

MUSCULOSKELETAL

IN REVIEW

TM

Volume 3, Number 5

Published by Physicians Specializing In
Musculoskeletal Medicine

September 5, 2016

ACUTE EFFECTS OF VITAMIN D3 SUPPLEMENTATION ON MUSCLE STRENGTH

Vitamin D is a complex hormone involved in a wide range of functions, with research confirming the link between muscle function and 25 (OH) D3. This study examined whether vitamin D supplementation significantly increases serum 25(OH) D as well as muscle function in indoor athletes.

This prospective study included male, white, national level, judoka athletes, involved in full-time training. The group was randomized to receive either vitamin D3 (150,000 IU) or a placebo. All participants were assessed twice, eight days apart, before the start of training and after two days of rest. The subjects underwent anthropomorphic measurements, blood tests, and muscle function tests. Concentric quadriceps and hamstring muscle function were measured using an isokinetic dynamometer.

At baseline the Judo athletes demonstrated insufficient levels of 25 (OH) D. The treatment group demonstrated a 34% increase in serum 25 (OH) D levels between days one and eight, while the placebo group remained constant. Muscle strength increased by a mean of 13% between days one and eight in the treatment group and by three percent in the placebo group.

Conclusion: This study of high-level indoor (judo) athletes found that levels of vitamin D were generally low at baseline, and that vitamin D supplementation resulted in significant increases in muscle strength within eight days.

Wyon, A., et al. Acute Effects of Vitamin D3 Supplementation on Muscle Strength in Judoka Athletes: A Randomized, Placebo Controlled, Double-Blind Trial. *Clin J Sport Med.* 2016, July; 26(4): 279-284.

RESTORING CORTICAL CONTROL OF MOVEMENT IN QUADRIPLÉGIA

Previous studies have shown that intracortically recorded signals can be decoded to provide information related to motion, allowing nonhuman primates and paralyzed humans to control computers and robotic arms. This study demonstrates a real-time application of the use of such devices in a human with quadraplegia.

This subject was a 24-year-old male with stable, non-spastic, C5-6 quadriplegia, sustained four years prior to the study. The patient underwent the implantation of a microelectrode array at his left primary motor cortex. He was then trained to use his neuronal activity to control a neuromuscular electrical stimulator, positioned to allow for six different wrist and hand motions. To test the system, five trials of the six movements were performed.

During the trials, the subject achieved overall accuracy of 70%, ranging up to 93% for wrist flexion and 97.3% for thumb flexion. Assessing the upper limb function, using the Gradient and Redefined Assessment of Strength, Sensibility and Prehension (GRASSP), it was determined that the C5-C6 participant gained wrist and hand function consistent with a C7-T1 level of injury.

Conclusion: This case demonstrated, for the first time, that a human with quadriplegia could regain volitional movement through the use of intracortically recorded signals linked to neuromuscular signals in real time.

Bouton, C., et al. Restoring Cortical Control of Functional Movement in a Human with Quadriplegia. *Nature.* 2016, May 12; 533(7602): 247-250.

LONG-TERM RENAL FUNCTION AFTER SPINAL CORD INJURY

Patients with spinal cord injury (SCI) are at increased risk of renal deterioration and urinary tract complications. This study described the extent of renal deterioration in patients with SCI over a 45-year follow-up period.

Medical records were reviewed of all patients admitted to the Spinal Cord Clinic of the Rigshospitalet, Hornbæk, Denmark, with a traumatic SCI sustained during 1944 to 1975. Most patients attended follow-up examinations with assessment of renal function every other year. Until the 1980s, exams included plasma creatinine and x-ray of the abdomen. From the 1980s, CT scan and renography were routine. The primary outcome variable of the study was renal deterioration, based upon results of renography and gender adjusted relative GFR.

At year 45, the cumulative risk of moderate renal deterioration was 58%, while that of severe renal deterioration was 29%. The probabilities of moderate deterioration after 20, 30 and 40 years were 14.5%, 30% and 47.5%, respectively. The probabilities of severe renal deterioration at 20, 30 and 40 years were 3.4%, 13.6% and 21.1%, respectively. A history of renal/ureter stones requiring removal was significantly associated with a decreased GFR.

Conclusion: This study of 116 patients with spinal cord injury found that the cumulative risk of severe renal deterioration was 29% after 45 years.

Elmlund, M., et al. Forty-Five Year Follow-Up on the Renal Function after Spinal Cord Injury. *Spinal Cord.* 2016, June; 54(6): 445-451.

Editor-in-Chief

Daniel Burke, B.S.
*Georgia College & State University,
Milledgeville, GA*

Content Editor

David T. Burke, M.D., M.A.
Emory University, Atlanta, GA

Executive Editor

Di Cui, M.D.
Emory University, Atlanta, GA

Copy Editor

Tracie E. McCargo, EMBA
*Harvard University Extension School,
Cambridge, MA*

Distribution Manager

Michael P. Burke, M.S.

