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IN REVIEW

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AEROBIC VERSUS RESISTANCE EXERCISES IN DIETING ELDERLY ADULTS

In designing weight loss programs for the elderly, some have expressed concern that weight loss could worsen frailty by accelerating sarcopenia and osteopenia. This study was designed to determine whether aerobic and/or resistance exercises, combined with weight loss, would result in better outcomes in physical performance and the preservation of muscle and bone.

This randomized, controlled trial included 141 adults, 65 years of age or older, with a body mass index (BMI) of 30 kg/m2 or greater, who were sedentary, and had mild to moderate frailty. The subjects were randomized to one of four groups, including a control group with neither weight management nor exercise intervention. The other groups received a diet with an energy deficit of 500 to 750 cal per day, plus either

60 minutes of aerobic or resistance exercise or 75 to 90 minutes of aerobic plus resistance exercise, three times per week. Frailty was assessed with the Physical Performance Test (PPT), with measurements of body composition, bone mineral density and quality of life, with assessments repeated at six months.

Scores on the PPT improved by 21% in the combination group, by 14% in the other two exercise groups ($p=0.01$ and $p=0.02$), and by four percent in the control group ($p<0.001$ for all comparisons). Body weight decreased by nine percent in all three exercises groups. Lean mass decreased by three percent in the combination group, two percent in the resistance group and five percent in the aerobic group. Bone mineral density at the total hip decreased insignificantly (<one percent) in the resistance group, 2.6% in the aerobic group and 1.1% in the combined group. Peak oxygen consumption increased more in the combination (17%) and aerobic groups (19%) than in the resistance (8%) group ($p<0.001$).

Conclusion: This study of elderly adults found that weight loss plus resistance training combined with aerobic training results in greater improvement in physical function and reduction of frailty than does either exercise regimen alone.

Villareal, D., et al. Aerobic or Resistance Exercises, or Both, in Dieting, Obese, Older Adults. N Engl J Med. 2017, May 18; 376 (20):1943-1955.

BEDSIDE ULTRASOUND TO DIAGNOSE NEUROGENIC HETEROTOPIC OSSIFICATION

Neurogenic heterotopic ossification (NHO) is associated with stroke, traumatic brain injury, spinal cord injury, encephalitis and burns. This study investigated the role of ultrasound (US) for the evaluation of patients with suspected NHO.

Subjects were 310 consecutive patients treated in the ICU for acquired brain injury. Each day, the major joints were evaluated by a physical therapist for a decrease in range of motion. Those with decreased ROM were assessed daily thereafter, by US. An x-ray was used to confirm any US identified NHO.

Of the 310 patients identified with a decreased range of motion, US evidence of NHO was identified in 21, all of whom demonstrated the latter stage zone phenomenon, 42.8% that demonstrated distorted muscle architecture and 81% that demonstrated hyperemia. Comparing the x-ray findings and the US findings, x-ray evidence of NHO was found to be delayed by 2 weeks as compared with the US findings. The hip was the most common joint identified, in 66.6%, followed by the knee and the elbow. Of those surviving for 12 months, 12 of the 21 had a resolution by x-ray, US and clinical examination.

Conclusion: This pilot study demonstrates that ultrasound may be used to detect heterotopic ossification two weeks earlier than can conventional x-ray.

Stefanidis, K., et al. Bedside Ultrasound to Facilitate Early Diagnosis and Ease of Follow-Up in Neurogenic Heterotopic Ossification: A Pilot Study from the Intensive Care Unit. J Head Trauma Rehabil. 2017. DOI:10.1097/HTR.0000000000000293.

BETA ALANINE AND JUDO PERFORMANCE

As muscle acidosis is considered a major cause of fatigue during high intensity, intermittent exercise, nutritional strategies aimed at attenuating muscle acidosis have been a focus of intervention. This study reviewed the effect of amino acid beta-alanine, which participates in the synthesis of carnosine, which acts as a hydrogen buffer within the muscle pH transit range.

Twenty-three, well-trained, male judo competitors were randomized to receive either beta alanine at two, 800 mg tablets, four times per day, or a placebo, for four weeks. Performance of the competitors was assessed before (PRE) and after (POST) supplementation, beginning with a five minute sparring match, followed by three successive tests of the number of throws performed in the Special Judo Fitness Test (SJFT). Blood samples were collected, immediately after warm-up, after the sparring match, and after the SFJT.

Athletes in the supplement group had a greater number of throws per SJFT test, as well as total number of throws throughout the three SJFTs ($p<0.05$). Blood pH and HCO3 were reduced after exercise, with no

between group differences. Post-hoc analysis revealed a within-group effect for BA with every SJFT ($p<0.001$). In contrast, the number of throws per set in the placebo group did not change from PRE to POST in any of the SJFT measurements (all $p>0.05$).

