerotic risk factors and neck pain were seen that required a multidisciplinary approach with involvement of neurologists, physicians, psychiatrists, psychologists and physiotherapists. With multidisciplinary team approach, greater number of patients reported improvement at 3 months compared to historical controls.

## An Application for Smart Terminal Can Detect Finger Dexterity of People With Cognitive Disorder

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**Objectives:** Deterioration of dexterity has been reported in the population of dementia. We have found that there were differences of finger tapping between people with cognitive disorder and healthy peers with device with using magnetic sensor (UB-1). Although the result suggested that this device was able to use to screen the abnormality of finger tapping, it was not commercially available. So, we developed the application for smart terminal to make finger tapping to use for screening in community health study. The purpose of this study was to define parameters of finger tapping measured with using application for smart terminal to detect the difference between people with cognitive disorder and age matched control.

**Methods:** 46 subjects diagnosed Alzheimer disease or mild cognitive disorder (AD/MCI group: average age 74.1 SD 6.0) and age matched 48 peers without cognitive disorder (Control group: average age 73.6 SD 8.3) were recruited in this study. Finger dexterity of both groups was evaluated by measurement of taping movement with using application in smart terminal. We also assessed the Cognitive function of AD/MCI group with Mini-Mental State Examination (MMSE) and defined the relationship to finger tapping with spearman of correlation coefficient. Ethical committee of National Center for Geriatrics and Gerontology approved this study.

**Results:** There were statistically significant differences between AD/MCI group and Control group in variation of rhythm and reaction time ($p=0.05$), and more difficult tasks ($p=0.01$). The statistically significant correlation between cognitive function and finger tapping was found mainly in parameters related to contact duration ($r=0.36$ - $0.5$)

**Conclusions:** It was suggested that finger tapping measured with application for smart terminal was able to use for screening test for people with MCI in community health study.

## The Fifteen Minute Assessment of Cognition Over the Telephone (FACT): A Telephone Interview to Detect and Monitor Dementia

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**Objectives:** To test the FACT and compare its performance with a standard brief cognitive tool in differentiating patients with MCI from AD. Follow up cognitive evaluation is essential in both mild cognitive impairment (MCI) and dementia. To widen our range of detecting dementia in those who cannot visit hospitals, a brief telephone-screen, the fifteen-minute assessment of cognition over the telephone (FACT) was designed and piloted for its ability to differentiate and monitor patients with MCI and Alzheimer's disease (AD).

**Methods:** The FACT consists of 27 items categorized under attention and orientation, memory, language, and executive functions domains. Healthy volunteers (*n*=23) matched for age and education to patients with MCI (*n*=22) and AD (*n*=20) were administered the FACT a week after presentation and neuropsychological testing at the clinic. Performance on the Addenbrookes Cognitive Examination (ACE III) was used to correlate test performance on the FACT.

**Results:** The Pearson correlation coefficient between the FACT and the ACE III was 0.82 (p = 0.00). Correlations on the subcomponents of the FACT and the counterpart domains of the ACE III indicated moderated to high correlations. The area under the ROC curve for FACT discriminating MCI from AD was 0.92 and MCI from healthy volunteers was 0.83.

**Conclusions:** The FACT proved to be a comparable and effective tool to the ACE III in detecting MCI and monitoring progression to AD. It successfully differentiates patients with MCI from AD, which has clinical and research implications for early intervention and better monitoring of cognitive decline. This test can potentially be used as a telemedicine tool to pick up early dementia in suburban India.

## Sub-Sensory Galvanic Vestibular Stimulation Can Provide Long-Term Relief from Hemi-Spatial Neglect

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**Objectives:** Hemi-spatial neglect is a refractory, neurological disorder in which the sufferer fails to acknowledge or respond to stimuli appearing in contralesional space. In a randomised, controlled, double-blind trial, we showed that the administration of sub-sensory galvanic vestibular stimulation to sub-acute neglect patients was associated with statistically significant and clinically relevant improvements on the conventional scores of the Behavioural Inattention Test (BIT) and Barthel Index at 1 month follow-up1. Here we re-assessed participants 1-3 years later.

**Methods:** In the original trial, 52 participants were allocated to one of three treatment arms in which the number of daily galvanic vestibular stimulation sessions was 1, 5 or 10. At 1 month post-treatment, all 3 treatment arms showed the same degree of improvement from pre-treatment baseline. To assess longevity of effect, we re-administered BIT to 28 participants.

**Results:** Analysis of covariance was used to compare change in Behavioural Inattention Test mean response across treatment arm, adjusting for the baseline covariates age, inpatient/outpatient status, symptom severity, and the number of days between the follow-up assessment and the last stimulation session. For all treatment arms, the adjusted means at follow-up were marginally higher than those observed at week 4. The number of days between the final stimulation session and follow-up was not a statistically significant covariate in the analysis, and there were no statistically significant differences between treatment arm scores at follow-up.

**Conclusions:** These 1-3 year follow-up data indicate, for the first time, that the clinical improvements observed after 4 weeks of stimulation1 are relatively long-lasting. They also run counter to the hypothesis that repeated daily sessions of stimulation are associated with better outcomes than just a single session when followed-up over the longer term.

A brief programme of galvanic vestibular stimulation can bring long-term relief from the symptoms of hemi-spatial neglect.

## Connecting to a Locked-In Mind: Communication with an Unresponsive Patient Using a Brain-Computer Interface

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**Objectives:** Patients with disorders of consciousness (DOC) have varying levels of cognitive activity, with categories such as vegetative state (VS), unresponsive wakefulness syndrome (UWS) or minimally consciousness state (MCS). Often, it is difficult to know which cognitive functions are left, but it is crucial to learn whether patients can understand conversations.

**Methods:** The system works with (i) vibro-tactile P300 with 2 tactors and (ii) vibro-tactile P300 with 3 tactors. In both (i) and (ii), odd-ball paradigms are presented to the patient for 2.5 minutes, and the patient has to actively count deviant vibro-tactile stimuli. In (ii), the patient has one tactor on the left hand, one tactor on the right hand and one on a neutral midline location. The person has to count either the stimuli on the left or right hand to produce a corresponding P300 response in the EEG. Then, the evoked potentials are calculated and statistically analyzed. Additionally, brain-computer interface (BCI) algorithms are trained on the data to provide an objective measure of classification accuracy. In the next step, questions can be asked to the patient, who can answer by counting the stimuli on the right hand to say YES and on the left hand to say NO.

**Results:** In the current study the patient was trained and assessed and finally he achieved 100 % accuracy. Based on this data the system was calibrated and 20 questions were asked to the patient. 15 were answered correctly, 1 was wrong and 4 were undetermined.

**Conclusions:** The system can assess DOC patients and help us understand if they can do standard cognitive tasks. The classification accuracy is an objective marker to understand whether the patient can follow conversations and even communicate with others.

## Clinically Tailored Portable Virtual Reality Based Motor Rehabilitation System for Neurological Patients: A Feasibility and User Perspectives Study

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**Objectives:** Virtual reality (VR) and video game technology are emerging as a potentially valuable adjunct to traditional neurological rehabilitation. While some centers already utilize low-cost consumer gaming systems (e.g. Nintendo Wii), recent findings failed to show their superiority, when compared to other recreational activities. This finding, however, may be linked to the generic game content and difficulty in adapting such systems to neurological patients' and therapists' needs. We evaluated the feasibility and user perspectives of a portable, versatile, and user-friendly VR-system (MindMotion™ GO, CE-certified medical device). The system design is guided by therapists and clinicians representing the targeted users, and consists of training activities targeting hand, upper and lower limb, and trunk.

**Methods:** To assess the feasibility of using the MindMotion™ GO system, rehabilitation centers in the UK, Switzerland and Germany we evaluated the system over a period of 3 months and recorded various demographic and user perspective data through patient and therapist questionnaires.

**Results:** 26 rehabilitation centers (inpatient and outpatient) tested the system with 263 patients (age: [11-90], 38% female). 70% were stroke patients (others included traumatic brain injury, spinal cord injury, multiple sclerosis, cerebral palsy, and Parkinson's disease). 90% of the patients found the system easy and fun to play, reporting high levels of motivation and believing in its potential to improve their motor function. 93% of the patients also expressed interest in using the system to track progress. Most therapists (71% of 96) believed that the system addressed unmet needs of rehabilitation and would recommend its use to their peers.

**Conclusions:** This feasibility study shows that medical-grade, but enjoyable and easy-to-use virtual reality gaming-based systems could potentially promote patient adherence to rehabilitation and training exercises during early and independent home use.

## Real-Life Dosing Regimens for Three Different Botulinum Toxin A Formulations in Post-Stroke Spasticity Management: Experience of a Reference Center

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**Objectives:** Describing doses of botulinum toxin (BoNTA) used for 3 BoNTA formulations, most injected muscles, and dosing when treating upper limb (UL) or upper + lower limbs (UL + LL).

**Methods:** Data collected prospectively and retrieved from files of post-stroke outpatients who were treated in 2014 to 2016, adding data from all their treatment sessions (2001 to 2017).

**Results:** 1465 BoNTA treatment sessions in 163 patients. Mean stroke age 54 years and median time from stroke to first BoNTA 0.92 years. Most patients had hemiparesis (98%). Mean of 9 BoNTA sessions/patient (SD 6.68). Most frequently treated, UL and LL (61.30%), UL (26.38%), LL (12.69%). UL muscles most frequently injected: flexor digitorum superficialis (64.41%), biceps (41.11%), flexor digitorum profundus (28.83%), flexor carpi radialis (25.15%), pronator teres (25.15%) brachioradialis (23.92%). For abobotulinum toxin (AbT), the mean total dose used was 1142.06U (SD 367.87); for incobotulinum toxin (InT) 404.61U (SD 145.49) for onabotulinum toxin (OnT) 384.90U (SD 163.96). For UL, the mean total dose of AbT was 740U (SD, 267.92); InT 261U (SD, 102.509), and OnT 242U (SD, 101.73). Mean dose proportion between BoNTA preparations for UL and LL and UL only were 2.82:1 and 2.83:1 for InT/AbT whereas it was 2.96:1 and 3.05:1 for OnT/AbT. Importantly, these ratios were different from muscle to muscle. When UL + LL were treated, the mean doses for some UL muscles tended to decrease.

**Conclusions:** This is a long-term report of real-practice of BoNTA treatment in a very large cohort of patients with post-stroke spasticity treated in a reference centre. We found no fixed conversion ratio between the 3 preparations of BoNTA.