UNLOADING SHOES FOR KNEE OSTEOARTHRITIS

Previous studies have suggested that 10 -25% of women and 5 -15% of men, 60 years of age or older, have knee osteoarthritis (OA). Recent research has focused on the development of unloading shoes which reduce medial knee loads through changes in foot and ankle biomechanics. This study was designed to determine whether such shoes can reduce pain and physical dysfunction associated with knee OA. This randomized, controlled trial included adults, 50 years of age or older, with knee pain on most days of the previous months, and with radiographic evidence of medial tibiofemoral OA. The subjects were randomly assigned to wear either unloading walking shoes, which significantly reduced measures of load across the medial knee, or commercially available, neutral walking shoes. The participants were asked to wear the shoes as much as possible during the day for six months and to avoid changing shoes. The primary outcome measures were self-reported pain and physical function, as measured with the numerical rating scale (NRS) and the Western Ontario and McMaster University Osteoarthritis index (WOMAC), at six months.

At six months, 160 had completed the questionnaires. While both groups reported improvement in function, no significant difference was found between groups in scores on

the NRS or the WOMAC.

Conclusion: This study of patients with osteoarthritis did not find that shoes designed to unload the medial compartment of the knee reduced pain or improved function as compared with conventional shoes.

Hinman, R., et al. Unloading Shoes for Self-Management of Knee Osteoarthritis: A Randomized Trial. *Ann Intern Med* 2016. doi: 10.7326/M16-0453.

BONE MARROW ASPIRATE FOR KNEE OSTEOARTHRITIS

Osteoarthritis (OA) of the knee is a painful, degenerative condition that affects millions of patients. The American Academy of Orthopedic Surgeons recently published a position paper which recommended against most conservative therapies. This study reviewed the effects of bone marrow aspirate concentrate (BMAC), without additives, as a treatment for OA of the knee.

Subjects included 25 patients seen for bilateral knee OA between 2013 and 2015. All had been unresponsive to conventional treatments. Each patient received a randomly determined intra-articular injection of BMAC, (harvested from the patient's superior iliac crest) into one knee, and a similar volume of normal saline placebo into the contralateral knee. At baseline and follow-up, the patients were assessed using the Osteoarthritis Research Society International (OARSI) measures, the Intermittent and Constant Osteoarthritis Pain (ICOAP) questionnaire and visual analog scale (VAS) pain scores.

Significant improvement was noted in both groups in ICOAP scores and VAS pain scores, with no significant difference found between the treatment groups. In addition, while there was significant improvement in the activity levels of both groups compared to baseline, there was no significant difference in the degree of improvement between the two treatment groups at any of the follow-up periods.

Conclusion: This study of patients with chronic osteoarthritis of the knee found that injections with saline produced similar results in pain reduction and functional abilities as did injections with bone marrow aspirate concentrate.

Shapiro, S., et al. A Prospective, Single-Blind, Placebo-Controlled Trial of Bone Marrow Aspirate Concentrate for Knee Osteoarthritis. *Amer J Sports Med*. DOI:10.1177/0363546516662455

CAPSULAR RELEASE FOR ADHESIVE CAPSULITIS

Adhesive capsulitis of the shoulder is marked by the spontaneous onset of worsening shoulder pain and limited active and passive range of motion. Surgical options for recalcitrant cases include open release, manipulation under anesthesia or arthroscopic release. This study evaluated short-term recovery following arthroscopic capsular release of idiopathic adhesive capsulitis.

This retrospective study included adults, clinically diagnosed with idiopathic adhesive capsulitis, all with shoulder symptoms of at least four weeks' duration. All patients underwent arthroscopic capsular release. Before surgery, the subjects completed a standardized questionnaire evaluating shoulder pain and function, based on the Shoulder Rating Questionnaire. An independent examiner assessed shoulder strength and range of motion at baseline and at weeks one, six, 12 and 24.

Participants included 88 women and 45 men, with a mean age of 56 years. After release, the patients experienced immediate improvement in all ranges of shoulder motion ($p < 0.0001$). External range of motion had a mean preoperative range of 21°, increasing to 76° after surgery, and regressing to 49° at 12 weeks, where it remained steady for the duration of the study. This pattern was similar for all other ranges of motion measured. At six, 12 and 24 weeks all ranges of motion were significantly better than before surgery. Activity pain was reported as "always" in 64% before surgery and in 22% at 24 weeks. Frequency of pain during sleep was "always" in 65% before surgery and in 16% at 24 weeks. Extreme pain was reported by 38% preoperatively and by 2% at 24 weeks. Overall shoulder function was rated as good by 0% preoperatively and by 45% at 24 weeks.

Conclusion: This study demonstrates that arthroscopic capsular release for patients with idiopathic adhesive capsulitis resulted in significant improvements in shoulder pain, function and range of motion within one week, with significant improvement persisting at 24 weeks.

Barnes, C., et al. Short-Term Outcomes after Arthroscopic Capsular Release for Adhesive Capsulitis. *J Shoulder Elbow Surg.* 2016, September; 25(9): e256-e264.