Conclusion: This study found that four-week supplementation with beta alanine can improve judo related performance in well-trained judo athletes.

De Andrade Kratz, C., et al. Beta-Alanine Supplementation Enhances Judo-Related Performance in Highly Trained Athletes. J Sci Med Sport. 2017, April; 20(4): 403-408.

CERVICAL SPINE SURGERY COMPLICATIONS IN THE ELDERLY

The frequency of surgical spinal procedures in the United States continues to grow, particularly for the elderly. This study was designed to better understand the incidence of complications and associated risk factors of cervical spine surgery in an elderly cohort.

Using a five percent random sample of Medicare physician/carrier claims data from 2010 to 2012, patients undergoing cervical decompression and posterior cervical fusion were identified. The 90-day, postoperative rate of newly diagnosed adverse events was assessed. A multivariate Cox regression was used to evaluate risk factors for complications, adjusted for age, socioeconomic status, Charleston comorbidity index, race, census region, gender and year of surgery.

A total of 1,519 patients underwent cervical decompression (CD) and 1,273 underwent cervical fusion (CF).Respiratory complications occurred in 12.1% of CD, and 14.6% of CF patients. Other complications of CD and CF were urinary retention in 8.2% and 9.1%, respectively, acute delirium in 5.3% and 6.0%, respectively and postoperative nausea and vomiting occurred in 2.8% and 3.1%, respectively. Older patients and those with a history of smoking had higher risks of respiratory complications. Patients with dementia were at a higher risk of acute delirium after both CD and CF ($p<0.001$ for both comparisons).

Conclusion: This study, using a nationally representative cohort of elderly patients undergoing cervical decompression and posterior cervical fusion, demonstrated that respiratory complications, urinary retention, postoperative nausea and vomiting, as well as acute delirium, were the most common postoperative complications.

Radcliff, K., et al. Cervical Spine Surgery Complications and Risks in the Elderly. Spine. 2017, March 15; 42(6): E347-E354.

EFFECT OF DAYTIME SLEEPINESS ON BALANCE AND MOBILITY IN THE ELDERLY

Diminished ability to maintain balance is associated with a fear of falling and an increased risk of falling. As balance is sensitive to sleep deprivation, the prevalence of sleep deprivation with aging may worsen this risk. This study reviewed the association between self-reported, daytime sleepiness and balance among community dwelling, elderly adults.

Subjects were cognitively intact, community dwelling adults, 65 years of age or older, and able to walk household distances. Patient sleepiness was assessed using the Epworth Sleepiness Scale (ESS). A score of nine or more was used to indicate daytime sleepiness. Subjects were assessed for gait speed and gait characteristics, and for balance, with self-reported measures of balance and mobility also applied.

Participants were 116 adults with a mean age of 78 years, among whom 45% reported daytime sleepiness. Those with daytime sleepiness had a significantly higher body mass index, and more comorbid illnesses. Among those not reporting daytime sleepiness, 30% reported having fallen in the previous year, compared to 40% of those with daytime sleepiness ($p=0.06$). Those with daytime sleepiness had a slower gait speed, a wider step width and lower Activities Specific Balance Confidence Scale scores.

Conclusion: This study of community dwelling, elderly individuals found that 45% reported daytime sleepiness, with gait speed and self-reported balance confidence lower among those with daytime sleepiness than among those without.

Tyagi, S., et al. Mobility in Community -Dwelling Older Adults: Effect of Daytime Sleepiness. J Am Ger Soc. 2017, May; 65(5): 1019-1025.

EFFECTS OF IBUPROFEN AND RESISTANCE TRAINING ON BONE AND MUSCLE

Chronic inflammation is thought to be a contributing factor to the loss of bone and muscle mass with aging. This study assessed the combined effects of progressive resistance training and ibuprofen supplementation on bone strength and density.

Subjects were randomized into one of four groups, including 1) resistance training combined with ibuprofen 400 mg after exercise, 2) resistance training combined with placebo, 3) flexibility training combined with ibuprofen or 4) flexibility training combined with placebo. All participants were provided supplements of calcium and vitamin D. The resistance strengthening program included two sets of eight to 12 repetitions to fatigue for a total of 12 machine and dumbbell exercises.

Exercises were focused on the hip, lumbar spine, distal radius and tibia. At baseline, the participants underwent evaluations of bone structure and volumetric density by peripheral quantitative computed tomography (pQCT), through anthropometric measurements, and by assessing cross-sectional area content and density for total and trabecular bone and estimates of bone strength in compression.