## Is Physiotherapy Delivered During Stroke Rehabilitation in India Evidence Based? : An Observational Study

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**Objectives:** To identify the contents of in-patient, out-patient and home-based physiotherapy delivered during stroke rehabilitation in India and to compare the contents with the interventions supported by current available high quality evidence.

**Methods:** The design was a cross sectional study and the setting 20 centers delivering stroke rehabilitation across the state of Gujarat. The participants were 74 physiotherapists working in hospitals and private physiotherapy centers. After obtaining permission from the administrative head of the data collection sites, a physiotherapist observed 156 patients with stroke during routine treatment sessions provided by participating physiotherapists and recorded the treatment provided using the adapted version of stroke physiotherapy intervention recording tool (SPIRIT) version 3. The observations were done for a single treatment session on a randomly selected day of a week. Analysis was carried out by descriptive statistics, one-way ANOVA and chi-squares which were used to describe content of interventions and effects of the aim of treatment. Contents of interventions are compared with the interventions supported by current available high quality evidence.

**Results:** Physiotherapists focused on therapist supervised, impairment focused interventions; most common interventions are active isolated movements and passive interventions such as passive movements, sensory stimulation, stretching (45%); functional tasks are rarely (11%) practiced. There is strong evidence for physiotherapy interventions favoring intensive high repetitive task-oriented and task-specific training in all phases post-stroke. However, majority of interventions provided did not involve practice of real life tasks.

**Conclusions:** Conventional physiotherapy interventions delivered during stroke rehabilitation in India is outdated and primarily focuses on alleviating impairments. Strategies to implement evidence based interventions; integrating practice of functional activity tasks; promoting physical activity is essential to achieve optimal stroke rehabilitation outcome in Indian settings.

## Activity Levels from Multiple Accelerometers During Inpatient Rehabilitation After Stroke

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**Objectives:** To quantify activity levels and possible differences in physical activity in weekdays and weekends and investigate clinical feasibility of accelerometers in subacute stroke.

**Methods:** 21 patients undergoing in-patient rehabilitation were included. Data were collected from five triaxial accelerometers during 48 hours sessions on weekdays and weekends, respectively. Acceleration data was expressed as Signal Magnitude Area (SMA) from day-time periods of 2 consecutive days (8am-8pm). Measurements with less than 22 hours acceleration data for session were not analyzed. Mean activity level from each sensor and symmetry indices for upper and lower extremities were calculated. Sensorimotor impairment was assessed using Fugl-Meyer Assessment (FMA). Participants' experiences regarding sensors were evaluated through semi-structured interview and a 5-point Likert-type statement was used to assess comfort.

**Results:** Full accelerometer data were collected in 82 % of all measurement and 75 % had data from both weekdays and weekend. Categories of missing data were technical failures (11%) or patient-related (7%). Data from18 individuals were included in the final analysis (61% male, mean age: 54.6 yrs, mean FMA score: 55/100). Mean activity levels on weekends were significantly lower for the affected and non-affected arm compared to weekdays. In all other measures, a lower non-significant activity level was found during weekends. The ratios between limbs indicated less active affected side, also confirmed in a significantly lower activity of the affected arm and leg compared to the non-affected side both on weekdays and weekend. 41% were mostly positive, 47% neutral and 18% found sensors not comfortable to wear.

**Conclusions:** Accelerometers allowing raw-data handling can provide meaningful information about activity levels. Accelerometer data from extremities and the ratio between affected and non-affected extremity were most informative. In clinical settings, individual modifications for application and technical support are required. Accelerometers have clinical potential but need further development.

## Factors Related to Long Term Motor, Behavioural and Scholastic Outcome in Children with Acute Disseminated Encephalomyelitis

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**Objectives:** To study the long-term outcome of ADEM and to delineate factors affecting the same.

**Methods:** We chose a retrospective cohort study of children diagnosed with ADEM between January 2006 and December 2015 (fulfilling IPMSSG criteria), after excluding other diagnoses at a follow-up visit. The major outcome variables were motor deficit, scholastic underperformance and behavioral abnormality.

**Results:** The criteria were fulfilled by 102 children. Three died in hospital. The follow up ranged from 1-10 years with a mean(SD) of 4.81(2.78) years. Motor deficit was seen in 17(17.2%), attention deficit in 25(25.3%), behavioral abnormality in 13(13.1%) and scholastic backwardness in 41(41.4%). At follow up, mean modified Rankin Scale (mRS) score was 0.556 and mean(SD) Expanded disability status scale (EDSS) score was 1.71(2.22). Bivariable analysis: Motor deficit was significantly more in children who presented with fever, signs of meningeal irritation, myelitis with

a sensory level, encephalomyeloradiculoneuropathy (EMRN) type of ADEM, Glasgow coma score less than 10, MRI lesions in the internal capsule, thalamus, spinal cord or corpus callosum, a poor mRS and EDSS score, in those who needed ventilation, those who had ventilator associated pneumonia and those with a poor mRS, EDSS and Glasgow outcome score(GOS) at discharge. The EDSS score at admission, the EDSS and GOS at discharge and EMRN type of ADEM were related to poor scholastic performance. Behavioral abnormality was associated with tumefactive demyelination. On multivariate analysis, the mRS score at discharge and thalamic lesions on MRI were significantly associated with motor sequelae; poor scholastic performance with EMRN type of ADEM and behavioral abnormality with tumefactive demyelination.

**Conclusions:** Children with ADEM have residual motor deficits, behavioral abnormality and scholastic underperformance and prognostication may be attempted with the present results.

## Effects of Transcranial Magnetic Stimulation on Upper Limb Dysfunction and Spasticity in Spinal Cord Injury

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**Objectives:** Upper limb dysfunction is common among patients with Cervical Spinal cord injury (SCI). Intermittent theta-burst stimulation (iTBS) a type of Transcranial magnetic stimulation, may help in improving the had functions. Objective of this study is to determine the feasibility of using iTBS for upper limb dysfunction in SCI.

**Methods:** This was a randomised, single-blind, sham-controlled crossover trial with a two-week washout in adults with cervical SCI. Intervention: Active iTBS was delivered to the hand representation of primary motor cortex at 80% resting motor threshold with a circular coil in 10 sessions. Sham iTBS was delivered with the coil was rotated 90° to ensure no brain stimulation. Outcomes: combained total Modified Ashworth scale (MAS) of elbow and wrist extension and flexion, Leeds Arm Spasticity Impact Scale (LASIS), Visual Analogue Scale (VAS-S), Upper extremity motor score ( UEMS)and the spinal cord independence measure (SCIM).

**Results:** Among 11 participants 10 completed the protocol. The mean combined total MAS reduced from 10.6(2.0) to 5.9(3.1) after iTBS and from 9.6(5.1) to 7.6(4.8)after sham. The LASIS changed from 2.2(1.2) to 2.1(1.4) after the iTBS and from 2.0(1.3) to 1.8(1.4) after sham. The VAS improved from 50.8 (21.8) to 54.9 ( 26.2) with iTBS and declined from 64.5(20.6) to 46.7(25.7) after sham. There were no changes in UEMS with iTBS or sham. The SCIM improved from 41.5(21.6) to 46.8 (25.8) after iTBS and declined from 50.1(25.2) to 45.4(24.0) after sham. There were no adverse vents expect in one patient who experienced painful shoulder spasm.

**Conclusions:** iTBS is safe and may improve hand functions in SCI

## Transcranial Direct Current Stimulation - An Emerging Therapeutic Intervention for Motor Recovery in Spinal Cord Injury

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**Objectives:** Transcranial Direct Current Stimulation (t-DCS) is a noninvasive brain stimulation technique which induces neuromodulation and polarity dependent neural plastic changes in sensory-motor cortex and corticospinal tract functions. With promising effects and better motor performance from t-DCS interventions in neurorehabilitation, does it produce similar results for people with incomplete SCI. This review aimed to explore the efficacy and supporting evidence for t-DCS application aimed to improve motor function in individuals with motor incomplete SCI.

**Methods:** We systematically searched PubMed, Science Direct, Medline, CINHAL for clinical trials that incorporated t-DCS for adults with incomplete SCI published from 2010-2016. 256 potential articles were retrieved. Two independent authors assessed for duplication and reviewing articles. A case series and two clinical trials are found to be relevant. Physiotherapy Evidence Database (PEDro) scale was used to assess the study quality, and characteristics of included studies are summarized.

**Results:** Twenty chronic traumatic SCI participants sustained at neurological level C4-C7 with ASIA C or D underwent anodal- t-DCS at the optimal site in the motor cortex, determined by Transcranial Magnetic Stimulation (TMS) to identify for anatomical integrity with functionally intact motor-evoked responses in paralyzed muscles. The intervention ranged from 24-36 sessions with each session delivered with 2mA for 20 minutes. Motor improvement in upper extremity and gait functions are favourable for anodal- t-DCS group. There were no reported adverse events.

**Conclusions:** The preliminary finding is warranted with small samples, heterogeneous clinical presentation and dosing parameters. There is a growing bud of evidence for t-DCS to modulate motor system function in chronic SCI.

**Keywords:** Transcranial Direct Current Stimulation, Spinal Cord Injury, Rehabilitation

## Value of Group Holidays for Clients with Catastrophic Injury

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**Objectives:** I arrange trips for adults and children with brain injury and spinal injury to include skiing, safaris in Africa, surfing in the UK, and camping in Europe. We have captured on film the feedback from clients, showing the benefit they and their families obtain from these experiences.

**Methods:** The film shows how valuable it is for all clients to spend time in different environments, face new challenges, and increase their

confidence and self-esteem. I show clients' discussing how they gained an insight into their own conditions from the experience. Responses such as, 'It was the first time I felt normal' and, 'I realised that I could function in a group and enjoy myself' are part of the story of how they progressed.

**Results:** We saw physiotherapy benefits from surfing in the UK and in Africa. We have a spinal-injured, ventilated client skiing in France, showing there are no physical boundaries. The children's trips show the value of activities with siblings eg a child going down an advanced run in contrast to the rest of the family, who are on basic runs! The film is an ideal medium to demonstrate that such activities benefit both family and carers.

**Conclusions:** It is not necessary to go overseas for some clients: similar benefits can be obtained from a surfing holiday in Devon. The safari was a very positive experience, ranging from snorkelling and shark cage diving, to surfing. We saw animals from an accessible open-top vehicle and hippos from a boat, and took a group to a special-needs orphanage, and the children joined them for lunch. It became difficult to tell who were clients, guides, support workers, or family.

## The Effects of Arm-Cycle Training on Trunk Muscle Function and Seated Balance Control in Individuals with Spinal Cord Injury

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**Objectives:** To determine the effect of an arm-cycle interval training program on seated balance control in individuals with spinal cord injury (SCI).