CONTINUOUS VERSUS ON-DEMAND DICLOFENAC FOR ANKYLOSING SPONDYLITIS

Ankylosing spondylitis (AS) is defined by the presence of structural bone damage, visible on x-rays of the sacroiliac joints and/or spine. This study was designed to determine whether nonsteroidal anti-inflammatory drugs (NSAIDs), given continuously, can reduce the progression of radiographic evidence of AS, as compared with NSAID on-demand therapy.

The Effects of Nonsteroidal Anti-Inflammatory Drugs on Radiographic Damage in AS (ENRADAS) study was a prospective, randomized, controlled trial conducted in 19 German centers. Using a block randomization method, patients were assigned to treatment with diclofenac continuously, at a dose of at least 50% of the maximally recommended daily dose (150mg), or on demand, for a period of two years. The primary outcome variable was spinal radiographic progression, assessed by the change in the modified Stoke Ankylosing Spondylitis Spine Score (mSASSS). Data concerning NSAID intake were collected at baseline and every 12 weeks thereafter during the two years of follow-up.

After correcting for baseline, the mean Bath Ankylosing Spondylitis Disease Activity Index values decreased during the two years of treatment to 2.7 in the continuous group and 3.2 in the on-demand group. The mSASSS progression, while numerically higher in the continuous group, was not significantly different than that for the on-demand group. In addition, looking only those who were C-reactive protein positive or had syndesmophytes at baseline, higher radiographic progression was noted in the continuous, as compared to the on-demand, group.

Conclusion: This study of patients with ankylosing spondylitis did not find that the use of continuous nonsteroidal anti-inflammatory drug treatment would reduce the progression of the disease more than on-demand medication.

Sieper, J., et al. Effect of Continuous versus on-Demand Treatment of Ankylosing Spondylitis with Diclofenac of Two Years on Radiographic Progression of the Spine: Results from a Randomized, Multicenter Trial (ENRADAS). *Ann Rheum Dis.* 2016, August; 75(8):1438-1443.

INJECTIONS VERSUS HYDRODILATION FOR FROZEN SHOULDER

Frozen shoulder, also known as adhesive capsulitis, is a common disease that results in restricted passive and active range of motion in the glenohumeral (GH) joint. If conservative measures fail, treatment for this disorder may include intra-articular (IA) injections, subacromial (SA) injections or IA hydrodilatation (HD). This study compared these three injection techniques for their ability to improve range of motion, function and pain.

Subjects were 164 consecutive patients with primary frozen shoulder, all of whom were unresponsive to conservative treatment. All patients were assessed using a VAS for pain, the Simple Shoulder Test, a Constant Score and passive range of motion at baseline and up to six months after treatment. The intraarticular group (IA) received 1 mL of triamcinolone (40 mg), 4 mL of 2% lidocaine and 5 mL of normal saline, injected into the GH joint. The HD group were injected with 4 mL of contrast medium for joint space confirmation, and then 1 mL of triamcinolone (40 mg), 4 mL of 2% lidocaine, and 40 mL of normal saline into the GH joint. The SA group received 1 mL of triamcinolone (40 mg), 4 mL of 2% lidocaine and 5 mL of normal saline at the subacromial space.

Improvements from baseline to six months were noted for all measures in all groups (all $p < 0.001$). Every patient in each group was satisfied with his or her results at six months. At one month, VAS scores were significantly more improved in the HD group than in the intra-articular group ($p = 0.035$), with no significant differences between groups noted at three and six months. The HD group demonstrated better ROM and functional scores in the early follow-up, with no difference between groups at six months.

Conclusion: This study of patients with adhesive capsulitis found that, among three injection methods tested,

hydrodilatation resulted in better pain scores and range of motion at one month, with better functional scores up to three months after injection, with no difference between the injection methods at six months.

Yoon, J., et al. Intra-Articular Injection, Subacromial Injection, and Hydrodilatation for Primary Frozen Shoulder: A Randomized, Clinical Trial. *J Shoulder Elbow Surg.* 2016, March; 25(3): 376-383.

COMMUNITY ACQUIRED MRSA IN HIGH SCHOOL AND COLLEGIATE ATHLETES

Community acquired methicillin-resistant *Staphylococcus aureus* (CA-MRSA) accounts for approximately 45% of all MRSA related hospitalizations. As athletes are a high risk population for this infection, this study assessed the standard of care and yearly incidence of CA-MRSA infections in high school and intercollegiate athletics settings.

Data were collected from 156 athletic trainers for the season 2012- 2013, and 87 athletic trainers for the 2013-2014 season. Questionnaires were distributed to determine demographic information, cases of physician confirmed CA-MRSA infection, and the treatment provided to those infected.