Subjects were 69 women. Exercise with ibuprofen decreased the average total bone content in comparison to

exercise only (p = 0.032) and ibuprofen only (p = 0.050). Resistance training with ibuprofen decreased total bone content (-1.5%) at the distal radius as compared to resistance training alone (p=0.03) and ibuprofen alone (p=0.05). The resistance training group had preserved muscle density more than did the stretching group.

Conclusion: This study found that ibuprofen taken immediately after exercise has a negative effect on distal radius bone mineral mass, while resistance training and ibuprofen taken alone prevent bone loss.

Duff, W., et al. Effects of Ibuprofen in Resistance Training on Bone and Muscle: A Randomized, Controlled Trial in Older Women. Med Sci Sports Exer. 2017, April; 49(4): 633-640.

ELITE SPORTING ACTIVITY AND HIP OSTEOARTHRITIS

Male athletes in certain elite level sports appear to be at an increased risk of hip osteoarthritis (OA) later in life. This phenomenon differs from knee OA, as there is often no history of any preceding associated hip injury. This systematic review investigated the association of sporting activity with the development of hip OA.

Medical databases were reviewed for studies involving male participants in competitive sports activities who were diagnosed with hip OA. From these studies, pooled rates of outcomes of hip OA were calculated. Eleven studies were chosen, all investigating the rate of OA in male participants relative to controls. Of these, soccer was most commonly investigated sport along with long distance running.

Participation in elite-level impact sports was associated with a two- to nine-fold increased risk of hip OA. The studies investigating competitive long distance running demonstrated inconsistent results

Conclusion: This systematic review demonstrated that patients with a history of participation in certain elite level impact sporting activities are at a significantly higher risk of developing hip osteoarthritis.

Vigdirchick, J., et al. C. What is the Association of Elite Sporting Activities with the Development of Hip Osteoarthritis? Am J Sports Med. 2017, April; 45(4): 961-964.

LIFE EXPECTANCY OF DIFFERENT OLYMPIC ATHLETES

Previous studies have demonstrated favorable mortality outcomes among elite athletes, when compared to the general population. However, this has not held true for all sports. This study was designed to determine whether survival differs between elite ectomorph and mesomorph athletes.

Publicly available data were used to identify the top ten male and female athletes in Olympic high jump, discus, marathon and 100 m runs from 1928 to 1948. Internet searches were used to identify age at competition, height, weight, country of origin and date of death. Outcome measures included all-cause mortality, expected survival and country of origin.

Of the 429 athletes followed, the date of death was identified for 336. The observed versus expected survival was greatest for high jumpers (7.1 years for women and 3.7 years for men), and lowest for sprinters (-1.6 years for women and 0.9 years for men). A multivariate analysis demonstrated that the greatest survival was for high jumpers and marathon runners, as compared with discus throwers and sprinters (p=0.005). Controlling for weight reduced the survival benefit of high jumpers over discus throwers, but had little effect on the survival benefit of marathon runners versus sprinters.

Conclusion: This study of Olympic athletes found that high jumpers and marathon runners live longer than the general population,.while 100 meter runners do not.

Lee-Heidenreich, J., et al. Differences in Life Expectancy between Olympic High Jumpers, Discus Throwers, Marathon and 100 M Runners. BMC Sports Sci Med Rehabil. 2017. 9: 3.

LONG-TERM EFFECTS OF HABITUAL BAREFOOT RUNNING AND WALKING: A SYSTEMATIC REVIEW

Barefoot running (BR) is a growing practice in the running community. While the short-term effects of BR have been studied, the long-term effects are not as well understood. This study was designed to better understand the long-term effects of BR and walking on anthropometrics, biomechanics and performance.

This meta-analysis included randomly controlled trials, case controls, cohorts and cross sectional studies from peer reviewed journals. Fifteen studies were included in the final analysis. Three studies revealed evidence of reduced ankle dorsiflexion at foot strike in BR ($p<0.0001$). There was limited evidence showing reduced contact time, stride length, stride time and increased cadence in BR. Five studies assessed morphology, showing BR to have wider, but not shorter, feet compared to nonbarefoot running. Two studies showed reduced hallux angle. Limited evidence showed reduced incidence of flat feet in BR children, but conflicting evidence in adults. Very limited evidence suggests that injury patterns are different, with plantar surface injuries more common in BR.

Conclusions: This large literature review and meta-analysis found insufficient evidence in the literature to draw significant conclusions concerning the effects of barefoot running as compared with shod running.

Hollander, K., et al. Long-Term Effects of Habitual Barefoot Running and Walking: A Systematic Review. Med Sci Sports Exer. 2017:49(4) 752-762.

LOW-LEVEL LASER THERAPY FOR LIMB FRACTURE

Delayed union of fractures occurs when there are no signs of bone healing within the expected timeframe. While operative intervention is an option after delayed union, many look for more conservative means of accelerating healing. The use of low-level laser treatment (LLLT) to promote healing has been reported in human fractures, although none have previously reported its use in a clinical setting. This case series reported on consecutive patients with delayed union of fracture who were clinically treated with LLLT.