**Methods:** 9 participants with chronic SCI were recruited for this study (Table 1). Participants attended a 5-week arm-cycle training program 3x/week. The classes contained intervals of supported and unsupported sitting during arm-cycling to challenge balance. In the pre-assessment, surface electromyography (EMG) was used to record bilaterally from rectus abdominis, external oblique, and erector spinae at the T3 and L4 levels during unsupported arm cycling. Seated balance control was evaluated before and after the training program using an elevated forceplate. The center of pressure (COP) during eyes open (EO) and eyes closed (EC) conditions, and total distance during a limit of stability (LOS) test were recorded.

**Results:** Trunk muscle activity was observed from all participants during unsupported arm-cycling. Unsupported cycling elicited statistically significant greater muscle activity than quiet lying for all muscles assessed. Most participants showed a general improvement in COP stability during the EO and EC trials but less improvement in the LOS trials.

**Conclusions:** These results show that trunk muscle activity can be elicited in SCI participants during arm-cycling, even in participants with high thoracic or cervical injuries who, according to their diagnosis, should not have function in these muscle groups. Our findings also suggest that a cycling program that engages core muscles has the potential to translate into improved seated balance control in those with SCI.

## Ambulation Augmentation in Low Level Paraplegics Using Resistance Bands- A Pilot Randomized Control Trial

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**Objectives:** Walking in low level complete paraplegics with simplistic orthoses and crutches is 5 times slower and over 9 times as much energy consuming as able bodied walkers resulting in low long term compliance. The available augmentative methods- FES, robotics or specialised orthoses, require superior technical expertise and are expensive. The Objective - develop an affordable, readily available, light weight, safe and customizable augmentation. I am attempting to use Resistance-Bands to achieve these goals, gauge its safety and feasibility and compare its effect on various gait and energy parameters.

**Methods:**

**DESIGN:** Prospective Pilot Randomized Control Trial followed by Partial cross over trial and Pre vs Post comparison. PARTICIPANTS: Motor complete T10-L1 Paraplegics, trained to walk with bilateral KAFOs and Crutches. INTERVENTION: Novel use of Resistance-Bands as an add-on to KAFOs. MAIN OUTCOMES: Speed (10meter walk test), Endurance (6 minute walk test), Energy expenditure (Physiological Cost Index-PCI), Step Length, Cadence and Acceptability questionnaire.

**Results:**

Part 1: The RCT showed statistical significance in increasing Step length and reducing PCI with uncertain effect on other gait parameters.

Part 2: The Partial cross over study showed statistical significance in increasing step length and decreasing PCI with uncertain effect on other gait parameters.

Part 3: The Pre-Post comparison showed statistical significance in increasing step length, speed and endurance with added statistical significance in decreasing PCI. The effect on cadence was however uncertain.

**Conclusions:** The addition of the resistance-bands to an already existing KAFO-crutch combination, augments the efficiency of gait and decreases energy consumption. This has the potential to increase walking compliance long term thereby limiting wasteful use of limited resources. The device is acceptable, safe and feasible to be tried out on a larger scale.

## Reintegration in the Workplace of People with Chronic Diseases: The EU Pathways Project and the Key Role of Rehabilitation

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**Objectives:** Individuals with chronic diseases, in particular neurological and mental disorders, often experience work-related problems. The rising prevalence of chronic diseases as well as the current economic crisis make this issue even more problematic, requiring actions in terms of innovative strategies to improve the participation of these persons in the labor market. Vocational rehabilitation plays an important role in people lives when it comes to maintain work in presence of a degenerative chronic disease or return to work after a period of injury or illness.

**Methods:** The response of EU Commission to the need for better knowledge on innovative strategies to improve participation in the labor market and to the need of having a stronger focus on reintegration or inclusion into employment, is provided by the 3-years European PATHWAYS Project. The project aims to a) identify integration and re-integration strategies that are available in Europe for persons with chronic diseases; b) determine their effectiveness; c) assess specific employment related needs of persons with chronic diseases and d) develop guidelines supporting the implementation of effective professional integration and reintegration strategies.

**Results:** The mapping of policies, systems and services facilitating the inclusion of persons with chronic disease performed in the first year of the project has revealed that in most cases people from this group are considered as part of a group of "persons with disabilities" and highlights the need for defining professional (re)integration strategies specifically targeted for persons with chronic diseases and personalized for each person's functioning.

**Conclusions:** Pathways projects' results show the key role of rehabilitation for work reintegration as well as for inclusion for those that never worked. Targeted rehabilitation, with proper assessment and defined goals, provides the foundation on which to establish goals and to develop and implement appropriate strategies to assist each person in realizing those goals.

## Ambulatory Accelerometry As Aid For Dose Titration with Levodopa-Carbidopa Microtablets in Parkinson's Disease - An Observational Study

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**Objectives:** Inert wearable sensors is a possible solution to the difficult task of optimizing levodopa treatment in patients with Parkinson's disease (PwPD) We aimed to examine the utility of using an objective accelerometry based measurement system to aid dose titration with levodopa-carbidopa microtablets delivered from a handheld automated dispenser with medication reminders.

**Methods:** 28 PwPD were recruited to an observational, open-label four-week trial. Participants had a stable levodopa at intervals of ≤ 4h. Any concomitant PD treatments, except for levodopa/carbidopa intestinal gel infusion, was allowed. The baseline levodopa schedule was translated to microtablets. Patients were evaluated at baseline, after two weeks using the unchanged microtablet schedule and two weeks after the schedule was revised based on 6 days of free-living accelerometry monitoring.

**Results:** A total of 24 participants completed the study per protocol (14 male [58%]; median 68 years, range 58-82). Dose adjustment resulted in a 15% increase in total daily levodopa dose and an increase in number of doses in most subjects. At the end of the study there were significant improvements in MDS-UPDRS II and III, disease specific quality of life (PDQ-8), self-reported depression scores (MADRS-S), number of wearing-off symptoms (WOQ-19) and reported non-motor symptoms (NMS Quest) compared to baseline. No significant differences in the generic quality of life (EQ-5D-5L) and scores of objective measurements.

**Conclusions:** It is feasible to use free-living inert sensor monitoring to aid titration of levodopa treatment in PD. This open label study confirms that motor fluctuations are common in patients with ≤4h levodopa dose intervals and suggests that individualizing treatment with a microtablet dispenser can improve PD symptoms and disease specific quality of health in the short term.

## Development of Health Related Quality of Life Questionnaire for People With Parkinson's Disease (PWP) In India

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**Objectives:** Parkinson's disease (PD) is found to affect Quality of Life (QOL) & various scales like PDQ 39 are used to measure same. Recent literature suggests that psychometric properties of PDQ 39 has to be reassessed & few reflect that dimensions of measure like Social Support may not be sufficiently reliable to be used as final outcome. Need is to explore socio-economic-cultural factors specific to a particular background affecting QOL in PD. Objective of study was to establish health related quality of life questionnaire for PD in India.

**Methods:** Delphi method was used. Items Generation for questionnaire was done through open ended interview of professionals working with PD. The interviews were qualitatively reviewed & expressions affecting QOL were selected & pooled. These expressions were reviewed through focus group discussion of professionals & rank order given by them in terms of clarity, importance & frequency. These responses were analyzed by field experts & questionnaire with 55 items under 7 domains was finalized. Pilot administration of questionnaire was done on 120 PwPs along with overall assessment. Responses of each domain & its items were subjected to Principal Axis Factoring and orthogonal Varimax rotation.

**Results:** Factor loadings of items of each domain were analyzed & were subjected to rotation multiple times until items loaded on a single factor thereby indicating that group of items measure single domain characteristics. Final version of questionnaire was developed had with 55 items under 10 domains which was found to be reliable with Cronbach's Alpha 0.954. Pearson's correlation with PDQ 39 & PDQ 8 was r =0.908 & 0.862 ($p<0.01$) respectively.

**Conclusion**: Health related Quality of Life Questionnaire developed for PwPs in India incorporating socio-economic-cultural factors affecting QOL is a promising indigenous tool.

## How Does the Placement of a Single Sensor Impact on Activity Recognition in Older Adults?

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**Objectives:** The use of wearable sensors in healthcare (such as fall detection) relies upon activity recognition using single or multiple sensors attached to the body. A single sensor arrangement may encourage participation and compliance and is becoming more prevalent. Many studies involving activity recognition using a single-sensor, have placed the sensor on the waist as this closely reflects the centre of mass. However, the acceptability of the sensors worn on the wrist/ankle is higher than the waist among users.

The research objective of this study was to examine which sensor location provides the highest activity recognition rate. We aimed a comparison of machine learning algorithms trained on data of tri-axial accelerometer of the waist, ankle and dominant wrist to identify different physical activities.

**Methods:** 10 older adult participants took part in the study. Sensors were placed around the right wrist, the right ankle and around the waist over spine. Clinical researchers asked them to perform standard mobility tests in the lab. These tests included standing, walking, sit-to-stand, stand-to-sit, backwards walking, Timed Up and Go, Tandem walk and Standing-Start 180 Turn test.

We examined three classification algorithms, including random forest, support vector machine and NaiveBayes trained on several feature sets derived from data to identify the most reliable sensor position. We used a 10-fold cross-validation for training and testing of these algorithms to evaluate the accuracy, recall and precision of these classifiers.

**Results:** Random forest provided the highest accuracy rate on average for three sensor locations. The highest classification accuracy was for waist data 87.76%.

**Conclusions:** We assessed how the position of a single wearable sensor effects activity recognition in older adults using machine learning algorithms. The accuracy of activity recognition using waist data and random forest algorithm showed the best accuracy. We would like to examine the proposed framework in a larger group.

## Adult Brachial Plexus Injuries- Is the Picture Gloomy?

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**Objectives:** A retrospective review of 600 cases of adult brachial plexus injury is done (2000-2015). The purpose of the study was to analyze the outcome and results taking in to consideration the various factors involved in affecting the ultimate outcome with respect to functional recovery of the paralyzed limb.

**Methods:** In 85% patients the injury was following trauma. Motor bike accident was the common cause (78%). The other causes were assault, following surgery, procedures like central line insertion, nerves blocks. Male were predominantly affected (96%). The injury was more common in young adults (52%). The predominant presenting features were monoparesis of the upper limb with associated pain and numbness. Depending on the various stage of presentation muscle wasting was also found. EMG-NC and MRI of the brachial plexus were the pre operative investigations done in all patients. The operative procedures done ranged from external neurolysis, nerve grafts to nerves transfers. The results were evaluated with respect to functional recovery and post operative pain and paresthesia.