During the first season, 29% of the respondents reported a minimum of one CA-MRSA infection during the athletic year. Overall, the rates were 15.5 and 16.3 per 10,000 athletes in the 2012-2013 and 2013- 2014 seasons, respectively. The majority of infections occurred among football players (36%), followed by wrestlers (26%). The rates for wrestling and football were 90.2 and 42.3 respectively, per 10,000 athletes in the 2012-2013 season and 89 and 61.4 respectively per 10,000, in the 2013-2014 season. Isolation and decontamination were common school responses to these infections, with 60% of the athletes referred to their PCP for treatment.

Conclusion: This study of community acquired MRSA infections in high school and college athletes found the highest risk among those participating in wrestling and football.

Braun, T., et al. CA-MRSA Infection Incidence and Care in High School and Intercollegiate Athletics. *Med Sci Sports Exer.* 2016. August; 48 (8):1530-1538.

ISOMETRIC AND ISOTONIC EXERCISE REDUCES SYMPTOMATIC PATELLAR TENDINOPATHY

Patellar tendinopathy, also known as jumper's knee, is common in sports that involve jumping motions. As isometric exercise been found to decrease tendon pain in the short term, this study compared the effects of isometric and isotonic exercises during an athletic season.

Participants were volleyball and basketball players, 16 to 32 years of age, presenting with patellar tendinopathy. After baseline measures were obtained, the subjects were randomized to participate in an exercise program involving either isometric exercises, performed at 80% of maximum voluntary contraction with a knee joint angle of 60°, or isotonic exercises, at 80% of an eight repetition max. The primary outcome variable was pain during a single leg decline squat (SLDS), scored on a numeric rating scale, as well as the VISA-P, a questionnaire assessing the pain and function of the knee. The participants were also asked to rate the global rate of change of their patella pain from much worse (-4) to much better (+4).

Thirteen patients were randomized to the isometric group and 16 to the isotonic group. The median pain scores improved significantly over the four weeks of intervention in the isometric ($p=0.012$) and the isotonic ($p=0.003$) group. There was no significant difference between groups. In addition, the median VISA-P scores improved in both groups over the four weeks of intervention, with no difference between groups.

Conclusion: This study of basketball and volleyball players with patella tendinopathy, found that treatment during the season with both isometric and isotonic exercise could reduce pain over a four-week trial.

van Ark, M., et al. Do Isometric and Isotonic Programs Reduce Pain in Athletes with Patellar Tendinopathy in-Season? A Randomized Clinical Trial. *J Sci Med Sport*. 2016, September; 19(9): 702-706.

LIMAPROST VERSUS PREGABALIN FOR LUMBAR SPINAL STENOSIS

Lumbar spinal stenosis (LSS) can produce neurogenic claudication. Some have recently suggested that neuropathic pain mechanisms are important in the genesis of leg pain among patients with LSS. Limaprost is a prostaglandin E1 derivative with effects that include the inhibition of platelet aggregation, improvement of erythrocyte deformability and inhibition of reactive oxygen production, in addition to potent vasodilation. As this medication can improve peripheral arterial circulation and increase blood flow in compressed nerve issue, pain can be improved in patients with LSS. This study compared the effect of this medication with that of gabapentin.

This prospective, double-blind, randomized trial included patients with LSS who were 20 to 75 years of age. The patients were divided into treatment groups to receive limaprost, at five micrograms three times daily, pregabalin, at 75 mg three times daily, or the combination of the two three times daily. The primary outcome measure was the Oswestry Disability Index (ODI) score at 8 weeks after treatment.

At eight weeks, data were available for 126 participants. Changes of the baseline-adjusted ODI scores, VAS scores for leg pain, EQ-5D scores and initial claudication distance during the follow-up assessments did not differ among the three groups. Compared with the limaprost group, the other two groups showed a significantly higher incidence of drug-related, adverse events ($p=0.002$ and $p=0.009$).

Conclusion: This study of patients with lumbar spine stenosis and neurogenic claudication found that limaprost is not inferior to pregabalin for the treatment of lumbar spine stenosis. No advantage was found by combining the two medications.

Kim, H., et al. Comparative Study of the Efficacy of Limaprost and Pregabalin as Single Agents and in Combination for the Treatment of Lumbar Spinal Stenosis: A Prospective, Double-Blind, Randomized, Controlled, Non-Inferiority Trial. *Spine J*. 2016, June; 16(6): 756-763.

OFFLOADING FOOTWEAR FOR NEUROPATHIC DIABETIC FOOT ULCERS

Ulceration is thought to be responsible for up to 85% of diabetic foot amputations. Despite the efficacy of treatment with offloading, using total contact casts (TCCs), data suggest that this treatment is markedly underused. Suggesting that the underuse of TCC may be related to technical limitations, costs and acceptance by patients, the authors of this study compared the clinical efficacy of TCC with both removable and non-removable, commercially available, walking boots.

