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PULSED ELECTROMAGNETIC FIELD FOR EARLY OSTEOARTHRITIS

Osteoarthritis (OA) is a common and growing diagnosis encountered by physicians. Pulsed electromagnetic fields (PEMFs) are known to modulate the calmodulin (CaM) dependent nitric oxide (NO)/cyclic guanosine monophosphate (cGMP) signaling pathway, impacting pain in patients with OA. This study was designed to determine whether PEMF, configured to modulate the CaM/NO/cGMP signaling pathway, can reduce pain among patients with early knee OA.

This double-blind, placebo-controlled, randomized trial included 34 patients with knee OA and an initial visual analogue scale (VAS) pain score of at least four on a 10 cm scale. Those randomized to the treatment group received a PEMF signal, consisting of a 7 ms burst of 6.8 MHz sinusoidal waves, repeating at 1 burst/s, and delivering a peak induced electric field of 34 ± 8 V/m in the knee for 15 minutes twice daily. Those in the control group were treated with sham devices. The patients were asked to self-report maximum daily VAS pain scores at baseline, and then daily for the first 14 days and then from days 29 to 42.

No adverse effects were reported. The treatment group realized a 50% decrease in the mean maximum VAS, starting on day one and persisting to day 42 ($p < 0.001$). The overall decreases in VAS scores from baseline were 2.7 ($p < 0.001$) for the active group and 1.5 ($p = 0.168$) for the sham group. The difference between groups was significant at days three, 14, 29 and 42 ($p = 0.036-0.008$).

Conclusion: This randomized, placebo-controlled trial of patients with early osteoarthritis of the knee found that a pulsed electromagnetic field, applied 15 minutes twice per day, significantly reduced pain.

Nelson, F., et al. Noninvasive Electromagnetic Field Therapy Produces Rapid and Substantial Pain Reduction in Early Knee Osteoarthritis: A Randomized, Double-Blind, Pilot Study. **Rheumatol Intern.** 2013, August; 33(8): 2169-2173.

AYURVEDIC MEDICINE FOR KNEE OSTEOARTHRITIS

The ancient Ayurvedic medicine system is a 5,000-year-old system of natural healing whose origins lie in the Vedic culture of India. Among the target conditions this system is thought to improve is osteoarthritis (OA). This study compared the effect of two anti-arthritis Ayurvedic formulas, SGC (*Zingiber officinale*, *Tinospora cordifolia*, *Phyllanthus emblica*) and SGCG (*Zingiber officinale*, *Tinospora cordifolia*, *Phyllanthus emblica* and *B. serrata*) with two standard Western medications.

Subjects were patients ages 40 to 70 years of age, diagnosed with knee OA. All had pain valued at least four on a 10 cm visual analogue scale (VAS). The subjects were randomized to receive one of four treatments, glucosamine sulfate, 2 g daily, celecoxib, 200 mg daily, SGCG, 400 mg daily or SGC, 400 mg daily. The patients were evaluated at baseline and at two and four weeks, and then monthly until study completion at six months. Outcome measures included VAS pain scores, WOMAC pain scores and function difficulty scores. Laboratory tests included CBC, lipid profile, kidney and liver function tests and urinalysis.

From baseline to study completion at six months, significant improvement was noted in all treatment groups in pain VAS and WOMAC scores, with no significant difference between groups. Seven patients in the Ayurvedic group were withdrawn due to a threefold rise in

the upper limit of normal in one liver enzyme (SGPT).

Conclusion: This study of patients with symptomatic knee osteoarthritis found that the Ayurvedic formulations, SGCG and SGC, are equivalent to glucosamine and celecoxib in reducing pain and improving function.

Chopra, A., et al. Ayurvedic Medicine Offers a Good Alternative to Glucosamine and Celecoxib in the Treatment of Symptomatic Knee Osteoarthritis: A Randomized, Double-Blind, Controlled Equivalence Drug Trial. **Rheum.** 2013, August; 52(8): 1408-1417.

LITHIUM PLUS VALPROATE FOR TRAUMATIC BRAIN INJURY

In animal models, sub-effective doses of both lithium and valproic acid (VPA) have shown considerable neuroprotective effects in central nervous system diseases, including traumatic brain injury (TBI), by inhibiting glycogen synthase kinase-3 (GSK-3) and histone deacetylases (HDACs), respectively. This animal study assessed the efficacy of combining low doses of these two medications for the treatment of TBI.