**Results:** The functional recovery noted in partial injury group was 64% whilst in flail arm/complete injury was 42%. The functional recovery was significantly better in patients operated within 6-months from the time of injury. In 11% patients post operative pain and paresthesia was a significant problem and needed long-term symptomatic treatment.

**Conclusions:** Brachial plexus injury needs timely and aggressive treatment. The functional recovery is better with many treatment options available.

## Continuous Improvement in Composite Active Range of Motion Across Repeated Injections with AbobotulinumtoxinA (Dysport®) for Upper and Lower Limb Spasticity

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**Objectives:** To evaluate active range of motion (XA) in patients with upper (UL) or lower limb (LL) spasticity following repeated abobotulinumtoxinA (Dysport®) injection cycles using a novel composite index. Here we present post-hoc analysis results from two randomized, placebo-controlled, double-blind studies each followed by open-label extensions (OLE) performed over ≤18 months.

**Methods:**

UL studies: Patients received abobotulinumtoxinA 500U, 1000U or placebo during double-blind phase (one cycle) and up to four cycles of abobotulinumtoxinA (500U, 1000U or 1500U) during OLE. LL studies: AbobotulinumtoxinA 1000U, 1500U or placebo during double-blind phase (one cycle) and up to four cycles of abobotulinumtoxinA (1000U or 1500U) during OLE. Composite $X_A$ was calculated as sum of $X_A$ for elbow, wrist and extrinsic finger flexors (UL) or soleus and gastrocnemius muscles (LL). Mean (±SD) change in $X_A$ from baseline to Week 4 (double-blind) and to Weeks 4 and 12 at each cycle (OLE) are presented. Data for abobotulinumtoxinA doses combined.

**Results:** UL studies: 238 patients were injected in the double-blind phase (abobotulinumtoxinA, n=159; placebo, n=79), of whom 223 were administered abobotulinumtoxinA at OLE Cycle 1, with 31 newly-recruited patients (total n=254 in OLE). LL studies: 381 patients were injected in the double-blind phase (abobotulinumtoxinA, n=253; placebo, n=128), of whom 345 received abobotulinumtoxinA at OLE Cycle 1. In both UL and LL, composite $X_A$ showed continuous improvements across treatment cycles. Mean±SD change at Week 4 in composite $X_A$ increased from 36.6±51.0° (n=128) to 62.3±74.1° (n=64) during UL studies (double-blind to OLE Cycle 4, and from 6.3±16.4° (n=253) to 10.2±16.3° (n=135) during LL studies, peaking at OLE Cycle 3 (11.2±19.0°;n=224).

**Conclusions:** These results demonstrate continuous improvement in $X_A$ with repeated abobotulinumtoxinA injection cycles, when assessed using a novel composite index.

## Effect of Simultaneous Upper and Lower Limb AbobotulinumtoxinA Injections and Guided Self-Rehabilitation Contracts in Spastic Hemiparesis: Engage Study Methodology

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**Objectives:** To assess the effect of abobotulinumtoxinA (aboBoNT-A; Dysport®) on voluntary movements following a 1500U total dose injection split between the upper (UL) and lower limb (LL) in conjunction with Guided Self-rehabilitation Contracts (GSC).

**Methods:** ENGAGE is an ongoing phase 3b/4 (country dependent), prospective, single-arm, open-label study (NCT02969356) expected to enrol 155 adults with spastic hemiparesis due to acquired brain injury at 20 centres across Europe and the USA; stratified so either UL or LL is primary treatment target (PTT) in 50% patients (±10% flexibility). Patients will receive two consecutive injection cycles (12–20 weeks apart) of aboBoNT-A 1500U, split between the UL and LL. Doses administered per investigator judgement; ≥750U required in PTT for each cycle. Personalized GSC will consist of prescribed alternating stretch postures and a series of maximal active efforts to be performed daily and recorded in a diary.

Primary efficacy endpoint: proportion of responders (improvement in composite active range of motion of ≥35° or 5° in UL or LL, respectively), in the PTT (finger, wrist and elbow flexors for UL; soleus and gastrocnemius muscles for LL) at week 6 of cycle 2. Secondary efficacy endpoints: active function in UL (Modified Frenchay Scale) and LL (walking speed), patient satisfaction with GSC, change in patient and physiotherapist beliefs that GSC can help to improve function, global assessment of benefit by both patients (caregivers) and physicians, and quality-of-life assessments. Safety assessment includes recording of adverse events and vital signs.

**Results:** The planned study period is December 2016 to July 2018. Data on baseline characteristics and study results will be disseminated through peer-reviewed journals and at international congresses.

**Conclusions:** The ENGAGE study will provide insights into the safety and efficacy on voluntary movements of the combination of GSC and abobotulinumtoxinA, simultaneously injected into ULs and LLs, in adults with spastic hemiparesis.

## Relationship Neurophysiological and Functional Effects of Constraint Induced Movement Therapy: A Systematic Review and Meta-Analysis

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**Objectives:** The aim of this review was to systematically look at the literature to find out studies reporting on the neurophysiological changes in the brain following constraint induced movement therapy (CIMT), and to see whether there is relationship between the neurophysiological changes and motor functional performance.

**Methods:** PubMed search engine was searched from its inception to 2nd November, 2016 with the search strategy: constraint induced movement therapy and stroke.

**Results:** The search provided 414 hits in which only 7 studies (in which 4 were used for meta-analysis) satisfied the review inclusion criteria. The 7 studies mostly with high methodological qualities (n=119) reviewed, reported improvement in neurophysiological outcomes such as significant increase in motor map representation, increased gray matter in sensory, motor and hippocampi areas, increased bilateral activation of primary motor cortex (PMC) and somatosensory cortex (SMC), increased mean peak to-peak amplitude of motor evoked potential, and significant inter-hemispheric inhibition of the contralesional hemisphere that correlated with the motor function outcomes. Additionally, the

results of the meta-analysis showed that, there was significant correlation between motor function and neurophysiological changes, fixed effect (z=3.268, p=0.001, 95% CI=0.227 to 0.994) and random effect (z=2.106, p=0.035, 95% CI=0.0424 to 0.827).

**Conclusions:** There is a significant correlation between neurophysiological and functional effects of CIMT.

## Kinematic Variables Quantifying Upper Limb Motor Function After Stroke in a Virtual Environment

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**Objectives:** Kinematic analysis using virtual reality environment provides quantitative assessment of upper limb movements. It may be used for assessment of motor impairment following stroke. The aim is to identify the kinematic variables that discriminate between different function levels in individuals with stroke and healthy controls while performing a target-to-target pointing task.

**Methods:** Sixty-seven participants (mean age of 65.7, 42% female) with moderate (31-57 points) or mild (58-66 points) stroke impairment as assessed with Fugl-Meyer Assessment for upper limb were extracted from the Stroke Arm Longitudinal Study at Gothenburg University - SALGOT cohort of non-selected individuals within the first year of stroke (mean time after stroke is one month). The stroke group and 43 healthy controls performed the target-to-target pointing task, where 32 circular targets appear one after the other and disappear when reached to, and pointed at by the haptic handheld stylus in three-dimensional virtual environment. The kinematic parameters captured by the stylus characterizing temporal aspects and smoothness of movement were analyzed for significant differences within and between groups using Kruskal-Wallis and Mann-Whitney U tests.

**Results:** The kinematic analysis revealed significant differences between individuals with mild stroke, moderate stroke and healthy controls in terms of movement duration, mean velocity, peak velocity and smoothness, as defined by the number of complete stops during the task. There were significant differences between mild and moderate stroke groups in terms of peak velocity and between mild stroke group and healthy controls in terms of time to peak velocity.

**Conclusions:** A set of temporal and smoothness-related kinematic variables were identified during pointing task that may discriminate between different functional levels of the upper extremity in individuals with stroke.

## Role of rTMS in Recovery of Acute Ischemic Stroke: A Clinical and Biomarker Study with Estimation of Serum Growth Factors

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**Objectives:** To evaluate the role of low frequency repetitive trans cranial magnetic stimulation (rTMS) to the contralesional (M1) cortex with intensive physiotherapy in motor recovery of patients with acute ischemic stroke (AIS). To correlate the motor recovery to serum growth factor levels.

**Methods:** In this Double blind, sham controlled study, patients diagnosed with AIS, NIHSS = 2-15 were recruited. Randomization was done at 75±7 days. Total 750 pulses, 1Hz rTMS at 110 % RMT with inter train stimulus interval ~ 45 seconds to contralateral primary motor cortex (M1) area for 10 days ( 5 days /week) was administered in the rTMS group. Physical therapy regime was administered after rTMS application in both the groups. National Institute of Health and Stroke Scale, modified Rankin Scale, modified Barthel Index, FMA Upper Extremity assessment and Serum VEGF and BDNF levels were measured at the Baseline and post rTMS intervention.

**Results:** Hundred patients were randomized into rTMS group ( N =50) and Control group (N =50). Mean age was (54.2±15.65; {M:F = 2:1}). Non parametric Wilcoxon rank sum tests between the groups revealed significant changes in the delta NIHSS, mRS,mBI and FMA Upper Extremity (P<0.001). Significant difference in VEGF (P =0.03) and BDNF (P <0.001) was seen.

**Conclusions:** Low frequency rTMS in study group for 10 days along with physiotherapy for 90 days enhances motor recovery in patients with AIS along with up regulation of serum growth factor levels.

## Role of Botulinum Toxin in the Management of Upper Esophageal Sphincter Spasm in Patients with Neurogenic Dysphgia: A Case Series

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**Objectives:** To analyze the efficacy of local botulinum toxin injection in the management of upper esophageal sphincter spasm in patients with neurological disorders

**Methods:** Retrospective analysis of consecutive patients with neurogenic dysphagia referred for swallow rehab at the centre for rehabilitation at a tertiary centre who had upper esophageal sphincter spasm confirmed on videofluroscopy were identified during the period July 16 to June 17. Injection botulinum toxin 100units was injected under endoscpopic

guidance in operating room. Repeat Videofluroscopic examination was done after one week as assess the effect on the spasm and improvement in dysphagia.

**Results:** 6 patients (M=6), age range from 25 – 70 years of neurogenic dysphagia with upper esophageal sphincter spasms were identified and all of them were injected botulinum toxin (Botox [tm]). The primary pathology was posterior circulation stroke -4, traumatic brain injury – 1 and brain stem glioma -1. All patients had significan reduction in the spasm as documented by repeat videofluoroscpoy and lead to improvement in dysphagia, thus allowing to start oral feeding.