Subjects were patients with diabetic foot ulcers of at least one cm², stage IA or IIA. The patients were randomized to receive a total contact fiberglass cast (group A) or the Optima Diab Walker, either rendered irremovable by the application of a locking strap (group B) or maintained as removable (group C). The removable group was instructed to wear the device on all occasions, avoiding the use of other shoes or walking barefoot. All participants were followed weekly for up to 90 days or until the lesions had (PM&R), with the cooperation and healed.

At follow-up, 95% had achieved complete healing in group A, as had Medicine. The summaries 90% in group B and 80% in group C. The mean healing times of the three duration of the study. Patient satisfaction was significantly higher in group C than in the other groups ($p<0.05$). When normalized for days treated, treatment costs were significantly higher in group A than in the other two groups.

Conclusion: This study of patients with diabetic foot ulcers demonstrated that an off-the-shelf walking boot was as effective and safe as a total contact cast for the healing of the ulcers. Patients preferred the removable device.

Piaggese, A., et al. Comparison of Removable and Irremovable Walking Total Contact Casting in Offloading the Neuropathic Diabetic Foot Ulceration. *Foot Ankle Intern*. 2016, August; 37(8): 855-861.

TREATMENT OF ANKYLOSING SPONDYLITIS

For patients with ankylosing spondylitis (AS), nonsteroidal anti-inflammatory drugs (NSAIDs), and tumor necrosis factor-Alpha targeted therapies have proven efficacy. This study assessed the efficacy of treating patients with both medications, as compared to NSAIDs alone.

In the Infliximab as First-Line Therapy in Patients with Early Active Axial Spondyloarthropathies Trial (INFAST), patients with early active disease who had been treated with suboptimal doses of NSAIDs were selected. The patients were treated with naproxen 1000mg (if tolerated) plus either infliximab or placebo for 28 weeks. A post-hoc analysis of these data evaluated outcomes to determine who did or did not meet modified New York radiographic criteria for AS. The main efficacy measure was the percentage of patients who met the Assessment of SpondyloArthritis International Society (ASAS) partial remission criteria at 28 weeks.

The subjects included 94 patients who met AS criteria and 56 with non-radiographic axial SpA (nr-axSpA). For both the AS and the nr-axSpA groups, partial remission rates at week 28 were greater in the combination than in the naproxen group. The treatment effect was greater in the AS group than in the nr-axSpA group ($p=0.0009$ vs $p=0.55$). In addition, for both subgroups, the combination therapy group scored better on the BASDAI, ASDAS, BASFI and EuroQoL five-dimension questionnaires (EQ-5D).

Conclusion: This study of patients with early, active axial SpA found that greater partial remission occurs when treatment involves a combination of nonsteroidal anti-inflammatory therapy and infliximab than with non-steroidal anti-inflammatory therapy alone.

Sieper, J., et al. Partial Remission in Ankylosing Spondylitis and Non-Radiographic Axial Spondyloarthropathies Treatment with Infliximab plus Naproxen or Naproxen Alone: Associations between Partial Remission and Baseline Disease Characteristics. *Rheum*. 2016; 263; doi:10.1093/rheumatology/kew230

TAI CHI VERSUS PHYSICAL THERAPY FOR KNEE OSTEOARTHRITIS

Knee osteoarthritis (OA) is a major, age-related public health problem, with few effective medical treatments. While physical therapy is recommended as an element of care for patients with knee OA, there remains a need to identify new and effective treatments. This study compared the effectiveness of tai chi with that of physical therapy for patients with OA of the knee.

This single-blind, randomized, comparative study included symptomatic adult patients, at least 40 years of age, with radiographic knee OA. The subjects randomized to the tai chi group received 60-minute sessions occurring twice per week for 12 weeks. After completing these 24 sessions, the participants were instructed to continue tai chi for 52 weeks. Those in the physical therapy group underwent two, 30-minute sessions per week for six weeks, after which they were instructed to continue exercise in 30-minute sessions four times per week for six weeks. The primary outcome measure was the change in the pain subscale score of the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) between baseline and week 12.

Subjects included 204 adults, with a mean age of 60 years and a mean body mass index of 33 kg/m². At 12 weeks, both groups showed significant improvement in WOMAC pain scores, with no significant difference between the groups. In addition, both groups showed similar improvements in most of the secondary outcomes at 12 weeks, and in all outcomes as measured 24 and 52 weeks.

Conclusion: This study of patients with osteoarthritis of the knee found that both tai chi and physical therapy resulted in clinically significant improvements in pain and related health outcomes by 12 weeks, with the benefits maintained at 52 weeks.

Wang, C., et al. Comparative Effectiveness of Tai Chi versus Physical Therapy for Knee Osteoarthritis: A Randomized Trial. *Ann Int Med*: DOI. 7326/M 15-2143.

ULTRASOUND GUIDANCE FOR SUBACROMIAL INJECTIONS

Subacromial impingement is a common cause of shoulder pain in adults, with corticosteroid injections a frequent management tool for this condition. Ultrasound (US) guidance has been recommended for these injections due to the increased accuracy provided by US use. This study compared the clinical effectiveness of US-guided subacromial injections to that of blind subacromial injections. This prospective, double-blind, randomized, controlled trial included 51 patients diagnosed with subacromial impingement, with 28 shoulders undergoing US-guided landmark-guided injection. The main outcome measure was pain with overhead activity as measured by a 100 point visual analogue scale (VAS).