One hundred twenty-six male mice underwent induced TBI at eight weeks of age. The animals were treated with subeffective doses of lithium, VPA or a combination of lithium and VPA, beginning 15 minutes post-TBI and once daily thereafter for up to three weeks. Lesion volume was measured at three days post-injury. In addition, the animals were tested for blood brain barrier integrity, for function, with a beam walk test, for neuro-degeneration via Fluoro-Jade B staining, and for protein levels of acetylhistone H3, phospho-GSK-3 β , and β -catenin via Western blotting.

Neither the low dose of lithium or of valproic acid resulted in

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significantly reduced lesion volume three days after the TBI. However, when combined, the medications reduced lesion volume from 8.11 mm to 5.97 mm, suggesting a synergistic effect. The combined medications also significantly preserved blood brain barrier integrity ($p < 0.05$), reduced neuronal degeneration ($p < 0.05$), and significantly reduced the number of foot faults on the beam walk test, as compared to high-dose valproic acid ($p < 0.05$ - $p < 0.001$).

Conclusion: This animal study suggests that combining sub-therapeutic doses of lithium and valproic acid can significantly attenuate TBI induced brain lesions, blood brain barrier disruption and neurodegeneration, and can also improve functional recovery.

Yu, F., et al. Post-trauma Cotreatment with Lithium and Valproate: Reduction of Lesion Volume, Attenuation of Blood-Brain Barrier Disruption, and Improvement in Motor Coordination in Mice with Traumatic Brain Injury. *J Neurosurg.* 2013, September; 119: 766-773.

CRANIOPLASTY AND NEUROLOGIC FUNCTION

Over the past decade, there has been a resurgence in the interest in the use of decompressive craniotomy for patients with traumatic brain injury, stroke and subarachnoid hemorrhage. One complication, receiving relatively little attention, is the neurologic dysfunction that can occur due to the absence of the bone flap. This study assessed whether cranioplasty is associated with significant changes in neurocognitive function.

Patients underwent cranioplasty between June of 2010 and February of 2013. All underwent functional and neurocognitive assessments less than three days before and seven days after the procedure. Assessments included measures of activities of daily living, Functional Independence Measurements (FIM) and the Cognitive Assessment Report (Cognistat).

Of the 27 patients who underwent cranioplasty, 25 were recruited to the study. The median time between craniectomy and cranioplasty was 100 days. After surgery, 16% improved significantly (at least two points) in FIM scores. Three patients

significantly deteriorated following cranioplasty. Four demonstrated improvements in Cognistat scores, ranging from 9.7% to 37%. Three patients showed deterioration in these scores. After excluding three patients who had immediate medical or surgical complications after surgery, a mild, overall improvement was seen in mean FIM scores ($p = 0.049$).

Conclusion: This study of patients undergoing cranioplasty found that a small, but significant, number appear to improve clinically following surgery.

Honeybul, S., et al. The Impact of Cranioplasty on Neurological Function. *Br J Neurosurg* 2013, October; 27(5): 636-641.

COGNITIVE SUPPORT TECHNOLOGIES FOR TRAMATIC BRAIN INJURY

Recent data have suggested that 3.17 million individuals are living with long-term disability as a result of a traumatic brain injury (TBI). Even mild TBI is associated with long-term cognitive deficits, resulting in challenges for the individual and the family. Cognitive support technologies (CSTs) are devices and services intended to reduce the impact of disability for individuals with functional deficits and impaired cognition. This study explored the current use of off-the-shelf CSTs by individuals with TBI.

Subjects were individuals ages 21 to 65 years, recruited from a TBI model system project. The participants and their caregivers were queried concerning types of support needed to perform everyday tasks, and were asked to evaluate the efficacy of those technologies.

The most commonly encountered difficulties noted by the patients were with learning, memory, organization and time management. Participants used a wide range of strategies for cognitive support. Most declared a strong need for independence and wanted to use technology as much as possible. Cell phones were considered to be the most important technology by the majority of the patients. Other technologies used included computers and multiple versus single prompts. Critical considerations for use of these tools included the availability of training in

using features of the device and the cost of purchasing the device.

Conclusion: This study of patients with traumatic brain injury found that cognitive support devices are often used by those patients, with the most common being a cell phone.

Chu, Yee., et al. Cognitive Support Technologies for People with TBI: Current Usage and Challenges Experienced. **Disability Rehab Assistive Tech.** 2013, August; 6: 1-7.

TRANSCRANIAL DIRECT CURRENT STIMULATION AND LANGUAGE

Neuromodulation techniques, including transcranial direct current stimulation (tDCS), have provided clues concerning the neural circuits underlying normal language, and have helped to explain the pathophysiology of aphasia and its recovery. This review was designed to understand the cumulative data concerning tDCS for the modulation of language, in both healthy individuals and in patients with aphasia.