**Conclusions:** The results from the case series shows that botulinum toxin injection is an effective strategy to reduce upper esophageal sphincter spasm in patients with neurogenic dysphagia. Large double blinded studies are required.

## Effectiveness of Tendon Transfers in Upper Extremity in the Management of Spastic Hemiplegia - A Prospective Surgical Study

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**Objectives:** To study the impact of age on the results of tendon transfers in the management of upper extremity in spastic hemiplegia as well as the incidence of affection with regards to the sex and the side of involvement.

**Methods:** The study was performed at the All India Institute of Physical Medicine and Rehabilitation (AIIPMR), Mumbai, cleared by the institutional ethical committee and written informed consent was obtained from all participants.

All study samples were subjected to three surgical procedures, either in one or multiple stages, depending upon the severity and general condition of the patient. Post operatively, no major complications were reported and all patients were put on the same rehabilitation protocol.

**Results:** Out of the total study sample, 25% showed good results, 58.33% showed fair results and 16.67% showed poor results in observed improvement scores. Majority of cases that showed good improvement belonged to younger age group (5-9 years).

**Conclusions:** It can be concluded that upper extremity surgery in spastic hemiplegia should be advocated as it improves both hand function and appearance of the hand. Better results are achieved at a younger age and those limited to soft tissue deformities only. No single procedure offers complete reconstruction of the spastic hand and wrist. Various procedures described must be combined and treatment protocols must be individualized for each patient depending upon the severity of the case. Also good functional results were achieved in only 25% of patients; cosmetic results were achieved in all the study samples.

## Rehabilitation of Spinal Cord Injury Patients: An Armed Forces Perspective

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**Objectives:** Cervical spine injuries accounts for upto 3 % of injuries in trauma victims and can lead to quadriplegia, significant functional loss and permanent disability. While management of these patients can be conservative or surgical, irrespective of the procedure performed the overall neurological recovery of these patients is largely based on their subsequent rehabilitation. Rehabilitation of spinal cord injury patients is triphasic with an acute phase ( 4 to 8 weeks ), a subacute phase (8 weeks to 48 weeks) and a chronic phase (48 weeks to 2 yrs). A baseline assessment of neuromuscular status is of paramount importance in devising a rehabilitation protocol for a spinal cord injury patient and is conventionally based on the ASIA score. Interventions in the acute stage of rehabilitation involves passive mobilisation, use of splints to prevent contractures and deformities and physiotherapy. The subacute phase is also the beginning of the active phase of mobilisation wherein the patient is first made to sit in a suitable wheelchair and then to stand with support starting with the tilt-table followed by the standing frame, parallel bars and gait training with maximal assistance. The phase of active mobilisation helps to prevent development of orthostatic hypotension, osteoporosis, contractures and deformity due to the mobilisation of all joints, improves vital capacity, trunk balance, builds up the morale of the patient and leads to optimum neuromuscular stimulation. Active- passive exercises for upper and lower extremities with a focus on maximal neuromuscular recovery is continued upto the chronic phase. The transition from the subacute to the chronic phase is where the patients are trained on activities of daily living including self care like eating, dressing, grooming, toileting, communication etc with the use of assisted devices like 'universal cuffs' and 'reachers', recreational activities like sports followed by skill training wherein they can undergo formal training in certain technical courses which makes them independent and self-employable once they are out the phase of rehabilitation. The management of spinal cord injury patients is multidimensional and more long drawn than meets the eye and a dedicated team is vital to providing these patients with the outcome they deserve.

## Challenges for Neuro-Rehabilitation in India

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**Objectives:** Neurorehabilitation works with the skills and attitudes of the disabled person and their family and friends. It promotes their skills to work at the highest level of independence possible for them. It also encourages them to rebuild self-esteem and a positive mood. Thus, they can adapt to the new situation and become empowered for successful. By focusing on all aspects of a person's wellbeing, neurorehabilitation offers a series of therapies from the psychological to occupational, teaching or re-training patients on mobility skills, communication processes, and other aspects of that person's daily routine. The most important therapies are those that help people live their everyday lives. These include physiotherapy, occupational therapy, psychological therapy, speech, vision therapy, language therapy and therapies focused on daily function and community re-integration.

**Methods:** This is a single institution retrospective study of patients admitted in the neurosurgery department of a tertiary care hospital. This study encompasses all the modalities in effect at the centre involved in the rehabilitation of adfmitted neurotrauma patients.

**Results:** This study will take into account all admitted patients in the department of neurosurgery undergoing rehabilitation programmes in view of neurotrauma and their final outcome at the time of discharge.

**Conclusions:** This study depicts that a holistic and exhaustive patient centric approach is the need of the hour for complete rehabilitation of neuro-trauma patients.

## Is Thinking with the Body Effective for Cogntive Training? A Randomized Clinical Trial "Thinking in Motion" Study

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**Objectives:**

**Background:** The association between cognition and gait was widely shown. Evidences have shown that cognitive training can improve gait and via-a-versa. However, whether a combined training can improve both gait and cognition more than a specific training is yet to be explored. "Thinking in motion" program is an adaptation of "Writing motion" by Eshcol-Wachman, originally developed for dancers. The program translates motions to writings signs and as such it is cognitive-motor training by its nature.

**Aim:** To compare the effect of "thinking in motion" intervention versus a control group computer-based cognitive training "cognifit" on cognitive gait.

**Methods:** Using a randomized single-blind control design, 48 sedentary older adults recruited to the study (mean age: 81.2 SD-2.2, MoCA- 16.2 SD-3.1) and randomly assigned to 8-week, 3 times per week "Thinking in motion" intervention (n=28) or "Cognifit" training (n=19). Primary outcome was gait speed under single and dual-task conditions and cognitive function as measured by "Cognifit" battery evaluation. Due to abnormal distributions of the outcomes Mann-Whitney test was conducted and intent-to-treat was implemented.

**Results:** Of 48 participants, 2 did not complete the study (one in each group). Both groups improve in gait and cognition. No significant differences on age, sex, cognitive function, use of walking aids and gait speed were found between groups at baseline. After 8-week the intervention group was improved significantly higher in cadence (mean difference intervention – 26.5, SD-2.8, control- 16.72 SD-1.9, p=0.0013) only during single task condition and cognitive performance as measured by Cognifit evaluation (mean difference intervention 26.39, control-17.92 p=0.03).

**Conclusion:** "Thinking in motion" is a promising venue to improve gait and cognition.

## Restoring "Body Image" in Chronic Pain: An Innovative Application of Virtual Reality

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**Objectives:** Chronic pain, such as low-back pain or facial pain, is a highly disabling condition degrading people's quality of life (QoL). Not every patient respond to pharmacological therapies, thus alternative treatments have to be developed. The chronicity of pain can lead to a somatic dysperception, meaning a mismatch between patients' own body perception and its actual physical state. Since clinical evaluation of pain relies on patients' subjective reports, a body image disruption can be associated with incorrect pain rating inducing incorrect treatment and a possible risk of drug abuse. Our aim is to reduce chronic pain through a multimodal neurorehabilitative strategy using innovative technologies helping patients regain a correct body image.

**Methods:** Patients with chronic low-back pain (n=5) and facial pain (n=5) were included. Before and after treatment, patients underwent: neurological exam; neuro-psychological evaluation testing cognitive functions (memory, attention, executive functions) and personality traits, QoL and mood; pain ratings; sensorimotor functional abilities. Patients underwent a 6 week-neurorehabilitative treatment (total 12 sessions) using virtual reality (VRRS system, Khymeia, Italy). Treatment consisted on teaching patients to execute correct movements with the painful body parts to regain a correct body image, based on the augmented multisensory feedback (auditory, visual) provided by the VRRS.

**Results:** Our preliminary results showed improvements of QoL in the domains of role limitations due to physical health and emotional issues, social functioning and pain; a reduction in pain rating scale scores (mean numerical rating scale score before: 5,7 ± 2,3; after: 3,4 ± 4,2); improvements in functional scales, mood and reduction of analgesic drugs intake.

**Conclusions:** This non-pharmacological approach aiming at restoring a correct body image was able to act on the multi-dimensional aspects of pain and improved patients' QoL, pain intensity, mood and patient's functional abilities. This treatment was also able to reduce drug intake.

## 'Reboot Online': A Randomised Controlled Trial Demonstrating that an Internet-Delivered Multidsipclinary Pain Management Program is Effective in Chronic Pain

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**Objectives:** Chronic pain is a complex and debilitating condition that affects one in five adults. Multidisciplinary pain management programs are considered best-practice in treating patients with pain, however access to such programs is often limited for people who live in rural/remote areas, those with work/family commitments, or those in poor health who cannot attend face-to-face appointments. Here we trial an innovative online multidisciplinary program designed specifically for chronic pain: '*Reboot Online*'.

**Methods:** 80 participants with self-reported chronic pain were enrolled into this randomized controlled trial and allocated to either the Reboot Online intervention, or usual care. The Reboot Online program was delivered through a web-accessed 'virtual clinic' and modelled on face-to-face pain management programs, consisting of 8 formal lessons over 16 weeks accompanied by homework activities. Lessons incorporated input from medical pain physicians, physiotherapists and psychologists and involved education lessons, graded exercises programs, pacing and relaxation strategies. All participants completed a suite of outcomes measures at baseline, post-treatment and 3-month follow-up, assessing pain, self-efficacy, fear avoidance, catastrophising behaviours and mood.

**Results:** Participants who completed Reboot Online experienced significant improvements across a variety of domains including pain interference, pain self-efficacy or 'resilience', pain-related stress, kinesiophobia or 'fear of movement', fear avoidance belief, depression and general distress (all $p<0.001$). Moderate effect sizes were observed between the intervention and usual care group for measures of pain self-efficacy, kinesiophobia and pain-related disability. Improvements were significantly greater for the intervention group post-treatment, and were largely maintained at 3-month follow-up.

**Conclusions:** Reboot Online is a unique and effective way to deliver evidence-based multidisciplinary pain management. It represents a pragmatic alternative and adjunct to face-to-face programs, to increase the accessibility of specialist pain management services to those with chronic pain.

## The Effect of Mirror Neuron Therapy in Parkinson's Disease: A Systematic Review of the Literature

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**Objectives:** The objective of this study was to evaluate the effectiveness of mirror neuron therapy in treating parkinson's patient's using systematic review

**Methods:** A systematic literature search of the Cochrane Database of controlled trials, PubMed/MEDLINE, CINAHL, EMBASE, PsycINFO, PEDro, RehabTrials and Rehadat,also Google scholar was made No restrictions were made regarding study design and type of Parkinsonism.