Both groups realized significant improvements in VAS scores for pain, decreasing from 59 before the injection to 33 at week six in the US group, and from 63 to 39 in the blind injection group, with no significant difference between the groups. Both groups showed significant improvement in the American Shoulder and Elbow Surgeons (ASES) score with no significant difference between the groups.

Conclusion: This study of patients with subacromial impingement syndrome found no significant difference in clinical outcomes between those injected using ultrasound guidance and those injected using landmark guidance.

Cole, B., et al. Ultrasound-Guided versus Blind Subacromial Corticosteroid Injections for Subacromial Impingement Syndrome. Randomized, Double-Blind, Clinical Trial. *Am J Sports Med*. 2016, March; 44(3): 702-707.

RESISTANCE TRAINING, MUSCLE MASS AND STRENGTH IN THE ELDERLY

Resistance training (RT) is important from the fifth to sixth decades of life, to control sarcopenia, as well as to enhance mobility and quality of life. Despite the efficacy of RT performed with heavy loads, some have suggested that strength and muscle mass gains are also achievable with

lighter loads. This literature review and meta-analysis compared the efficacy of heavy and light load RT in elderly cohorts.

Online databases were reviewed to retrieve studies comparing the effects of light to moderate RT to conventional, intense RT programs. Intense RT was defined as the use of loads of 80% of a one rep maximum or higher, while low to moderate RT was defined as using loads of 60% of a one rep maximum or lower.

Fifteen studies were included in the analysis, including data from 448 subjects. Training was performed three times per week in all studies. The total population effect favored high intensity RT, although this finding failed to reach statistical significance ($p=0.06$). Compared to no-training control groups, both training interventions were found to provoke strong significant gains in muscle strength ($p<0.001$ for both comparisons). When matching for the amount of work, average increases in strength were 43% in the high and 35% in the moderate load RT groups. All studies found training with higher intensities of load to be more effective in provoking muscle hypertrophy.

Conclusion: This meta-analysis found that both intensive and light to moderate load resistance training programs can increase skeletal muscle mass and strength in elderly cohorts.

Csapo, R., et al. Effects of Resistance Training with Moderate versus Heavy Loads on Muscle Mass and Strength in the Elderly: A Meta-Analysis. *Scand J Med Sci Sports*. 2016, Sept; 26(9): 995-1006.

SINGLE INJECTION OF HYALURONIC ACID VERSUS CORTICOSTEROID FOR KNEE OSTEOARTHRITIS

Treatment options for patients with osteoarthritis (OA) of the knee include injections with intra-articular hyaluronic acid or corticosteroids. As both have been found to be effective treatment options, this study was designed to clarify the difference between these two for relieving pain and improving function.

This double-blind, randomized, controlled study included 110 patients with symptomatic knee OA.

The subjects were randomized to receive an injection with either Hylan G-F20 or triamcinolone acetonide. The primary outcome variables were knee pain, functional improvement and knee range of motion at six-month follow-up.

At six months, both groups demonstrated significant improvement in visual analogue scale pain scores ($p<0.001$), modified WOMAC scores ($p<0.001$) and knee flexion ($p<0.001$). Pain was significantly more improved at 24, 48 and 72 hours, as well as one week after the injections, in the triamcinolone group as compared with the Hylan G-F20 group. WOMAC scores were similar between groups at all points except at two weeks, when the triamcinolone group obtained better scores.

Conclusion: This randomized, controlled trial of patients with knee osteoarthritis found that a single triamcinolone acetonide injection provides similar improvement in knee pain, function and range of motion at six months as does Hylan G-F20, with slight superiority of triamcinolone acetonide in the first two weeks.

Tammachote, N., et al. Intra-Articular, Single Shot Hylan G-F20 Hyaluronic Acid Injection Compared with Corticosteroid in Knee Osteoarthritis. A Double-Blind, Randomized, Controlled Trial. *J Bone Joint Surg*. 2016, June; 98 (11): 885-892.

SURVIVAL AFTER DIABETIC LOWER EXTREMITY AMPUTATION

Type II diabetes affects approximately 370,000,000 people worldwide, with complications including those involving the lower extremities. While the majority of diabetic foot ulcers heal, five to 24% require limb amputation within a period of six to 18 months. This study assessed the mortality rates following major amputations of those with diabetic wounds.

This retrospective study included records of patients admitted to a hospital with a diabetic foot amputation between January 1, 2001, and January 1, 2011. Clinical follow-up and results of patients with major lower limb amputations were assessed. The indications for major lower limb amputation were

failure of wound healing, an overwhelming infection or associated severe systemic comorbidities that impeded treatments.