Subjects included consecutive patients with a mean age of 26 years presenting with delayed union of upper or lower extremity limb fracture, who had been offered, but had refused surgical intervention. All received LLLT every other day, eight weeks for UE and 12 weeks for LE fractures. The patients were followed for clinical and radiologic findings of fracture healing, as well as satisfaction with the procedure.

At presentation, the age of the fractures ranged from six to eight weeks. Of the patients who completed

the study, 15 of 16 achieved union. The time to clinical and radiologic fracture union was seven weeks for UE and 10 weeks for LE fractures. The mean satisfaction of those with UE fractures was 9/10, while that for those with LE fractures was 8/10.

Conclusion: This case series of patients with delayed union of fractures found that, after initiating low level laser therapy, solid union was achieved in seven to 10 weeks.

Ip, D., Use of Low-Level Laser Therapy in Conservative Treatment of Delayed Union of Human Upper and Lower Limb Fractures. Internet J Ortho Surg. 2017; 25(1): 1-7.

MYOFASCIAL RELEASE FOR CHRONIC LOW BACK PAIN

Low back pain (LBP) is a common condition with negative economic and social consequences. As some have suggested that lumbar fascia might be involved in chronic low back pain (CLBP), this study assessed the effect myofascial release (MFR).

This double-blind, parallel controlled trial involved adults 18-60 years of age diagnosed with nonspecific, chronic (>3months) LBP. Those who were randomized to an MFR group received four sessions of myofascial treatment, 40 minutes per session, twice per week. The MFR techniques included longitudinal sliding of lumbar paravertebral muscles, MFR of the thoracolumbar fascia, MFR of quadratus lumborum and MFR of the psoas muscle. A control group received sham MFR. The primary outcome measure was pain, assessed with the Spanish version of the Short Form McGill Pain Questionnaire (SF-MPQ) and a visual analog scale (VAS) of pain.

Both groups demonstrated significant improvement at two weeks in SF-MPQ scores, with significantly better scores at 12 weeks in the MFR group in the pain ($p=0.023$) and sensory subscales ($p=0.011$) than in the control group. A significant improvement on the VAS was found for both groups with no significant difference between the two groups. In addition, disability, as measured with the Roland Morris Questionnaire and Fear Avoidance Beliefs Questionnaire scores were significantly better in the MFR group than in the sham group ($p<0.05$).

Conclusion: This study of patients with nonspecific low back pain found that myofascial release techniques help improve pain and disability.

Arguisuelas, M., et al. Effects of Myofascial Release and Nonspecific Chronic Low Back Pain: A Randomized, Clinical Trial. Spine. 2017, May 1; 42(9): 627-634.

ORAL CONTRACEPTIVES AND SPRINT INTERVAL PERFORMANCE

Studies have shown that near maximal to maximal interval training (80% to 100% peak heart rate) or sprint interval training (SIT) can rapidly improve peak aerobic capacity and endurance performance in as little as two weeks. As previous studies have found that oral contraceptive (OC) use may influence athletic performance, this study assessed the influence of these medications on performance adaptations to SIT.

Healthy, recreationally active women who were either OC users or experienced regular natural menstrual cycles were studied. At baseline, the subjects were assessed for serum hormone levels and VO2peak, peak power output (PPO), peak cardiac output (Qpeak), peak stroke volume (SVpeak), peak HR (HRpeak), peak rating of perceived exertion (RPEpeak), peak respiratory quotient (RQ) and minute ventilation (V·EV·CO2slope). Each participant then completed three supervised SIT sessions (at 100 to 120% PPO) per week for four weeks, with a minimum of 36 hours between sessions. Assessments were again made immediately after completing and four weeks after completion of the program. Those taking oral contraceptives were compared to those who were not.

The MC group showed greater improvement than did the OC group in V·O2peak ($p = 0.010$), and Q·peak ($p = 0.002$). The SVpeak increased in the MC group ($p = 0.002$), and remained elevated from pre-training at follow-up ($P = 0.023$), but did not change in the OC group. The MC group had a higher RQ compared with the OC group at all time points including baseline ($p = 0.038$), post-training ($p= 0.015$) and follow-up ($p= 0.025$).

Conclusion: This study of recreationally active women involved in sprint interval training found that oral contraceptives can reduce gains in VO2peak and Qpeak.

Schaumberg, M., et al. Oral Contraceptive Use Dampens Physiological Adaptations to Sprint Interval Training. Med Sci Sports Exer. 2017, April; 49 (4): 717-727.