Data were reviewed from published manuscripts in PUBMED between March of 2005 and January of 2012. From those, 64 papers were identified, including 10 reviewing aphasic patients, 10 reviewing healthy subjects and one combining both aphasic and healthy subjects.

Despite the heterogeneity of the studies, the review demonstrated that tDCS can improve language performance in healthy subjects as well as in patients with aphasia. Among those with aphasia, improvements of approximately 25-30% in speech performance were noted.

Conclusion: This literature review found that transcranial direct current stimulation over language-related brain areas can modulate linguistic abilities in healthy individuals, and can also improve language performance in patients with aphasia.

Monti, A., et al. Transcranial Direct Current Stimulation (tDCS) and Language. **J Neurol Neurosurg Psychiatry.** 2013, August; 84: 832-842.

DRIVING AFTER TRAUMATIC BRAIN INJURY

Traumatic brain injury (TBI) and stroke are common causes of cognitive impairment in adults. As safe driving requires cognitive abilities that may be reduced after stroke or TBI, clinicians must often assess the ability of their patients to safely drive after such an injury. This study examined the neuropsychological testing used in return to drive assessments, and sought to develop standardized cutoff values for the likelihood of driving success.

This retrospective study examined patients six to 20 months post-injury, all of whom had sustained a TBI or stroke. All underwent medical examination, neuropsychological testing and a comprehensive on road assessment. A forward, stepwise, logistic regression analysis was used to test the predictive power of demographic, diagnostic and neuropsychological variables on on-road test results.

Forty-three patients passed and 35 failed the on-road driving task. CalCap Simple Reaction Time, Trail Making A and Grooved Pegboard results accounted for 46% of the variance in the on-road results. An ROC analysis suggested that the optimal cutoff for simple reaction time was 395 ms, with 77% of those who passed the on-road test correctly identified by that measure. For Trail Making A, the optimal cutoff was 46 seconds, with a sensitivity of 0.85 and a specificity of 0.28. For the Grooved Pegboard, the best cutoff was 97.5 seconds, with a specificity of 0.29 and a sensitivity of 0.82.

Conclusion: This study of patients with a recent stroke or traumatic brain injury found that three neuropsychological tests statistically differentiated subjects who passed from those who failed the on-road test.

Aslaksen, P., et al. Prediction of on Road Driving Ability after Traumatic Brain Injury and Stroke. **Europ J Neurol.** 2013, September; 20(9): 1227-1233.

DRY NEEDLING FOR MYOFASCIAL PAIN

Myofascial pain syndrome (MPS) is a common condition associated

with myofascial trigger points in patients presenting to primary care or pain clinics. Dry needling has been used to address these trigger points, although the mechanism of action is not well understood. This study was designed to better understand the efficacy of this treatment modality.

This meta-analysis included randomized, controlled trials, identified from several medical data bases. Included were trials involving dry needling intervention for myofascial pain syndrome involving the upper quarter. Twelve studies met the inclusion criteria and were scored for quality by three separate reviewers.

A meta-analysis was performed for four different domains. Three studies, comparing the effects on pain of dry needling to sham or control at four weeks, found a large effect favoring dry needling. However, the difference was not statistically significant in two of the three studies. In studies comparing dry needling to other treatments at three weeks, treatments other than dry needling were slightly, although not significantly, better for pain relief. Studies involving an injection with lidocaine found superior outcomes as compared to those with dry needling.

Conclusion: This study of patients with myofascial pain found that dry needling may be effective in reducing pain for up to four weeks after treatment.

Kietrys, D., et al. Effectiveness of Dry Needling for Upper-Quarter Myofascial Pain: A Systematic Review and Meta-Analysis. **J Ortho Sports Phys Ther.** 2013, September; 43(9); 620-634.

OCCUPATIONAL THERAPY VERSUS HOME-BASED EXERCISES FOR ROTATOR CUFF TEARS

Rotator cuff tears are a very common cause of chronic shoulder pain, particularly among middle-aged to older individuals. Rotator cuff tears are often initially treated with conservative management, with a large variation among protocols. This study investigated whether patients treated by occupational therapists differ in outcome from those treated with home-based therapy.

Patients, 18-75 years of age, with unilateral, symptomatic, atraumatic

rotator cuff tears were recruited for nonoperative treatment. The participants were randomized to perform home-based exercises or treatment by occupational therapy (OT). The OT group underwent supervised exercises three times per week for eight weeks. Patients in the home-based received an exercise guide booklet with detailed instructions and were taught how to perform the exercises correctly. Before therapy and two months after treatment initiation, the subjects were assessed with the Constant-Murley Score, isokinetic strength testing and for health-related quality-of-life.

