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EXTRACORPOREAL SHOCKWAVE THERAPY FOR MENISCAL TEARS

As extracorporeal shockwave therapy (ESWT) has been effective in the treatment of tendinopathies, this animal study explored the effect of ESWT in promoting the healing of meniscal tears.

Twelve-week-old male rats were divided into three groups: normal [untreated], ESWT(-), and ESWT(+). The latter two groups were subjected to full-thickness tears in the avascular region of the anterior horn. One week after surgery, the ESWT (+) group received 800 impulses of shockwave at 0.22-mJ/mm^2 energy flux density. At two, four, and eight weeks post- surgery, the rats were euthanized, and compared by histological and immunohistochemical analysis.

The meniscus healing scores of the ESWT+ group were significantly higher than the ESWT- group at four weeks (p=0.009) and eight weeks (p=0.015), with all rats in the ESWT+ group demonstrating bridge linking at eight weeks. The ratio of BrdU-positive cells to all cells was significantly higher in the ESWT+ group than in ESWT- groups at two weeks (p=0.046), four weeks (p=0.008), and eight weeks (p=0.009). Gene expression was measured for *CCN2, SOX9, VEGF-a*, aggrecan, collagen type 2 alpha 1 (*Col1a2*), and collagen type 2 alpha 1 (Col2a1). The CCN2 upregulation was greater in the ESWT+ group than in the normal and ESWT- groups (p=0.05 for both). The SOX9 was also significantly upregulated in the ESWT+ group to a level approximately 3.5-fold higher than that in the normal and ESWT- groups (p=0.002 and p=0.003, respectively).

Conclusion: This animal study of meniscal tears found that extracorporeal shockwave therapy can accelerate the healing of a meniscal tear in the avascular region.

Hashimoto, et al. Extracorporeal Shockwave Therapy Accelerates the Healing of a Meniscal Tear in the Avascular Region in a Rat Model. **Am J Sports Med.** 2019, October;47 (12):2937–2944.

PEFICITINIB FOR RECALCITRANT RHEUMATOID ARTHRITIS

The Janus kinase (JAK) family of non-receptor protein tyrosine kinases have been found to be a promising alternative target for rheumatoid arthritis (RA) treatment. This study assessed the efficacy of a JAK inhibitor, Peficitinib, for the treatment of RA.

This randomized, placebo controlled, double-blind study was completed at 142 sites in Japan. All participants were diagnosed with RA, with a history of a poor response to other DMARDs. The subjects were randomized to receive treatment for 52 weeks with Peficitinib, 100 mg per day, 150 mg per day, or placebo once daily, orally, in combination with a stable dose of MTX (≤16 mg/ week) for 52 weeks. The primary efficacy endpoint was response rate at week 12, according to the ACR-20 improvement criteria, with secondary endpoints, assessed throughout the study, involving response rates to the ART 20/50/70 improvement criteria.

Five hundred nine patients completed the study. The primary efficacy variable at week 12 occurred in 57.7% of the 100 mg group, 70 4.

% of the 150 mg group, 83.5% of the entaracept group and 30.7% of the placebo group. Compared to placebo, significantly better outcomes were noted in the 100 mg and 150 mg groups (p<0.001 for both comparisons). Compared to the placebo group, the increase in ART 20/50/70s was significantly better throughout the study in the 100 mg and 150 mg groups as well as in the entaracept group.

Conclusion: This study of patients with DMARD resistant rheumatoid arthritis found significant improvement with a novel Janus kinase inhibitor, Peficitinib.

Tanaka, Y., et al. Efficacy and Safety of Peficitinib (ASP015K) in Patients with Rheumatoid Arthritis and an Inadequate Response to Conventional DMARDs: A Randomized, Double-Blind, Placebo Controlled, Phase 3 Trial (RAJ3). **Annals Rheum Dis.** 2019, October; 78(10): 1320-1322.