PHYSICAL ACTIVITY AND ADIPOSITY RELATED INFLAMMATION

While it has been well established that physical activity is associated with decreased cardiovascular morbidity and mortality, the mechanisms of this are not completely understood. Some have suggested that the anti-inflammatory effect of physical activity may be among the factors. This study evaluated the association between physical activity and obesity-related inflammatory markers.

Data were obtained from the Multi-Ethnic Study of Atherosclerosis (MESA), a longitudinal study of adults 55 to 84 years of age who were free from clinically apparent cardiovascular disease at the time of enrollment (2000 to 2002). Participants returned for follow-up clinic visits at two, four and six years after the baseline visit. Data collected at all visits included standard questionnaires concerning sociodemographics, ethnicity and health history. Body mass index (BMI) was determined, with waist and hip circumference and blood pressure also measured. Data collected also included physical activity assessments, blood samples and CT determined visceral and subcutaneous adiposity. The data were reviewed to determine associations between physical activity and adipokines.

Subjects were 6,814 adults with an average age of 64.7 years, and an average BMI of 28.2 kg/m², with one third having a BMI of greater than 30 kg/m². Multivariable adjusted linear regression revealed that a one standard deviation increment in moderate-to-vigorous physical activity was associated with higher adiponectin (6.7%), but lower leptin (9.5%), resistin (5.2%), TNF-α

(4.9%) and IL-6 ($p < 0.05$ for all comparisons). The association with adiponectin was attenuated by central adiposity.

Conclusion: This large study found that moderate to vigorous physical activity is associated with a more favorable profile of inflammatory markers, independent of risk factors for cardiovascular disease, including abdominal subcutaneous and visceral adiposity.

Vella, C., et al. Physical Activity and Adiposity-Related Inflammation: The MESA. Med Sci Sports Exer. 2017, May; 49(5): 915-921.

RETURN TO SPORT MATTERS AFTER ANTERIOR CRUCIATE LIGAMENT REPAIR

Prior studies have demonstrated that individuals undergoing anterior cruciate ligament (ACL) repair can expect normal or near normal knee function within one year. Despite these expectations, one of three report knee difficulties six years following the repair. This study assessed quality of life (QOL) and psychological health outcomes of patients 20 years after ACL repair.

All individuals undergoing a hamstring or patella tendon autograft ACL repair five to 20 years previously were identified from the surgical records of four orthopedic surgeons. The participants were asked to complete a battery of patient reported outcome measures, including the Knee Injury and Osteoarthritis Outcomes Score (KOOS), the ACL- QOL and the Assessment of QOL (AQoL-8D), the Workplace Activity Limitation Scale (WALS) and the Hospital Anxiety and Depression Scale (HADS). Knee difficulties were recorded, and were defined as knee pain, symptoms and functional limitations.

Participants were 162 individuals who were an average of nine years post-surgery and sought medical attention for knee difficulties. The patients reported a mean KOOS-QOL score of 57, suggesting impaired, knee-related QOL. A multivariable analysis revealed that non-return to sport, higher BMI and subsequent surgery were independently associated with worse KOOS-QOL scores. Return to sport explained the greatest proportion of variance of KOOS-QOL ($p=0.0001$), and resulted in an estimated 21-point higher ACL-QOL score compared to that of those who did not return ($p<0.001$).

Conclusion: Returning to sport after an anterior cruciate ligament tear is associated with better knee-related and general health-related quality of life among people with knee difficulties five to 20 years after ACL repair.

Fibay, S., et al. Return to Sport Matters-Longer Term Quality of Life after ACL Reconstruction in People with Knee Difficulties. Scand J Med Sci Sports. 2017, May; 27(5): 514-524.

SAUNA AND RISK OF ALZHEIMER'S DISEASE AND OTHER DEMENTIAS

Previous studies have suggested that sauna bathing is associated with better cardiovascular and circulatory function. This study investigated the association between sauna bathing and the risk of Alzheimer's disease (AD) and/or other dementias.

Subjects were 2,327 randomly selected men 42 to 60 years of age, who underwent baseline examinations between 1984 and 1989. All were assessed for tobacco use, blood pressure, alcohol use, body mass index, serum lipids, diabetes, physical activity and sauna use. The patients were followed for a median of 20.7 years for new cases of AD and/or other dementias.

Of the participants, 601 reported having a sauna bath once per week, 1,513 at a rate of two to three times per week, and 247 at a rate of four or more times per week. Compared to those using sauna once per week, the relative risk of dementia was 0.78 for those in the two to three times per week group and 0.38 for those in the four to seven times per week group. The hazard ratios for AD compared to the once per week group were 0.8 for the two to three times per week group and 0.41 for the four to seven times per week group. Multivariable analysis revealed that those in the four to seven times per week group had a 66% reduction of dementia and a 65% reduction of AD, as compared to those experiencing a sauna once per week.