Of the patients recruited, two thirds improved on clinical shoulder tests, with no significant difference between the two groups. The groups also did not differ significantly on measurements of pain, range of motion, maximum peak force in abduction or external rotation, Constant-Murley Scores or health-related quality-of-life. On self-assessment scores of quality-of-life, better scores were seen in the home-based group than in the OT group.

Conclusion: This pilot study of patients with rotator cuff tears found that home-based therapies provide outcomes equal to those realized by treatment by occupational therapists.

Krischak, G., et al. A Prospective, Randomized, Controlled Trial Comparing Occupational Therapy with Home-Based Exercises in Conservative Treatment of Rotator Cuff Tears. *J Shoulder Elbow Surg.* 2013, September; 22(9): 1173–1170.

PREHABILITATION FOR ANTERIOR CRUCIATE LIGAMENT REPAIRS

Preoperative quadricep strength is known to be a significant predictor of knee function following repair of the anterior cruciate ligament (ACL). This study evaluated the effects of a six-week, preoperative strengthening program for patients scheduled for ACL repair.

Patients awaiting ACL repair were randomly assigned to a control or an exercise group. The exercise group performed exercises four times per week, two in the gym and two at home, with weights increased weekly by 10 to 15%. Home exercises included the same exercises using a theraband instead of weights.

Proprioceptive training was completed using a wobble cushion. Subjects were assessed using a single leg hop test for quadriceps and hamstrings peak torque, and by magnetic resonance imaging of a muscle cross-sectional area. The Modified Cincinnati Knee Rating System and muscle biopsy of the vastus lateralis were completed at baseline, before surgery and 12 weeks post-surgery.

Compared with the control group, the exercise group showed significantly better performance on the single leg hop test at 12 weeks. Self-assessment reports on the Modified Cincinnati Knee Rating System were also higher preoperatively and at 12 weeks postoperatively for the exercise group ($p=0.001$ and $p=0.001$, respectively). The mean times to return to sport were 42.5 weeks for the control group and 34.18 weeks for the exercise group.

Conclusion: This study of patients undergoing anterior cruciate ligament repair demonstrated that a six-week, progressive rehabilitation program before surgery resulted in better strength and performance, and reduced time to return to sport.

Shaarani, S., et al. Effect of Rehabilitation on the Outcome of Anterior Cruciate Ligament Reconstruction. *Am J Sports Med.* 2013, September; 41(9): 2117–2128.

ROTATOR CUFF DISEASE EXAMINATION

Rotator cuff disease (RCD) consists of tendinopathy of at least one of the four muscles that form the rotator cuff, tears of these tendons or bursitis of the subacromial bursa. This meta-analysis was designed to determine the most accurate clinical examination for identifying RCD.

A literature search was completed for relevant studies in MEDLINE, EMBASE, and CINAHL, through May of 2013. Inclusion criteria were a description of history taking, physical examination or clinical tests concerning RCD, a determination of sensitivity and specificity and a reference standard with diagnostic criteria prespecified.

The search identified 28 studies which included the examination by a specialist, among which five were thought to be of sufficient quality for

inclusion in the data analysis. Positive findings on the internal and external rotation lag tests, and the presence of a painful arc, had the highest positive likelihood ratio for RCD and rotator cuff tears. A normal internal rotation lag test finding was the most accurate for identifying patients without a full thickness tear.

Conclusion: This meta-analysis found that a positive painful arc test and a positive external rotation resistance test are the most accurate in identifying rotator cuff disease, and that the positive lag test (internal or external) is most accurate in diagnosing a full thickness rotator cuff tear.

Hermans, J., et al. Does this Patient with Shoulder Pain Have Rotator Cuff Disease?: A Rational, Clinical Examination Systematic Review. *JAMA.* 2013, August 28; 310(8): 837–847.

BRACING FOR SCOLIOSIS IN ADOLESCENTS

Scoliosis develops in approximately 3% of children younger than 16 years of age, though only 0.3–0.5% have progressive curves requiring treatment. Studies examining the effects of bracing in adolescent idiopathic scoliosis have produced inconsistent results. This study, the Bracing and Adolescent Idiopathic Scoliosis Trial (BRAIST) was designed to further assess the effectiveness of bracing for the prevention of the progression of scoliosis.

This multicenter study included 25 institutions across United States and Canada, with enrollment beginning in March of 2007. Using a combined randomized cohort and a preference cohort, high-risk adolescent idiopathic scoliosis patients aged 10 to 15 years of age were included. Patients were randomized either to a control group, or to a treatment group to wear a brace 18 hours per day. Both groups were assessed by radiographic, clinical, orthotic and self-report data at six-month intervals. The primary outcome measure was either, when curve progression reached 50° or more (treatment failure) or skeletal maturity without this degree of curve progression (treatment success). The secondary outcome was the score on the Pediatric Quality Of Life inventory.