PLATELET RICH PLASMA VERSUS DRY NEEDING FOR ACHILLES TENDINOPATHY

For the treatment of tendinopathies, platelet rich plasma (PRP), and dry needling (DN) have shown some success in the reduction of pain and improvement of function. This study compared these two interventions for the treatment of non- insertional Achilles tendinopathy.

Subjects were patients with non-insertional Achilles tendinopathy for more than three months. Baseline measures including demographic and anthropomorphic data as well as pain on a visual analog scale (VAS), and an ultrasound examination of the tendon. The PRP group received five ml of mepivacaine 2% with a 21-gauge needle inserted into the tendon, with autologous PRP deposits place at the site of the most damage, and then proximal and distal for total of 4-5 mL. The three injections were performed at one week intervals. The dry needling group used a 21-gauge needle with multiple longitudinal passes performed over the tendon once a week for three weeks. After the second procedure, eccentric training and stretching was recommended daily for at least three months. Outcome measures included the Victorian Institute of Sport Assessment-Achilles (VISA-A), and pain evaluated by means of a 0–10 cm Visual Analogue Scale (VAS).

Data were complete for 46 patients in the PRP group and 38 in the DN group. From baseline to three and six month follow up the VAS-A scores for the PRP group were 49.7, 63.7 and 68.4 respectively (p=0.04) and for the DN group were 50,8, 62 and 64.8 respectively (p=0.13), with no significant difference between groups at any time period. At six months, VAS pain scores and the number of patients who had satisfactory results did not differ between groups.

Conclusion: This study of patients with Achilles tendinopathy found no significant difference in outcomes

between those treated with dry needling and those treated with platelet rich plasma.

Abate, M., et al. Platelet Rich Plasma Compared to Dry Needling in the Treatment of Non-Insertional Achilles Tendinopathy. **Phys Sportsmed.** 2019; 47 (2): 232–237.

WARMUP IN YOUTH BASEBALL VERSUS INJURY

Shoulder and elbow injuries are common in baseball players of all ages. Players 9 years of age or older have a significantly greater risk of medial elbow injury than those less than 9 years of age. Given previous studies have identified variables of physical function as risk factors for throwing injuries, this study assessed a preventative program focusing on these factors.

This prospective cluster randomized controlled study included 16 youth baseball teams in Yokohama Japan, who were block randomized into an intervention group or a control group. Players 9-12 years old were given a questionnaire concerning the position played and quantification of involvement each week. Those in the intervention group were instructed to perform stretching exercises aimed at improving range of motion at the elbow, and hip with dynamic mobility exercises focusing on the scapular and thoracic function with lower extremity balance training.

The program was completed within 10 minutes. Participants perform the program once per week under the supervision of the coaches. Those in the control group continued their usual preparations. All participants were followed for injuries to the shoulder and elbow.

Data were available for 117 participants in the intervention group and 120 in the control group. Over

12 months, 22% of the intervention group and 38.2% of the control group reported shoulder and elbow injuries of the throwing arm. Incidence of these injuries was 3.1 per 1,000 events in the control group and 1.7 per 1,000 athletic events in the treatment group (p=0.01).

Conclusion: This study found that a 10-minute injury prevention program reduced the incidence of throwing injuries of the shoulder and elbow among youth baseball players.

Sakata, J., et al. Throwing Injuries in Youth Baseball Players: Can a Prevention Program Help? **Am J Sports Med.** 2019, September; 47 (11): 2709-2716.

EXPOSURE TO THE NATURAL ENVIRONMENT AND ARTHROPLASTY RECOVERY

Rates of hip and knee arthroplasty are rising globally and are projected to continue to rise as life expectancy and obesity rates increase. This New Zealand study assessed whether living in greener and or more walkable neighborhoods would have an effect on opioid use and mortality following hip or knee arthroplasty.