Conclusion: This study of middle-aged Finnish men found a strong, inverse association between sauna bathing and the risk of Alzheimer's disease and other dementias. This association occurred independently of known risk factors.

Laukkanen, T., et al. Sauna Bathing is Inversely Associated with Dementia and Alzheimer's Disease in Middle- Aged Finnish Men. Age Aging. 2017; 46: 245-249.

SHOCKWAVE TREATMENT WITH ECCENTRIC TRAINING FOR PATELLAR TENDINOPATHY

Patellar tendinopathy is caused by an overload of the knee extensor mechanism, and is often chronic and difficult to treat. Eccentric training is a standard treatment method for patellar tendinopathy. As extra corporeal shockwave therapy (ESWT) has shown some promise for the treatment of tendinopathy, this study assessed the effect of combining ESWT and eccentric training for the treatment of patellar tendinopathy

This randomized, placebo controlled trial included patients 18 to 40 years of age with patellar tendinopathy, with symptoms persisting for at least eight weeks. All subjects were instructed to perform eccentric exercises twice daily, with three sets of 15 repetitions per session for 12 weeks. Those randomized to the treatment group received ESWT applied in three sessions at one-week intervals, while the control group received sham shockwave treatment. The primary outcome measure was the Victorian Institute of Sport Assessment-Patella (VISA-P). Secondary outcome measures were pain scores during functional knee loading tests, as rated with a numeric rating scale (0-10).

The mean improvements in VISA-P scores from baseline over time were 70.9 in the placebo group and

78.2 in the treatment group ($p=0.15$). No significant differences were found between groups in pain, except during three maximal vertical jumps at six weeks, which favored the sham group.

Conclusion: This study of patients with chronic patella

tendinopathy found no additional benefit when adding shockwave treatment to traditional eccentric exercise.

Thijs, K., et al. Effectiveness of Shockwave Treatment Combined with Eccentric Training for Patellar Tendinopathy: A Double-Blinded, Randomized Study. Clin J Sport Med. 2017, March; 27(2): 89-96.

SOMATOSENSORY CORTEX AND ACUPUNCTURE

Prior to surgery, several conservative therapies are recommended for patients with carpal tunnel syndrome (CTS). As previous neuroimaging studies of patients with CTS have demonstrated changes in the primary somatosensory cortex of the brain, this study was designed to further understand the effects of acupuncture on the symptoms, the peripheral conduction and the somatosensory cortex of patients with CTS.

Subjects were patients with CTS, 20 to 65 years of age. All underwent baseline clinical and MRI assessments and were randomized to one of three study arms. These included verum acupuncture localized to the more affected hand (L), verum acupuncture at distal body sites contralesionally (D) and sham acupuncture using nonpenetrating needles. All acupuncture treatments included 16 sessions over eight weeks, using a tapering schedule. Brain MRI and nerve conduction studies were obtained at baseline and after therapy. Symptoms were assessed using the Boston Carpal Tunnel Syndrome Questionnaire (BCTQ) at baseline, post-therapy and at three-month follow-up.

A total of 79 patients were enrolled. All three groups demonstrated improvement in BCTQ symptom severity scores immediately after therapy, with improvement retained at three months in the active groups ($p<0.001$), and no difference between the L and D active groups. Both were significantly better than the sham group ($p<0.04$). A significant improvement in median sensory nerve latency was found in the acupuncture groups ($p=0.01$), but not in the sham group.

A significant relationship was found between latency following acupuncture and BCTQ at three-month follow-up. Data from somatosensory cortical mapping with functional MRI found that D2/D3 separation distance was greater for the acupuncture groups than for the sham group ($p=0.04$).

Conclusion: This study found that acupuncture reduces symptoms of carpal tunnel syndrome and improves peripheral and brain-related neurophysiological outcomes.

Maeda, Y., et al. Rewiring the Primary Somatosensory Cortex in Carpal Tunnel Syndrome with Acupuncture. Brain. 2017, April; 140 (4): 914-927.

STOCKING USE AND PLANTAR SENSATION AFTER ANKLE SPRAIN

The most common injury in organized sports in United States is the lateral ankle sprain. Though often perceived as a minor injury, long-term symptoms are reported in nearly 40% of these individuals. Patients with chronic ankle instability (CAI) may present with insufficiencies including both mechanical and sensorimotor. As compression stockings have been shown to improve joint position sense, this study was designed to determine whether stocking use can influence tactile perception among patients with CAI.