A total of 242 patients were included in the primary analysis. The rate of success was 72% in the bracing group, and 48% in the control group. A significant positive association was found between hours of brace wear and the rate of treatment success. Given these outcomes, the data and safety monitoring board recommended termination of the trial.

Conclusion: This multicenter randomized and preference control study found that bracing of adolescents with idiopathic scoliosis could significantly decrease the progression of high risk curves, reducing the risk of reaching a surgical threshold.

Weinstein, S et al. Effects of Bracing and Adolescents with Idiopathic Scoliosis. *N Eng J Med* 2013. DOI: 10.1056/10 NEJMoA 130-7337.

HETEROTOPIC OSSIFICATION AFTER DISCONTINUATION OF INDOMETHACIN

Heterotopic ossification (HO) is a known complication after surgical treatment of acetabular fracture. Its reported incidence ranges from 18% to 90%, depending upon the surgical approach. Previous studies have questioned the efficacy of indomethacin for reducing HO rates after acetabular surgery. This study was designed to determine the change in incidence of HO at the study institution after routine use of post-surgical indomethacin was abandoned.

This retrospective chart review included 423 consecutive patients treated for acetabular fractures at a level one trauma center. Between January of 2006 and December of 2011, 202 patients were treated with the same surgical approach. All had at least one postoperative radiograph and follow-up clinic visit at 10 to 20 weeks. These data were compared with those of a historical control during a time when indomethacin was used for prophylaxis.

The combined incidence for Brooker Class III and IV HO was 21% during the study period, as compared with 15% in the historic control period ($p=0.36$). The overall incidence of radiographic HO was 46%, with 26% having mild, 13% having moderate and 8% having severe HO.

Conclusion: This study of patients undergoing acetabular fracture repair found no significant increase in the incidence of heterotopic ossification after the discontinuation of routine prophylaxis with indomethacin.

Griffin, S., et al. Heterotopic Ossification Rates after Acetabular Fracture Surgery Are Unchanged without Indomethacin Prophylaxis. *Clin Ortho Rel Research*. 2013, September; 471(9): 2776-2782.

CHARACTERIZATION OF CLINICAL FASCICULATIONS

Fasciculations are very common in the healthy population, and may be part of a benign fasciculation syndrome (BFS). This disorder is characterized by symptomatic fasciculations without progression. Despite their clinical training, medical practitioners often express concern over the sensation of fasciculations, fearing the possibility of ALS. This study was designed to better characterize fasciculation anxiety syndrome in medical practitioners.

Subjects were 20, consecutive medical practitioners presenting to a neurology clinic for assessment of fasciculations. These individuals underwent clinical assessment, including motor and sensory peripheral nerve conduction and proximal F wave conduction, as well as four extremity EMG of affected and unaffected muscles. Serum samples were tested for anti-voltage-gated potassium channel (VGKC) antibodies, creatine kinase (CK) and antinuclear antibodies (ANA).

Of the 20 clinicians, 14 had isolated fasciculations, most often exacerbated by stress, caffeine, fatigue and exercise. The remaining six had additional symptoms consistent with a diagnosis of cramp-fasciculation syndrome (3/6) sensorimotor neuropathy of axonal type (1/6), demyelinating sensory neuropathy associated with monoclonal gammopathy (1/6) and ALS (1/6).

Abnormal laboratory findings were not identified, and motor and sensory nerve conduction study results were within normal limits in all clinicians presenting with isolated fasciculations. All 14 clinicians with isolated fasciculations demonstrated anxiety about ALS. At a mean follow-

up of 7.9 years since symptom onset, none of those with isolated fasciculations developed muscle weakness. All however reported continued, although less frequent, fasciculations.

Conclusion: This study of medical practitioners who presented with fasciculations found that the majority were male, with isolated fasciculations, and anxiety concerning the possibility of a diagnosis of ALS. None with isolated fasciculations progressed to other disorders.

Simon, N., et al. Fasciculation Anxiety Syndrome in Clinicians. *J Neurol*. 2013, July; 260(7): 1743-1747.

COGNITIVELY NORMAL PERSONS WITH BETA AMYLOIDOSIS

Studies using imaging and cerebral spinal fluid biomarkers to assess the pathogenesis of Alzheimer's disease (AD) have focused on the accumulation of beta amyloid and the appearance of markers of neuronal death and synaptic dysfunction. This study was designed to determine whether excess β -amyloid accumulation induces an acceleration in brain injury in the period of transition from cognitive normality to impairment.