This cohort study followed patients who received total hip or knee arthroplasty [7,449 hip arthroplasties (THAs) and 6,558 knee arthroplasties (TKAs)] at a publicly- funded New Zealand hospital in 2006 and 2007. The individuals were followed longitudinally for nine plus years using healthcare records obtained from the Statistics New Zealand's Integrated Data Infrastructure. Outcomes included time to all-cause mortality and the number of post-surgical opioid prescriptions. Exposure to natural environment was assessed using greenness and walkability of patients' neighborhoods. Greenness was measured by the Normalized Difference Vegetation Index. Walkability was calculated using a previously validated Walkability Index (WI).

Patients who lived in greener neighborhoods lived longer and took fewer opioids in the 12 months following THA or TKA. These findings reached statistical significance only for THA. Walkability was not significantly associated with post-surgical longevity or opioid use.

Conclusion: This New Zealand observational study found that individuals living in greener neighborhoods lived longer and took fewer opioids following hip arthroplasty.

Donovan, G., et al. Relationship Between Exposure to the Natural Environment and Recovery from Hip or Knee Arthroplasty: A New Zealand Retrospective, Cohort Study. **BMJ Open**. 2019; 9: e029522.

PRE-SURGERY PHYSIOTHERAPY IN DEGENERATIVE LUMBAR SPINE DISORDER

Lumbar spine stenosis and disc herniation are the most common causes of spinal surgery. This study examined the effect of physiotherapy on walking and leg strength among patients scheduled for back surgery.

Subjects were consecutively recruited at a spinal clinic in Sweden between October of 2012 and March of 2015. All had a confirmed diagnoses of disc herniation, lumbar spine stenosis (LSS), degenerative disc disease (DDD) or spondylolisthesis of grade IV or greater. Patients allocated to a wait

list control group (C) received usual care, including information concerning the surgical procedure, postoperative rehabilitation and continued physical activity. The treatment group (TR) received physiotherapy twice per week for nine weeks, including exercises, behavioral interventions to decrease fear avoidance behavior and increase activity levels, with recommendations for physical activity of at least 30 minutes per day. Outcome measures included patient reported outcome and objective outcome measures at baseline and nine weeks, with the TR group compared to the C group.

At one year post-surgery, compared to the C group, patients in the TR group improved more on all variables from baseline to follow-up ($p< 0.001$ to $p<0.028$). Patients adhering to ≥12 treatment sessions significantly improved on all variables ($p<0.001$ to $p<0.032$), while those receiving zero to 11 treatment sessions improved only in normal walking speed ($p=0.035$). For post- surgical function at one-year, pre - surgical gait speed, self-rated walking ability and quadriceps strength together explained 17.4% ($p = 0.003$) of the variation in self-reported physical activity level. Adding pre-surgery physical activity level increased the explanatory value to 27.5% ($p = < 0.001$)

Conclusion: This study found that pre-surgical physiotherapy increased walking ability and strength, with these variables correlated with one-year postoperative physical activity.

Fors, M., et al. Effects of Pre-surgery Physiotherapy on Walking Ability and Lower Extremity Strength in Patients with Degenerative Lumbar Spine Disorder: Secondary Outcomes of the PREPARE Randomized, Controlled Trial. **BMC Musculoskelet Disord**. 2019; 20:468. https://doi.org/10.1186/s12891-019-2850-3.

INTRAARTICULAR CAPSAICIN FOR KNEE ARTHRITIS

With an increase in the average age of the population, the incidence of symptomatic knee osteoarthritis (OA) is increasing. This study assessed the long-term analgesic effect of intra-articular capsaicin on moderate to severe pain associated with OA of the knee.

Subjects were patients 45 to 80 years of age with radiographic evidence of chronic OA of the knee. The patients were randomly assigned to one of three treatment groups. These included a single intra-articular injection of; a) four mL of placebo, 2) synthetic trans- capsaicin 0.5 mg, 3) synthetic trans- capsaicin 1.0 mg. The subjects recorded pain during walking, daily from baseline to week 12, and then weekly for weeks 12 through 24.