Subjects were 45 young adults, including 15 without injury, 15 with CAI and 15 with a history of sprain without chronic symptoms (a coper group). For all individuals, after footwear removal, light touch was evaluated at three sites on the plantar surface using 20 calibrated Semmes- Weinstein monofilaments (SWM). The light touch threshold was evaluated at the head of the first metatarsal (1MT), the base of the fifth metatarsal (5MT) and the calcaneus (CAL). Testing conditions were compared with and without stocking use.

Thresholds were increased at all three sites with stocking use ($p < 0.05$). In the CAI group, significantly higher thresholds were identified during stocking use at the CAL, but not the 1MT or the 5 MT. In the control groups, SWM thresholds were higher at the 5MT, but not the 1MT or CAL, with stocking use. In addition, thresholds were higher when participants in the coper group wore stockings at the 5MT and the CAL, but not the 1MT.

Conclusion: This study of patients with ankle sprains found that, even though ankle compression and taping have been shown to improve joint position sense and postural control, a light stocking on the foot results in deterioration of light touch thresholds.

Burcal, C., et al. Effects of a Stocking on Plantar Sensation in Individuals with and without Ankle Instability. Muscle Nerve. 2017, April; 55(4):513-519.

AMBROXOL FOR FIBROMYALGIA

Previous research has suggested that fibromyalgia is a sympathetically- driven, neuropathic pain syndrome, often involving small, unmyelinated, peripheral nerve fibers. In small-fiber neuropathies, specific sodium channels in the dorsal root ganglia are involved in pain transmission. Ambroxol, a secretolytic agent used for decades to treat airway disorders, has recently been found to be a strong Nav1.8 sodium channel blocker, which is associated with small fiber neuropathy. This open- label study examined the effect of ambroxol for the treatment of fibromyalgia.

The subjects were twenty-five women who met 2010 American College of Rheumatology diagnostic criteria for fibromyalgia. Oral ambroxol was administered for one month at 30 mg, three times per day. Patients completed pre- and post- treatment questionnaires, including the Revised Fibromyalgia Impact Questionnaire (FIQ-R), a Hospital Anxiety and Depression Scale, and the American Congress of Rheumatology diagnostic criteria including: the Widespread Pain Index (WPI), the Symptoms Severity Scale (SSS), the Polysymptomatic Distress Scale (PDS), the Composite Autonomic Symptom Score, Self- report Leeds Assessment of Neuropathic Symptoms and Signs pain scale (sLANSS) and the Patient Global Impression of Change (PGIC). After treatment, scores on the FIQ-R decreased from 62 to 51 ($p = 0.013$), with scores on the VAS

improving from 77 to 56 (p = 0.018), and those on the WPI from 14.6 to 10.4 (p = 0.001). In addition, significant improvements were found on the SSS (p = 0.022) and the PDS (p = 0.001). No significant changes were found in anxiety or depression scores.

Conclusion: This small, unblinded, uncontrolled study of patients with fibromyalgia found that ambroxol, a Nav1.8 sodium channel blocker, may be a new therapeutic option to assist with pain control.

Martinez-Martinez L., et al. Ambroxol for Fibromyalgia: One Group Pre-Test-Post-Test, Open-Label Pilot Study. Clin Rheumatol. 2017: doi: 10.1007/s10067-017-3664-z.

BRAIN-CONTROLLED MUSCLE STIMULATION IN TETRAPLEGIA

Patients with high cervical spinal cord injury (SCI) events have difficulty performing the reaching and grasping movements required for many activities of daily living. This study explored the ability of an intracortical brain-computer interface to recognize cortical signals sufficiently to command functional electrical stimulators (FES) for arm movement.

The subject was a 53-year-old man with a C-4 ASIA-A injury. Two 96 channel microelectrode arrays were implanted into the hand area on the precentral gyrus of his motor cortex. The patient practiced movements of a three-dimensional virtual arm for four months, and then received 36 percutaneous muscle stimulating electrodes applied to his right arm. These were placed to restore finger and thumb, wrist, elbow and shoulder movements. The subject was then tested for cortically commanded, single-joint and coordinated, multi-joint arm movements for target acquisition.

The single-joint and coordinated, multiple-joint arm movements were completed using the FES at 80 to 100% accuracy. At 463 days after implantation, the subject was able to successfully reach and drink a mug of coffee on 11 of 12 attempts and by day 717 was able to feed himself.

Conclusion: This case study of a tetraplegic patient found that an intracortical brain computer interface could be used to effectively provide commands to peripheral functional electrical stimulation devices, allowing for functional use of the hand.

Ajiboye, A., et al. Restoration of Reaching and Grasping Movements through Brain-Controlled Muscle Stimulation in a Person with Tetraplegia: A Proof of Concept Demonstration. Lancet. 2017, May; 389(10081): 1821-1830.