A total of 223 patients were identified, all of whom had diabetic lower limb amputations. Of these, 62.8% had major amputations, of whom 27.8% had undergone a previous minor amputation of the same extremity. Postoperative wound complications were observed in 38.5%. The mortality rate of the group was 32.8% at one year and 70% at five years. A subgroup analysis revealed that, for those with below the knee amputations, one-year mortality was 24.6%, and five-year mortality was 66.3%. Among those with above the knee amputations, one year mortality was 43.3%, and five-year mortality 83.3%.

Conclusion: This study of patients with diabetes related amputations of the lower extremity found that mortality was 32.8% at one year and 70.5% at five years, with higher mortality in those with above the knee, as compared with below the knee, amputations.

Gok, U., et al. Survival Evaluation of the Patients with Diabetic Major Lower Extremity Amputations. *Musculoskel Surg*. 2016 DOI. 10. 1007/S12306-016-0399-y.

VITAMIN D DEFICIENCY AMONG PROFESSIONAL BASKETBALL PLAYERS

Previous studies have shown an effect of vitamin D on muscle function and recovery. As vitamin D has been linked to a deficiency in sunlight exposure, indoor athletes may be at particular risk. This study investigated the prevalence of vitamin D deficiency among players in the National Basketball Association (NBA).

This retrospective study included participants in the NBA Combines 2009 to 2013. Data obtained included age, height, weight, body mass index and vitamin D level. Vitamin D deficiency was defined as below 20 ng/mL, insufficiency between 20 and 32 ng/mL and sufficiency as above 32 ng/mL. Data were reviewed to assess the relationship between any player parameter and vitamin D status.

Among the 279 players evaluated, 32.3% were vitamin D deficient. In

addition, 47% were vitamin D insufficient. Only 20.8% were vitamin D sufficient. Vitamin D level was positively but weakly correlated with both height ($p=0.002$) and weight ($p=0.012$).

Conclusion: This study found a high prevalence of vitamin D deficiency and insufficiency among players attending the NBA Combine.

Fishman, M., et al. Vitamin D Deficiency among Professional Basketball Players. **Orthop J Sports Med**, July; 4(7): 2325967116655742.

SUPPRESSION OF ARTHRITIS BY A CALCIUM CHANNEL ANTAGONIST

Rheumatoid arthritis (RA) has a chronic relapsing course, often leading to the destruction of multiple joints. As osteoclastogenesis is dependent on calcium-release activated calcium current (CRAC) channels, suppression of these channels has been found to impair bone degrading osteoclasts. This study tested the effect of a CRAC antagonist, 3,4-dichloropropionaniline (DCPA) in an animal model of collagen-induced arthritis.

Collagen-induced arthritis was created using bovine-2 collagen plus 20 mg of Mycobacterium tuberculosis H37RA. At day 20, mice were provided with subcutaneous injections of either DCPA at 10.5mg/kg/day, 21 mg/kg/day or a placebo. The animals were monitored for arthritis and scored on an arthritic index, with all euthanized on day 40. Serum was analyzed for antibodies and cytokines, with histologic evaluation of the osteoclast bone interface and T-cell density.

While the lower dose of the DCPA had no significant effect on the mice, the higher dose reduced the arthritic index strongly before day 37 and by 20-50% at days 38 to 40. Bone and cartilage damage in sections of animal feet was reduced by 50% among those treated with the higher dose of DCPA. Effects on bone density were reduced more among the DCPA treated animals than in those without treatment.

Conclusion: This animal study of induced arthritis found that a calcium- release activated calcium channel antagonist can suppress the development of arthritis by approximately 50%.

Blair, H., et al. Suppression of Arthritis-Induced Bone Erosion by a CRAC Channel Antagonist. **RMD Open**. 2016.DOI:10.1136/rmdopen-2015-000093.

ULTRASOUND TREATMENT APPLIED WITH EXERCISE FOR ANKYLOSING SPONDYLITIS

Ankylosing spondylitis (AS) is a chronic inflammatory disease that often leads to back pain. Treatment goals include pain reduction and postural correction. As ultrasound (US) is a physical modality commonly used to treat musculoskeletal disorders, this study assessed the efficacy of US combined with exercise in ameliorating pain.

This randomized, prospective, double-blind, placebo-controlled trial included 50 patients diagnosed with AS. The subjects were randomized to perform exercise and receive US (15 minutes per session) or placebo US in 10 sessions over two weeks. Both groups were given instructions for an exercise program comprising postural stretching and breathing exercises. Both groups were evaluated for pain and stiffness, and with patient global assessments (PGAs), doctor global assessments (DGAs), the Bath Ankylosing Spondylitis Disease Activity Index (BASDAI), the Bath Ankylosing Spondylitis Metrology Index (BASMI), the Ankylosing Spondylitis Quality-Of-Life Questionnaire (ASQoL), and the Ankylosing Spondylitis Disease Activity Score (the ASDAS-ESR, and ASDAS-CRP).