Studies that had Mirror neuron therapy given as a long-term treatment were included. The studies were assessed for eligibility and risk of bias by using the Amsterdam–Maastricht Consensus List. The studies were heterogeneous regarding design, size, conditions studied and outcome measures. The search keywords were mirror neuron therapy, movement disorders, Parkinson disease. The search was tabulated for easy analysis

So a total of 986 studies were reviewed and a conclusion was drawn after careful aggregation and segregation of the results

**Results:** From the detailed review it's clearly noticeable that mirror neuron therapy is an effective physio treatment tool to treat the patients with Parkinson's disease

**Conclusions:** The mirror neurons which are abundantly pooled in the pre-motor cortex can be used to train and treat the Parkinson's patient effectively by improving their cognitive skill by the method of self-realization and visual stimulation.

## Repeated Sessions of Caloric Vestibular Stimulation Reduce the Frequency and Severity of Episodic Migraine

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**Objectives:** Migraine causes significant disability in ~12% of people worldwide. Current preventatives do not provide full relief. Caloric vestibular stimulation has been shown, albeit in small, uncontrolled samples, to acutely mitigate pain, including the pain experienced during attacks. We evaluated, via a multi-site randomised, controlled trial, the efficacy and safety of repeated caloric vestibular stimulation as an adjuvant therapy for episodic migraine prevention (clinicaltrials.gov: NCT01899040).

**Methods:** 81 participants diagnosed with episodic migraine without aura completed a 1month pre-treatment baseline followed by 3 months of twice daily sham or active caloric vestibular stimulation. The active saw-tooth waveform discharged warm and cool currents to the left and right ears respectively via a novel thermo-electric device inserted within the left external ear canal (Scion Neurostim). To avoid preferential hemispheric activation, this mapping was reversed every 2 days. In the placebo condition, participants followed the same procedure but the device remained unpowered. Headache frequency was captured via electronic diary.

**Results:** Per-protocol analysis showed that active-arm participants experienced immediate and steady declines in migraine days over the treatment period and exhibited significantly fewer migraine days during the final treatment month (-3.6 ±0.7 days), compared to placebo-arm participants (-0.9 ±0.7 days). Secondary analyses showed that active-arm participants also experienced significantly greater reductions in both acute prescription medication usage and total monthly pain levels. Active-arm participants showed no adverse effects in mood, cognition and balance. Participants completed the trial with an average rate of 90% treatment compliance, and no serious adverse events were recorded.

**Conclusions:** Caloric vestibular stimulation significantly reduced migraine days, subjective headache pain scores and the need for migraine abortive medications. The clinical efficacy, minimal side effects, self-administrative and adjunctive nature of the caloric vestibular stimulation therapy indicate that the procedure has the potential to provide substantial clinical and economic benefits for episodic migraine prophylaxis.

## Effects of Gaze Direction Recognition Exercise on Pain Intensity, Balance and Disability Level in Patients with Chronic Neck Pain

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**Objectives:** To determine contributions of the gaze direction recognition exercise (GDRE) to improve pain intensity, balance, and disability level among patients with chronic neck pain.

**Methods:** Eligible 40 patients were randomized to physical therapy program (Group I) or physical therapy plus GDRE (Group II) and were scheduled to receive a 3-week treatment, 5 sessions in a week. Pain Intensity was measured by a Visual Analog Scale (VAS). The Neck Disability Index (NDI) was used to determine disability level. To evaluate balance ability, four step square test (FSST) and single leg balance test (SLBT) with eyes opened and closed were used. All measurements were applied before and after a 3-week treatment program.

**Results:** VAS scores of the two groups decreased after the treatment program (p<0, 05). While there were significant differences in terms of balance ability and disability level in Group II after the treatment program (p< 0.05), no significant improvements were observed in Group I (p>0.05).

**Conclusions:** The results of this study indicate that adding GDRE to the physical therapy program leads to much more improvements in balance ability and in disability level among patients with chronic neck pain. GDRE can have a positive impact on the treatment program.

## Upper Limb Self-Efficacy Test (UPSET- Stroke): Its Validity and Relationship with Participants Age and Time Since Stroke

**Dr. Auwal Abdullahi[1]**

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**Objectives:** Upper limb self-efficacy test (UPSET-stroke) was developed to measure one's confidence in his ability to use the upper limb following stroke. However, its validity needs to be further determined. The aim of this study was to determine the relationship between UPSET-stroke and some measures of upper limb function.

**Methods:** The study was an observational study whose data was gotten from a Randomized Controlled Trial approved by the Research Ethics Committee of Kano State Ministry of Health (MOH/Off/797/T.I/176); the data was collected at Murtala Muhammad Specialists hospital. The study participants were acute stroke patients who were ≤ 4 weeks post stroke, ≥18 years of age, had mild to moderate upper limb motor impairment, with no significant cognitive impairment and had no neglect. Baseline data for UPSET-stroke, MAL, WMFT and FM; and participants' age and time since stroke were recorded. The data was analyzed using Pearson Product Moment Correlation.

**Results:** Twenty nine patients (14 males and 15 females) participated in the study with mean age 57.97±12.17 years and time since stroke 17.41±7.53 days. The results showed that there were significant (p<0.001) and large positive correlations between UPSET-stroke and MAL amount of use (r=0.67), MAL how well (r=0.78), WMFT (r=0.65) and FM (r=0.75). However, there were non-significant (p>0.05) and small negative correlation between UPSET-stroke and participants age (r=-0.26) and moderate positive correlation with time since stroke (r=0.31).

**Conclusions:** UPSET-stroke seems to be a valid instrument for measuring one's confidence in his ability to use the upper limb following stroke.

## Efficacy of Visual Evoked Response (VER) and Brainstem Evoked Response Audiometry (BERA) in Hypoxic Ischemic Encephalopathy (HIE) in Patients Prognosis

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**Objectives:** To study the efficacy of VEP and BERA response in patients with HIE as prognostic factors.

**Methods:** Prospective, cross sectional study, Department of Physical Medicine and Rehabilitation in a private tertiary hospital. Nine patients (6 males, 3 females) with HIE secondary to cardiac arrest, clinically stable transferred for in-patient neuro-rehabilitation from neurology intensive-care-unit were included. Age between 21-70 years, duration of in-patient rehabilitation 8-24 weeks. Intervention – Coma stimulation program and intensive neurorehabilitation. Evoked potentials-VEP and BERA done between 3-4 weeks post HIE. Glasgow Coma Scale(GCS) and Rancho Los Amigo Scale(RLAS) were used to assess neurological status whereas Functional Independence Measure(FIM-F and FIM-C) and Barthal Index(BI) scores were used to assess functional recovery and scores were compared at admission vs discharge.

**Results:** Positive VEP was observed in five patients, Positive BERA was observed in eight patients. Out of five patients with positive VEP and BERA three showed significant change in mean score in GCS and RALS at admission 7.3 and 2.0 to 15 and 8.5 respectively at discharge. FIM –F, FIM-C and BI also changed considerably from 13.00 5.00 and 0 at admission to 85.0, 33.33 and 91.66 respectively at discharge. Two patients had marginal change in GCS and RALS from but no change in FIM –F, FIM-C and BI score at admission and discharge. Three patient with only positive BERA and One with absent both BERA and VEP didn't show any change at admission and discharge.

**Conclusions:** Patients with positive VEP and BERA had better cognitive and functional outcome as compare to only positive BERA and absent VEP. Early coma stimulation and aggressive neruorehabilitation in the initial 12-24 weeks may enhance better neurological recovery in patients with positive VEP and BERA.

## Functional Connectivity Predicts Neuroplastic Response Induced by Non-Invasive Brain Stimulation in Stroke: Opportunities to Individualise Stimulation Based on Connectivity Profile

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**Objectives:** Non-invasive brain stimulation (NIBS) is a strong candidate to assist neurorehabilitation as it can induce neuroplasticity and improve

motor function. However, responses to NIBS are highly variable. Here we investigate brain connectivity to predict neuroplasticity induction.

**Methods:** Two randomised, sham-controlled, participant-blind, cross-over experiments were conducted. Experiment 1 investigated whether functional connectivity could predict physiological and behavioural change induced by an inhibitory NIBS paradigm (continuous theta burst stimulation) in 18 healthy adults. Experiment 2 investigated whether functional connectivity could predict physiological change induced by an excitatory NIBS paradigm (anodal transcranial direct current stimulation) in 10 stroke survivors. Connectivity was investigated using high-definition electroencephalography. Single-pulse transcranial magnetic stimulation quantified change in corticospinal excitability. Upper-limb function was measured with a customised pinch-grip manipulandum and Perdue Pegboard.

**Results:** As expected, NIBS responses were variable with no group-level effect on corticospinal excitability ($p > 0.05$). However, in experiment 1, beta frequency connectivity between the stimulated motor cortex and parietal cortex was a strong predictor of reduced corticospinal excitability following inhibitory NIBS (leave-one-out-prediction $R^2 = 0.72$), but not sham stimulation. Similarly, alpha frequency connectivity between the parietal and pre-motor region predicted change in motor function following inhibitory NIBS (leave-one-out-prediction $R^2 = 0.66$), but not sham. In experiment 2, alpha frequency connectivity between the stimulated ipsilesional motor cortex, ipsilesional parietal cortex and contralesional frontal cortex predicted increased corticospinal excitability following excitatory NIBS (leave-one-out-prediction $R^2 = 0.69$), but not sham.

**Conclusions:** Responses to NIBS are highly variable and it is likely this is not a one-size-fits-all therapy. Individualised approaches are likely to provide a more robust response and improve clinical uptake in neurorehabilitation. Functional connectivity may be an important biomarker to help develop tailored NIBS protocols.

## Self-Regulating Brain and Muscle Activity Simultaneously to Minimize Non-Obvious, Compensatory Tendencies During Stroke Rehabilitation: A Randomized Clinical Study

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**Objectives:** This study was designed to compare upper limb rehabilitation outcomes achieved using the SynPhNe (Synergistic Physio-Neuro) platform with standard clinical care delivered by therapists (control group), to assess usefulness of SynPhNe to augment standard care at home or clinic.

**Methods:** SynPhNe acquires time-locked, surface electromyography (SEMG) and electroencephalography (EEG) data via a wearable data capture unit (WDCU) and transmits to a computer screen as real time feedback (Figure 1). The subject attempts to imitate a video-based exercise routine on the computer screen while managing the agonist-antagonist EMG activity (thus unlearning hitherto non-obvious compensatory muscle behavior) and maintaining an alert brain state using EEG feedback.