This longitudinal cohort study included 191 cognitively normal, elderly individuals from the Mayo Clinic Study of Aging. These individuals were compared to 17 individuals with mild cognitive impairment and nine with AD. All underwent serial brain imaging every 15 months from 2006 to the present, with scans including magnetic resonance, fludeoxyglucose F 18 (FDG) positron emission tomography (PET) and Pittsburgh Compound B (PiB) PET. The clinically normal individuals were divided into four groups based upon the initial assessment including all biomarkers normal (stage 0), abnormal brain β -amyloidosis only (preclinAD stage 1), abnormal brain β -amyloidosis and brain injury without regard to cognitive test scores (preclinAD stage 2+3), and normal brain β -amyloidosis with brain injury without regard to cognitive test scores (suspected non-AD pathophysiology (sNAP) group).

The rate of hippocampal volume loss was significantly greater among

those in the preclinAD stage 2+3 group than in the other three groups ($p<0.05$) and similar to that of the MCI group. The medial temporal region showed results similar to those of the hippocampus, with the greatest rate of volume loss in the preclinAD stages 2+3 compared with stage 0 ($P=0.004$), stage 1 ($P=0.02$), and sNAP ($P=0.03$).

Conclusion: This study of cognitively normal individuals found that, over time, those with abnormal levels of beta amyloid and brain injury biomarkers had higher rates of hippocampal volume loss and medial temporal neurodegeneration.

Knopman, D., et al. Selective Worsening of Brain Injury Biomarker Abnormalities in Cognitively Normal Elderly Persons with Beta Amyloidosis. *JAMA Neurol.* 2013, August; 70(8): 1030-1038.

LOW-FREQUENCY SUBTHALAMIC NUCLEUS DEEP BRAIN STIMULATION FOR PARKINSON'S DISEASE.

High-frequency, subthalamic nucleus deep brain stimulation (STN-DBS) is a well-established treatment for appendicular symptoms in advanced Parkinson's disease (PD). The effect of this treatment on axial symptoms, such as freezing gait, remains controversial. This study compared low-frequency stimulation (LFS) with high-frequency stimulation (HFS) in patients with PD, bilateral STN-DBS, and with axial symptoms.

Patients with idiopathic PD and with bilateral STN-DBS were included in this study. The participants were switched to low-frequency stimulation (≤ 80 Hz) when all previous adjustments using HFS had failed to improve or stabilize their axial symptoms. The primary outcome measures were total motor Unified Parkinson's Disease Rating Scale (UPDRS) scores, total axial subscores and the gait subscores. Secondary outcome measures included speech subscores and self-reported number of falls.

Of the 45 patients, 39 were switched to 80 Hz and six were switched to 60 Hz stimulation. All were followed for a median of 111.5 days. The average motor UPDRS score for HFS was 28.2, while that with LFS was 31.9. The average axial subscores with HFS was 7.4, while that with LFS was 7.6. The average gait subscore with HFS was 1.5, and

that for LFS was 1.7. Finally, the average speech subscores were 2.2 with HFS and 2.1 with LFS. None of those differences were statistically significant.

Conclusion: This study of patients with Parkinson's disease found no significant difference in axial symptom response between those treated with low-frequency and those treated with high-frequency subthalamic nucleus deep brain stimulation.

Sidiropoulos, C., et al. Low-Frequency Subthalamic Nucleus Deep Brain Stimulation for Axial Symptoms in Advanced Parkinson's Disease. *J Neurol.* 2013, September; 260: 2306-2311.

THROMBOLYSIS IN YOUNG STROKE PATIENTS

The use of tissue plasminogen activator (tPA) has been shown to reduce long-term disability in patients in selected groups who present with acute ischemic stroke. As hospitalizations for acute ischemic strokes are increasing among adults ages 19 to 44 years, this study evaluated the effectiveness of tPA for patients in this age group.

This retrospective analysis included data from the nationwide inpatient sample, a discharge database representing 20% of all United States hospitalizations. Cases were identified using the ICD-9 discharge diagnosis codes for ischemic stroke and the intravenous thrombolysis procedure code. Data were analyzed to review trends over time.

Between 2001 and 2009, the percentage of hospitalizations for acute ischemic stroke in young adults increased from 3.33% to 4.53% ($p<0.001$). Use of thrombolysis increased in this age group from 1.84% of patients in 2001 to 4.97% in 2009. The in-hospital death rate decreased from 6.81% in 2001 to 5.43% in 2009 (trend $p=0.0027$). While the rate of discharge to home did not change, discharge to inpatient rehabilitation increased from 3.42% of all discharges in 2002, to 12.7% in 2009. Discharges to long-term care facilities during the same time decreased from 29.16% in 2001 to 17.8% in 2009.