While improvements were noted in both groups, significantly superior results were seen in the US group at week two for parameters of BASMI, tragus to wall distance, PGA and DGA, and at six weeks for daily pain and the PGA, VGA, BAS PAI, ASDAS-CRP, ASDAS-ESR, and lumbar side flexion, the modified Shober test and the ASQoL.

Conclusion: This study of patients with ankylosing spondylitis found that continuous ultrasound treatment with exercise therapy can reduce pain, stiffness and disease activity, as well as improve lumbar mobility and quality of life, better than exercise alone.

Karaamanlioglu, D., et al. Effectiveness of Ultrasound

Treatment Applied with Exercise Therapy in Patients with Ankylosing Spondylitis: A Double-Blind, Randomized, Placebo-Controlled Trial. **Rheum Intern**. 2016, May; 36 (5): 653-661.

FRACTURE RISK WITH PARATHYROIDECTOMY AND BIPHOSPHONATES IN HYPERPARATHYROIDISM

Primary hyperparathyroidism (PHPT) is a common endocrine disorder, which, if left untreated, leads to a loss of bone mineral density (BMD) over time. As surgery is the only definitive treatment for PHPT, this study examined changes in BMD and fracture rates among patients with PHPT, treated with parathyroidectomy, biphosphonates or observation.

The Kaiser Permanente Southern California Laboratory Management System was queried to identify patients with a biochemical diagnosis of PHPT from 1995 through 2010. Those who initiated phosphonate treatment before the date of study inclusion and those treated with less than one year of biphosphonates were excluded. The database was reviewed to identify patients who underwent a parathyroidectomy, BMD results and for fracture outcomes. The change in BMD was studied over four discrete periods: zero to two years, two to five years, five to eight years, and beyond eight years. The study included 6,272 patients with PHPT. At baseline, 11% had normal BMD, 36% had osteopenia and 53% had osteoporosis. BMD increased in women after parathyroidectomy by 4.2% within two years and with bisphosphonates by 3.6% within two years, declining thereafter. In men, bisphosphonate treatment resulted in a sustained increase in BMD. BMD declined with observation only, in both men and women, losing 6.6% and 7.6%, respectively, at greater than eight years follow-up. In osteopenic and osteoporotic patients, parathyroidectomy was associated with reduced risks of hip fracture and any fracture, as compared with observation only, while biphosphonates were associated with an increased risk.

Conclusion: This study of patients with primary hyperparathyroidism found that the risk of fracture is reduced in those undergoing parathyroidectomy, with no reduction realized with the use of

biphosphonates.

Yeh, M., et al. The Relationship of Parathyroidectomy and Biphosphonate with Fracture Risk and Primary Hyperparathyroidism. An Observational Study. *Ann Intern Med.* 2016, June 7; 164(11): 715-723.

TRANSCRANIAL DIRECT CURRENT STIMULATION FOLLOWING LUMBAR SURGERY

While systemic opioid medications have been effective for pain relief, postoperative complications include mental clouding, confusion, and addiction. This study was designed to evaluate the effect of transcranial direct current stimulation (tDCS) on pain reduction among patients receiving spinal surgery.

Subjects were 27 patients undergoing lumbar spine procedures requiring overnight hospitalization. The patients were randomly assigned to receive four 20 minutes sessions of tDCS or a sham procedure during hospitalization. Postoperative orders included a standardized protocol for self-administered PCA hydromorphone

with patient pain ratings collected by a Brief Pain Inventory administered at admission and at discharge from the hospital. The groups were compared for use of PCA and pain ratings.

At the time of discharge, participants in the tDCS group used an average of 12.6 mg of hydromorphone while those in the sham group used an average of 16.5 mg, a 23% reduction in PC usage. Despite this difference in medication use, the groups did not differ in subjective reports of pain.

Conclusion: This study of patients undergoing lumbar spine surgery suggests that treatment with transcranial direct current stimulation may result in a reduced need for opioid pain medications during hospitalization.

Glaser, J et al. Motor/Prefrontal Transcranial Direct Current Stimulation (tDCS) Following Lumbar Surgery Reduces Postoperative Analgesia Use. *Spine.* 2016, May; 41 (10):835 – 839.

Musculoskeletal in Review (MSK) is produced by physicians specializing in musculoskeletal and neurological medicine, with the cooperation and assistance of Emory University School of Medicine. Summaries appearing in this publication are intended as an aid in reviewing the literature relevant to the practice of clinical musculoskeletal medicine. The summaries appearing in this publication are intended as an aid in reviewing the broad base of literature relevant to this field.

These summaries are not intended for use as the sole basis for clinical treatment, or as a substitute for the reading of the original research.

MSK is affiliated with the World Health Organization and multiple national medical societies worldwide.

Private subscriptions are available by email at mskinreview@aol.com or by phone at (417) 779-9101.



MUSCULOSKELETAL IN REVIEW

**Produced by the Department of
Rehabilitation Medicine, Emory
University School of Medicine**

Expanding the frontier of medicine in research, teaching, and patient care