Randomized treatment and control group stroke subjects (n=30; 28-76 years) completed a six week, 3 sessions/week protocol. The treatment group performed ten activities using the device while the control group was provided standard care (physio, physical and occupational therapy). Fugl Meyer Assessment (FMA), Action Research Arm Test (ARAT), Grip strength and 9-Hole Peg Test were used as assessment tools.

**Results:** All control group scores showed significant pre-post changes. A two-tailed t-test between treatment and control groups showed no significant difference ($P<0.05$) in improvements for FMA and ARAT, demonstrating that the SynPhNe device could augment therapy at home with effectiveness comparable to standard care. The largest percentage improvements in the treatment group were in ARAT and Grip Strength. Only high functioning treatment group subjects showed dexterity improvement as well.

**Conclusions:** The treatment group outcomes were comparable to standard care. This showed that SynPhNe is a promising technology to augment therapy at home or at a clinic for function recovery and saving manpower.

## Robotic Assisted Gait Training (RAGT) for Long Term Rehabilitation of Stroke Patients

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**Objectives:** The effectiveness and appropriate timing of locomotor training for stroke patients have not been established. The objective of the study is to evaluate the role of Robotic assisted Gait trainer ( RAGT) for long term rehabilitation of stroke patients.

**Methods:** The study included 126 patients who had stroke 3 months earlier. The patients with moderate to severe walking impairment (able to walk 0.4 meter/seconds to 0.8 meter/seconds and less than 0.4 meter/seconds) were randomly divided into two groups. Group A patients received Robotic assisted Gait training( RAGT) by using Lokomat Gait trainer and Group B patient received home managed physiotherapy for 6 months. Each intervention included 50 session of 60 minutes exercise each for 24 weeks. The primary outcome was proportion of patients who had improvement in walking ability at 24 weeks after intervention.

**Results:** The mean age of participants was 53.42 ± 9.472 years; 77 were male and 49 were female. Baseline characteristics between two groups were similar. Mean baseline walking speed in Group A was 0.425 meter/sec, and Group B was 0.408 meter/sec. At 24 weeks 42.1% of all patients have improvement in functional walking ability. The patients receiving robotic assisted gait training showed significant improvement than those receiving usual home managed physiotherapy, ($p< 0.05$, odd ratio for primary outcome, 0.484; 95 % Confidence interval (CI) 0.236 to 0.995). Both group patients improved in walking speed, motor recovery, balance, functional status and quality of life. Minor adverse events like dizziness, frequent fall sand muscle cramps were reported in both groups. No serious adverse event were reported.

**Conclusions:** Robotic assisted Gait Training (RAGT) improves walking ability in stroke patients as compared to usual home physiotherapy.

## Effect of Repetitive Transcranial Magnetic Stimulation on Corticomotor Excitability and Motor Function of the Affected Hand in Subjects with Stroke

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**Objectives:**

1. To evaluate central motor conduction time (CMCT) of abductor pollices brevis in normal individuals.
2. To examine the efficacy of rTMS on Corticomotor excitability, Motor function of the hand in subjects with stroke.
3. To examine correlation between corticomotor excitability and hand function.

**Methods:**

- This is Descriptive and interventional study done Prospectively on Patients with stroke and healthy volunteers as controls in dept of neurology, SVIMS, Tirupathi using Magstim rapid stimulator (Magstim co Ltd with booster modules, Jebsen hand function kit Peg boards, squeeze balls, hand dynmometer & Stop watchNormal control group (n=20)

rTMS group & sham rTMS grou include Patients with ischaemic hemiparetic stroke intervention

rTMS group(n=15 )

A train of 20 pulses at 10 hz at 80% RMT .Train is repeated 8 times over an 8 minute session/10 days.The coil was oriented to the direction posterior to the midline at 450 angle with 70mm of figure of 8 coil Motor training of the hand 30 minutes session twice a day / 10 daysSham rTMS group (n=17)

- Sham stimulation was done with coil held at 900 angle to the scalp with same parameters as of experimental group .
- Motor training of the hand 30 minutes twice a day for 10 days.
- Outcome measurements
- Corticomotor excitability =CMCT of APB muscle assessed at base line, after 5 days, 10 days of intervention.
- Motor function of the hand = Assessed by Jebson Taylor hand function test at baseline, after 5 days and 10 days of intervention

**Results:**

JHFT, CMCT of the rTMS group improved better compared with sham control group,from base to 5 days and 10days with significant correlation with motor function, corticomotor exicitability.

**Conclusions:** That treatment of patients with acute stroke with 10 hz rTMS combined with motor training elicted more improvement in paretic hand function than did sham control with motor training alone

## Effects of Music Therapy Intervention in Rehabilitation of Patients Diagnosed with Non-Progressive Brain Disorders

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**Objectives:** To study the effects of music therapy on arousal of comatose, minimally conscious patients with improvement in communication and interaction abilities in patients with non-progressive brain disorder

**Methods:**

- This case series was conducted in Department of Physical Medicine and Rehabilitation, Kokilaben Dhirubhai Ambani Hospital
- 10 subjects- Traumatic Brain Injury (4 patients), Hypoxic Ischemic Encephalopathy (5 patients) and Stroke (1 patient)- diagnosed with non progressive brain disorder were included
- 8 males and 2 females, aged between 13 to 59 years
- Neurologic Music Therapy (NMT) with active music therapy focusing Nordoff-Robbins approach was used as an intervention
- Each patient was given therapy once a day for 30 to 45 min. for 20 to 50 sessions
    - Outcomes were measured with pre & post assessment using following toolsGSC (Glasgow Coma Scale)
    - GOS-E (Extended Glasgow Outcome Scale)
    - CRS-R (Coma Recovery Scale- Revised)

**Results:** Significant difference was reflected in Pre and post assessment of subjects using GCS ($p<0.05$), GOS-E and CRS-R ($p<0.05$) with improvement in arousal including auditory, oro-motor functions with visual, motor and communication

**Conclusions:**

- Musical stimulation was found effective in patients with disorder of consciousness in terms of their recovery process as a part of Neuro-Rehabilitation
- Active Music Therapy factor in Neurologic Music Therapy and Nordoff-Robbins Approach played significant role with these patients showing improvement in different areas of rehabilitation
- Musical intervention effectively facilitated multisensory engagement and created a strong platform for arousal and improvement in communication and interactions
- Music Therapy was found very effective when given as an adjuvant to patients with disorders of consciousness under comprehensive neuro-rehabilitation

## Musculoskeletal Ultrasound Assisted Minimal Incision Flexor Retinaculam Release in Carpal Tunnel Syndrome

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**Objectives:** Carpel tunnel syndrome is one the most common compression neuropathies of the upper limbs. When conservative treatment fails surgery is considered a valid option. Palmar and recurrent branch of median nerve as well as superficial palmer arch are at risk of damage. . The most common complications of surgery are bleeding, injury to the branches of median nerve, Pillar pain CRPS, scarring of suture site. Preoperative ultrasonography help us to identify median nerve enlargement, bifid, trifid variations with or without persistent median artery, bowing of transverse carpal ligament, flexor teno synovitis.or space occupying lesions(eg, ganglia, tumors, thrombosed or anomalous arteries, abnormal muscle slips, or supernumerary muscles or tendons).

**Methods:** Fifty Patient posted for carpel tunnel release between 2012 to 2015 were included in the study. Pts were posted for CTS release only after confirming Moderate to severe cts by electrodignostic examination. We hypothesized that that structure at risk during carpal tunnel release such as anomalous artery and superficial palmar arch can be protected if they are visualized early and the incision planned accordingly. we also hypothesized that an avascular area exists in the flexor retinaculam and characterizing the anatomical extent of the avascular area helps in safe dissection with minimal intra operative bleeding and we can do the release without tourniquet.

A preoperative ultrasound examination of carpal tunnel is done and important anatomic structures are marked and a 2 to 2.5cnm incision marked accordingly. Under local anesthesia without tourniquet using minimal incision CTS release is done.

**Results:** The complication rate of open carpel tunnel release is 2 to 10 %. In our series apart from a suture granuloma there was no complications in a six month follow up.

**Conclusions:** Ultrasound assisted minimal incision carpal tunnel release is a safe and effective method of treating moderate to severe CTS.

## Role of Surgeries in Early Ambulation of Cerebral Palsy Analysis of 1540 Children

**Dr. Sreedhar Thuppal[1]**

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**Objectives:** In Cerebral Palcy children during the process of Rehabilitation to achieve our Goal of Ambulation and ADL we come across various hurdles due to the severe Spasticity leading to Deformities and Contractures

These need Surgical interventions followed up with Therapy programmes supports gait aids to achieve our Goal of Ambulation

In this paper study 1540 CP children with various types of deformities subjected to surgical interventions durng Rehabilitation discussed stressing the need of Surgical interventions

The common deformities in lower limbs in CP are Flexion & Adducton contracture at Hip Flexion contractures at Knee Equinous varus valgus deformities at foot leading to Scissoring Crouch gait Equinous gait etc

In this paper how these deformities are corrected by differnent Surgical procedures and the results analysed are discussed stressing the role of Surgical interventions in CP at different stages in Rehabilitation

**Methods:** A total no of 1540 Cerebral Palsy children operated between 1996 2016 at AIIPMR Mumbai Kamineni Hospital Apex Hospital Hyderabad are taken in this study and the pre operative deformities gait and post Surgical gait improvement are discussed

Of the 1540 cases operated 950 have undergone 2 or more surgeries due to deformities at various levels

Details of Surgical interventions are discussed

**Results:** Over all the final result of improvement in the Gait in all the cases are observed

Few cases walked with out any gait aids and few discarded AFOS after a period of 3 to 4 years managing with modified Shoes

950 cases had to be given Calipers and Gait aids for long term for their Ambulation

**Conclusions:** In Cerebral Palsy the role of Surgical interventions play an important role in Rehabilitation.

## Effects and Mechanism of Mirror Based Integrative Motor and Sensory Training on Upper Limb Function of Stroke Patients

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**Objectives:** To explore the effect and mechanism of mirror based integrative motor and sensory training on upper limb motor function of stroke patients.

**Methods:** 18 stroke patients with hemiplegia were randomly divided into two groups accepting ABA and BAB training protocol respectively. Protocol A is classic mirror therapy (MT) integrating simultaneous sensory stimulation on affected and unaffected hands. Protocol B is classic MT. The training lasts 30 minutes a day and 5 days per week. Brunnstrom stage and Fugl-Meyer assessment were adopted to evaluate upper limb motor function before and after every week's training. Transcranial magnetic stimulation (TMS) was used for 6 stroke patients and 8 healthy subjects to show the motor evoked potential (MEP) changes during they observed Video A (upper limb movement combined with sensory stimulation) and Video B (only upper limb movement). Furthermore, functional magnetic resonance imaging (fMRI) was implemented to reveal the brain activation difference between observing video A or video B in 2 healthy subjects.