Conclusion: This study found that, between 2001 and 2009, the use of thrombolysis in young patients with ischemic stroke increased by over

250%. This increase was associated with trends of decreasing mortality and discharges to long-term care facilities.

Kansara, A., et al. Thrombolysis and Outcome of Young Stroke Patients over the Last Decade: Insights from the Nationwide Inpatient Sample. *J Stroke Cerebrovasc Dis.* 2013, August; 22(6): 799-804.

TREATING SLEEP DISORDERS AND FATIGUE IN MULTIPLE SCLEROSIS

Fatigue is the most frequent symptom among patients with multiple sclerosis (MS). Despite its high prevalence, the exact pathogenesis remains unknown, with treatment options sparse. This study was designed to determine whether stringent treatment of sleep disorders (SLD) can improve fatigue in patients with MS.

A total of 66 patients with MS were identified, 49 with SLD and 17 without. The SLD included restless legs syndrome (RLS), periodic limb movement disorder or leg pain, insomnia or inadequate sleep hygiene, and sleep related breathing disorders. Of the patients with sleep disorders, all received treatment recommendations from a sleep specialist. The patients were divided into categories rating their compliance with the prescribed sleep medicine treatment. The main outcome measures were the Modified Fatigue Impact Scale (MFIS), Epworth Sleepiness Scale (ESS), Fatigue Severity Scale (FSS), Pittsburgh Sleep Quality Index (PSQI) and revised Beck Depression Inventory (BDI-IA).

A univariate analysis revealed that MFIS scores improved by 15 points in the good compliance subgroup ($p=0.025$), by 10 points in the moderate compliance group and by six points in the no compliance group. The FSS scores did not significantly improve in any of the subgroups.

Conclusion: This study of patients with multiple sclerosis found that treatment of sleep disorders may reduce fatigue. Fatigue scores improved most among those who strictly adhered to treatment recommendations.

Veauthier, C., et al. Treatment of Sleep Disorders May Improve Fatigue in Multiple Sclerosis. *Clin Neurol*

VIRTUAL REALITY FOR UPPER EXTREMITY REHABILITATION AFTER STROKE

The upper limb remains poorly functional in performing activities of daily living in up to 66% of all stroke patients, representing the most disabling of all residual impairments. This study further evaluated the effectiveness of virtual reality-based treatment for the improvement of upper motor limb function in patients with stroke.

This study included patients with hemiparesis after a first-ever stroke in the region of the middle cerebral artery. Most had received previous rehabilitation interventions in the acute/subacute post-stroke period, according to the related guidelines of the Italian National Health System. Intervention comprised 40 sessions of reinforced feedback in the virtual environment (RFVE) five days per week for 4 weeks. In the RFVE group, daily treatment comprised one hour of Upper Limb Conventional (ULC) therapy and one hour of RFVE therapy, while the ULC only group underwent two hours of conventional treatment. The primary outcome measures included the Fugl-Meyer Upper Extremity (FM-UE) measure and the Functional Independence Measure scales (FIM).

At the end of treatment, an increase was noted in the FIM scores by four percent ($p < 0.001$) in the ULC group, and ten percent in the RFVE ($p < 0.001$). A subgroup analysis revealed that patients with severe, moderate and mild impairments showed improvements on the FM-UE of five percent, five percent and three percent, respectively, after ULC therapy, with gains of 11%, 14% and eight percent, respectively, after RFVE therapy. All improvements were significantly higher in the RFVE group ($p < 0.001$).

Conclusion: This study of patients with motor impairment after stroke found that virtual reality provided significantly greater improvements in Fugl-Myer and Functional Independence Measure tests of the upper extremity than did conventional therapy.

Turolla, A., et al. Virtual Reality for the Rehabilitation of the Upper Limb Motor Function after Stroke: A Prospective, Controlled Trial. **J**

HEALTH-RELATED QUALITY-OF- LIFE AFTER FALLS IN THE ELDERLY

In the elderly, falls and their physical consequences have been well researched. While the majority of falls result in no severe physical injury, the psychological and functional consequences can be severe. This prospective study examined the long-term relationship between falls and health-related quality-of-life and life satisfaction over six years after the fall.

This prospective study included data from the Swedish epidemiological population study, "Good Aging in Scane", including 2,931 subjects, ages 60 to 93 years at baseline. A total of 1,709 subjects participated in a six-year follow-up assessment. Of these, 1,321 had a recorded fall history and complete data the Health-Related Quality-of-Life (HRQoL) and Life Satisfaction (LS) scales. The incidence of falling was based upon results of oral questioning at baseline and follow-up, using a structured questionnaire.