BRACING OF RECONSTRUCTED AND OSTEOARTHRITIC KNEES

Radiographic knee osteoarthritis (OA) is evident in more than 50% of people at 10-20 years after anterior cruciate ligament (ACL) reconstruction. This study compared the efficacy of an unloader brace, either with or without varus realignment for patients after ACL reconstruction.

Subjects were 19 patients with a primary ACL reconstruction 5-20 years prior to recruitment who demonstrated valgus malalignment as well as symptomatic and radiographic OA of the knee. Subjects performed hopping, stair ascent and stair descent tasks under three conditions including; no brace, unadjusted brace with a sagittal plane support and no varus alignment, and an adjusted brace with sagittal plane support and varus realignment. Quantitative motion analysis was performed during each examination, with kinematic and external joint movements computed.

There was no difference in pain during hopping or stair climbing between any of the three test conditions. Compared with no brace, the brace conditions increased the maximum knee flexion angle occurring at initial ground contact ($p<0.001$). The adjusted brace condition increased the maximum external knee flexion moment ($p=0.001$). There were no significant differences in kinetics or moments between the adjusted and unadjusted brace conditions.

Conclusion: This study of patients with ACL reconstruction and osteoarthritis of the knee found that, compared with no bracing, an unloader brace can positively modulate the kinematics and external joint moments during activity, with no additional positive effect found with the use of varus realignment.

Hart, H et al. Bracing of the Reconstructed and Osteoarthritic Knee during High Dynamic Load Tasks. **Med Sci Sports Exerc**. 2017, June; 49 (6):1086–1096.

CANNABIDIOL FOR SEIZURES IN DRAVET SYNDROME

The Dravet syndrome is a rare genetic form of epileptic encephalopathy. Small studies have reported a positive effect on seizure frequency of patients with Dravet through the use of cannabidiol. This study was designed to better understand the efficacy of this drug for the treatment of drug resistant epilepsy among patients with Dravet.

Eligible subjects had a diagnosis of Dravet syndrome and were taking one or more antiepileptic drugs. They had experienced four or more seizures during a 28-day baseline period. After a four-week baseline, during which a daily seizure record was maintained, the subjects were randomized to receive cannabidiol or a matching placebo. The cannabidiol group received doses escalated up to 20 mg/kg per day. Clinical and laboratory assessments were performed at baseline and after two, four, eight and 14 weeks. The primary endpoint was the percentage change in seizure frequency from baseline.

Compared to baseline, the median reduction in convulsive seizures between the treatment and the placebo group was 22.8 percentage points ($p=0.01$). Among the secondary endpoints, a reduction in seizure frequency by 50% or more was more often seen in the cannabidiol group ($p=0.08$) although that finding was not statistically significant. Freedom from seizures was achieved by three in the treatment group and zero in the placebo group. There was no significant difference between groups in sleep disruption scores or Epsworth Sleepiness Scale Scores.

Conclusion: This study of patients diagnosed with Dravet syndrome found that treatment with cannabidiol resulted in a significant reduction in seizure frequency.

Devinsky, O., et al. Trial of Cannabidiol for Drug-Resistant Seizures in the Dravet Syndrome. **N Eng J Med**. 2017, May 25; 376 (21):2011-2020.

WITH BLOOD FLOW RESTRICTION FOR PATELLOFEMORAL PAIN

Patellofemoral pain (PFP) is a common source of anterior knee pain among active adolescents. Those with PFP have pain-limited difficulty with resistance exercises at the recommended load of 60-70% one rep maximum (1RM). As blood flow restriction at the targeted muscle has been found to allow for strengthening at 20-30% of 1RM, this study compared the effects of these two types of strength training.

Subjects were between 18 and 40 years of age, with atraumatic PFP. Those randomized to a BFR group were assessed with an arterial occlusion pressure cuff placed at the proximal thigh in a standing position. The cuff pressure was then increased until the pedal pulse was no longer palpable. The BFR restriction exercise was performed at 60% of this pressure. This group exercised at 30% of the 1RM. Those randomized to a standard group exercised at 70% 1RM. Exercises included leg press, leg extension and knee flexion. The primary outcome variable was PFP at eight weeks.

Over eight weeks, those in the BFR group had a 93% greater reduction in pain with activities of daily living, as compared with the standard treatment group (p=0.022), with no significant difference in worst pain scores. A 49% greater improvement in the extensor torque was found in the BFR group, although this finding did not reach statistical significance (p=0.073).

Conclusion: This study of patients with patellofemoral pain found that blood flow resistance training can reduce pain with activities of daily living more than can traditional strengthening exercise.

Giles, L., et al. Quadriceps Strengthening with and without Blood Flow Restriction in the Treatment of Patellofemoral Pain: A Double-Blind, Randomized Trial. **Br J Sports Med.** 2017; 0: 1-8.

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