**Results:** Fugl-Meyer assessment of upper limb function improved more significantly after Protocol A than after Protocol B training ($P<0.05$). TMS experiments on both healthy subjects and patients indicated that the observation of Video A may induce higher MEP than the observation of Video B ($P<0.05$). fMRI experiment revealed that the observation of Video A activated more sensory- motor cortex than observation of Video B.

**Conclusions:** Mirror based integrative motor and sensory training i.e. classic MT combining with simultaneous sensory stimulation can promote better recovery of upper extremity function for stroke patients. The underlying mechanism may be related to stronger sensory-motor cortex activation (fMRI) and higher pyramidal property (TMS-MEP) reflecting functional reorganization and remodeling of the brain circuits relevant to upper extremity motor function.

## Effect of Vestibular Rehabilitation Therapy on Fatigue in Patients With Multiple Sclerosis: A Randomized Controlled Trial

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**Objectives:** To investigate the effect of additional Vestibular Rehabilitation Therap (VRT) program on Multiple Sclerosi (MS) related fatigue

**Methods:**

**Design:** Single blinded, parallel randomized controlled trial.

**Settings:** The Out-Patient Clinic at Faculty of Physical Therapy, Kasr Al-Ainy Multiple Sclerosis Unit (KAMSU) and Clinical Neurophysiology Unit, Cairo University, Egypt.

**Participants:** 40 patients with remitting-relapsing MS (RRMS).

**Intervention**: Patients were randomized into control and intervention groups; 20 patients each. Over four successive weeks, all patients received stationary bicycle endurance training. The intervention group received an additional VRT program.

**Outcomes**: The primary outcome measures included; fatigue perception (fatigue severity scale (FSS), functional walking capacity (the timed 25-feet walk (T25-FW) test), and cognitive performance (the Paced Auditory Serial Addition Test) during three (PASAT#3) and two (PASAT#2) seconds. The secondary outcome was the cortical activity measurement using quantitative electroencephalogram (QEEG).

**Results:** 55 patients were recruited. 40 patients were randomized and only 36 completed the study. An intention to treat analysis was applied. After treatment, the intervention group showed a remarkable improvement in cognitive performance (PASAT#3) and cortical activity (QEEG) over different sites ($P < 0.05$). Other outcomes showed insignificant differences between groups ($P > 0.05$).

**Conclusions:** Adding VRT to stationary bicycle endurance training has a positive effect on cognitive fatigue in RRMS. Besides, VRT enhances cortical reorganization at the areas concerned with sensorimotor integration, attention as well as memory.

**Trial registration:** www.pactr.org (PACTR201611001853408).

**Funding:** None.

## Pediatric Epilepsy Surgery Outcome

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**Introduction:** Pediatric epilepsy leads to considerable impact on cognitive and psychosocial life. Approximately 60% of all patients with epilepsy suffer from focal epilepsy syndromes. In about 15% of these patients seizures are not adequately controlled with anti-epileptic drugs. Such patients are potential candidates for surgical treatment and good proportion of these patients are in pediatric group (<18 years). Successful epilepsy surgery depends on unambiguous focus identification. Epilepsy surgery in children who have been carefully chosen can result in seizure freedom or a marked reduction in seizure burden (>90%) in approximately two third of children with intractable seizures. Early surgery in pediatric epilepsy patients improves scholastic performance in formative years of schooling. Post-surgery patients, who are seizure free, drug free and with normal EEG have improvement in both developmental and cognitive outcomes.

**Objective:** To evaluate the surgical outcome of epilepsy surgery in pediatric epilepsy.

**Methods:** All epilepsy patients of less than 18 years of age who had medically refractory epilepsy and had undergone epilepsy surgery (2001-2017) were included in the study.

**Results:** At our centre a total of 131 pediatric epilepsy surgeries were done between 2001 to 2017, amongst which 75 were anterior temporal lobectomy (ATL), 35 were lesionectomy (temporal and extratemporal), 11 were callosotomy and 10 were hemispherectomy. In those patients who underwent ATL 88% were seizure free on long term follow up (mean average of 5years). Among those who underwent callosotomy 4(36%) patients were completely free of drop attacks, whereas 5(46%) patients had 75% reduction in drop attacks and 2(18%) had 50% reduction in drop attacks. In those who underwent hemispherectomy 5(50%)patients had complete

seizure freedom and 5(50%)patients had 50% seizure reduction. In those who underwent lesionectomy 26(74%) had complete seizure freedom at 1 year, among which majority (80%) of patients had temporal lesions. One year neuropsychological follow up showed significant improvement in cognition and improved quality of life.

**Conclusions:** Detailed evaluation of medically intractable childhood epilepsies with timely surgical intervention helps to achieve better cognitive development and improved quality of life in pediatric epilepsies.

## Chronic Pain in Multiple Sclerosis: A Longitudinal Study

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**Objectives:** Pain can be a significant problem for a substantial proportion of persons with multiple sclerosis (pwMS). The aim of this study was to examine the course and impact of chronic pain, pain-related disability and carer burden in pwMS over a 10-year period.

**Methods:** A longitudinal, cross-sectional study using structured interviews and validated measures, which include the visual analogue scale (VAS); the numerical rating scale (NRS); chronic pain grade (CPG); the assessment of quality of life (AQoL) and the carer strain index (CSI).

**Results:** Mean age of the participants (n = 70) was 59.8±9 years (range: 39-74 years) and majority (70%) were female. The findings show that over 10 years period, majority of pwMS report bilateral lower limb dysesthesia (40%) followed mixed pain (35.2%) and widespread pain (17.1%). There was a significant deterioration in quality of life in those with more severe CPG, (in all AQoL domains except psychological). Almost half of the participants (44%) required care either from a private carer, institution or from a family member. The carers (n = 13) reported higher carer strain (mean CSI = 5.2), with over half reporting sleep disturbance, inconvenience, physical strains, family and personal constraints. Although fear of taking medications and side effects were common barriers to treatment for pain, there was an increase in the use of pharmacological treatment and healthcare services, mainly neurologists and general practitioners over time.

**Conclusions:** This study demonstrates that persistent chronic pain is a significant issue over time in pwMS, with clinical and health implications, poorer quality of life, and increased healthcare utilisation. Greater awareness of chronic pain in pwMS, cognitive classifications and an interdisciplinary approach is required to improve long-term patient outcomes and well-being.

## Prevalence of Dysphagia in China: An Epidemiology Survery Among 6102 Participants

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**Objectives:** To determine the prevalence of dysphagia across hospitals and communities in different provinces of China.

**Methods:** The survey used three-step approach consisting of questionnaire screening (Sydney or Ohkuma Swallowing Questionnaire) and clinical evaluation (Kubota's Water Swallow Test) and instrumental assessment (VFSS). The subjects consisted of elderly persons 65 years and older living in the communities/nursing home and three phenotypes of the patients (storke, head and neck cancer, neurodegenerative diseases) in the hospitals. We studied 6932 participants whose dysphagia could be assessed by the three-step approach.

**Results:** A total of 6102 persons (males : females=1.2:1) met inclusion criteria. Of all the participants, as many as 2363 (38.7%) were identified as having swallowing abnormalities and showed increased risk of oropharyngeal dysphagia (OD) with age. Dysphagia was found 46.3% in stroke patients of acute phase, 56.9% in stroke patients of chronic phase, 40.8% in Alzheimer's disease(AD), 46.2% in Parkinson's disease (PD), 12.5% in Multiple Sclerosis (MS), 50.0% in Amyotrophic Lateral Sclerosis (ALS), 35.5% in head/neck cancer. The prevalence of OD has also been calculated in older persons across different settings, with rates 26.4% in nursing home and 13.9% in community-dwelling older people. This study demonstrates that dysphagia of male (40.0%) is higher prevalent than female (36.3%) in these populations. Comparing three Chinese economic regions, the average prevalence rate of deglutition disorder in the midland (55.0%) was obviously higher than east coast (37.1%) and western area (32.5%) of China ($\chi^2$ =116.2, P<0.001).

**Conclusions:** The study demonstrates that dysphagia is highly prevalent in China, and should be given more importance and attention and thus be included in all standard screening protocols, treated and regularly monitored to prevent its main complications.

## Profile of Neurological Symptoms and Vitamin B12 Deficiency in a Neurology Clinic in an Urban Setting In India

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**Objectives:** Vitamin B12 deficiency is a systemic disease affecting many organs, including the entire nervous system. We studied neurological profile of patients presenting with vitamin B12 deficiency in the Indian population.

**Methods:** The present study was an observational study done over eight years at a neurology clinic in Mumbai, India. We studied demographics, clinical features, biochemical, imaging and electrophysiological characteristics (wherever applicable) of all patients who presented with neurological complaints and were detected to have low serum vitamin B12 levels. To define severity of neurological impairment especially in patients with subacute combined degeneration of cord (SACD), functional disability scales were used.

**Results:** Out of approximately 5000 patients who presented to the clinic, 261 patients (males-145/females-116) with low vitamin B12 levels were identified. The mean age±SD at presentation in these patients was 39.80

±14.44 years (range: 13 years-80 years). The mean serum vitamin B12 levels were 171.29±98.42 pcg/ml (55-1200 pcg/ml). Majority were vegetarian by dietary habits (87.7%). The presenting symptoms were: headache (41.3%), giddiness/ vertigo (16.8%), tingling and/or numbness in extremities (13%), gait imbalance and disturbances (10.3%), seizures (5%), tremors/ involuntary movements (4.2%), memory disturbances/ sleep disturbances (4.6%), Abnormal behaviour (19.1%) and Bells palsy(1.1%). The various neurological diagnoses noted were: chronic headache (37.9%), positional vertigo (10.3%), neuropathy (9.5%), epilepsy (5%), tremors/ involuntary movements (4.2 %), memory and behavioural disturbances (6.5%), Syncope (6.1%), stroke (4.2%), SACD (4.2%), cervical radiculopathy (3%), Visual disturbances (1.5%) and others (3.8%) (including patients with osteoarthritis, cerebellar ataxia, multiple sclerosis, vertebrobasilar insufficiency, Bells palsy, labyrinthitis).

**Conclusion:** Vitamin B12 deficiency presents with varied neurological manifestations, SACD being a severe manifestation. The association between chronic headache and low B12 levels remains yet unexplored.