Walking speed was determined by recording the maximum walking speed over 15 meters. Comorbid conditions were recorded at baseline, and included cognitive impairment, as measured by the Mini Mental State Examination. HRQoL was evaluated using the SF-12, Short Form Health Survey including both the physical and mental component summary (PCS, MCS), and life satisfaction with the Life Satisfaction Index A (LSI-A).

Almost one in ten reported one or more falls at baseline (8.6%). Compared to non-fallers, fallers scored significantly lower on the SF-12 PCS and MCS as well as the LSI-A than did non-fallers ($p < 0.001$ - $p = 0.004$). One or more falls at baseline predicted a significant reduction in the SF-12 PCS score at follow-up.

Conclusion: This prospective study found that elderly individuals who fall have a greater, chronic decrease in health-related quality of life and life satisfaction as compared with those who do not fall.

Stenhagen, M., et al. Accidental Falls, Health-Related Altered Quality of Life and Life Satisfaction: A Prospective Study of the General Elderly Population. **Arch Geront Geriatr.**

ELECTRICAL STIMULATION FOR WOUND HEALING

A number of studies have suggested that electrical stimulation may be an effective adjunctive therapy for wound healing. This study examined the results of randomized, clinical trials using electrical stimulation to accelerate the healing of wounds.

A literature search was completed using MEDLINE, identifying 21, randomized, controlled trials which used electrical stimulation to treat wounds. From those, five were excluded, as they included an insufficient number of subjects.

The protocols in these studies ranged in application from 20 minutes twice per day for 12 weeks to eight hours nightly for 12 weeks. Of these trials, 14 demonstrated significantly greater improvement in wound healing with electrical stimulation, as compared with sham treatment. The remaining two studies were inconclusive.

Conclusion: This review of randomized, controlled trials found that electrical stimulation is associated with either faster wound area reduction or a higher proportion of wounds that heal.

Thakral, G., et al. Electrical Stimulation to Accelerate Wound Healing. **Diabetic Foot and Ankle.** 2013; 4: 22081 [http://
dx.doi.org/10.3402/dfa.v4i0.22081](http://dx.doi.org/10.3402/dfa.v4i0.22081)

TIMING OF THERAPY AFTER SEVERE TRAUMATIC BRAIN INJURY

After a traumatic brain injury (TBI), patients often require long-term care and support services. This study examined the effect of early rehabilitation for patients who survive a severe TBI.

This retrospective study included patients with a TBI and a Glasgow Coma Scale score of eight or less, all of whom received a minimum of four months of multidisciplinary rehabilitation at the Center for Brain Injury Rehabilitation in Seville, Spain. From these patients, two groups were identified, based upon the time elapsed from brain injury to onset of rehabilitation. The early treatment group included those who began

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*Thiru Annaswamy, M.D.
Trixy Syu, D.O.
UTSW Medical Center, Dallas TX

*Rachel Hallmark, M.D., Ph.D.
Rebecca Louie, D.O.
UVA, Charlottesville, VA

*Ryan Solinsky, M.D.
Jennifer Soo Hoo, M.D.
University of Washington, Seattle, WA

*Bonnie Weigert, M.D.
Sara Liegel, M.D.
Sunlung Y. Suen, M.D., Ph.D.
University of Wisconsin, Madison, WI

*William Robbins, M.D.
Wiam Ahmed, M.D.
Greg Condie, M.D.
Dave Powell, M.D.
Jeff Zeckser, M.D.
VCU, Richmond, VA

*Adam J. Schulte, M.D.
Jawad Bajwa, M.D.
Joey Malbrough, M.D.
Sri Patchala, M.D.
Washington University, St. Louis, MO

Executive Editor Emeritus
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rehabilitation within the first nine months after trauma, with the late group beginning later. Patients were assessed with the Functional Independence Measure (FIM) and the Functional Assessment Measure (FAM).

Each group comprised 29 subjects, with both groups demonstrating significant functional gains on most subscales tested. The percent functional gain was greater in the early group than in the late group, in total FIM + FAM ($p=0.002$), and in subscores, including self-care (0.005), type of transfer (0.012), locomotion (0.002), psychosocial adjustment ($p=0.012$) and cognitive function ($p=0.01$).

Conclusion: This study of patients with severe traumatic brain injury found that those treated within nine months of injury had better responses to treatment than did those treated beyond nine months after injury.

Leon-Carrion, J., et al. The Sooner Patients Begin Their Neurorehabilitation, the Better Their Functional Outcome. *Brain Inj.* 2013; 27(10): 1119–1123.

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