Data were complete for 157 patients. The reduction in pain scores between baseline and week 12 was greater in the capsaicin 0.5 and 1 mg groups than in the placebo group ($p=0.07$ and $p=0.0001$, respectively). At week 24, compared with the placebo group, better pain relief was noted in the 1 mg group, but not in the 0.5 mg capsaicin group.

Conclusion: This study of patients with moderate osteoarthritis of the knee found that an intra-articular injection of capsaicin could significantly reduce pain, with the effects persisting for up to 24 weeks.

Stevens, R., et al. Randomized, Double-Blind, Placebo Controlled Trial of Intra-Articular Trans- Capsaicin for Pain Associated with Osteoarthritis of the Knee. **Arthr Rheum.** 2019, September; 71(9):1524-1533.

MARATHON RUNNING AND KNEE DAMAGE IN THE MIDDLE-AGED

Few studies have investigated the effects of marathon running on the internal structures of the knee. This study reviewed the effects of marathon running on the knee joints of first-time marathoners.

Subjects were 82 healthy, middle-aged, asymptomatic volunteers registered for their first marathon and 11 controls. All underwent bilateral MRI scans of the knee, six months before and two weeks after the marathon. The Knee Injury and Osteoarthritis Outcome Score (KOOS) was used as a self-report outcome measure.

Data were complete, including follow -up, for 71 subjects. At follow- up, MRI studies revealed decreased damage in the marathon group, including subchondral bone marrow edema in the condyles of the tibia ($p=0.011$) and femur ($p=0.082$). In contrast, worsened MRI scores were noted for the cartilage of the lateral patella ($p=0.0005$), semimembranosus tendon ($p=0.016$), iliotibial band ($p<0.0001$) and prepatellar bursa ($p=0.016$). After the marathon, only one runner obtained a worsened meniscus grade. The menisci of all other scanned knees remained unchanged. No significant changes between pre-marathon and post-marathon KOOS scores were identified in either group.

Conclusion: This study of middle-aged runners found that running a marathon improved MRI evidence of health in the subchondral bone of the tibial and femoral condyles but resulted in asymptomatic worsening of the peri-patella cartilage.

Horga, L., et al. Can Marathon Running Improve Knee Damage of Middle-Aged Adults? A Prospective Cohort Study. **BMJ Open Sport Exer Med.** 2019, October 16; 4-6.

PHONOPHERESIS WITH PHYLLANTHUS AMARUS FOR OSTEOARTHRITIS

Among the treatments for osteoarthritis (OA), ultrasound (US) has been used in combination with the drug therapeutic energy technique referred to as phonophoresis. As previous studies have found antioxidant and anti- inflammatory properties in Phyllanthus Amarus (PA), a rich source of polyphenols, this study assessed the efficacy of PA delivered by phonophoresis for the treatment of patients with OA of the knee.

Subjects were 30 patients, all over 50 years of age, with OA of the knee. The subjects were randomized to a control group or a treatment group. Both received daily sessions of US therapy ($1.0W/cm^2$ power at 1MHz), with the treatment group also receiving PA. The primary outcome measure was a visual analog scale (VAS) of pain, administered before and after 10 sessions of US treatment. Secondary outcomes included blood serum levels of TNF- Alpha, nitrous oxide (NO), superoxide dismutase (SOD) and serum total antioxidant capacity (TAC).

Compared with baseline values, a significant improvement in VAS pain scores was noted in both groups. The improvement was significantly better in the group receiving PA than in the control group ($p<0.01$). In addition, compared with baseline, the levels of TNF-alpha and NO were significantly more reduced ($p<0.01$ for both), and the SOD and TAC activity more increased, in the PA group than in the control group (both $p<0.01$).

Conclusion: This study of patients with osteoarthritis of the knee found that phonophoresis delivery of Phyllanthus Amarus resulted in better pain relief than did ultrasound alone. This improvement coincided with improvement on measures of oxidative stress and inflammation.

Pinkaew, D., et al. Phonophoresis Associated with Nanoparticle Gel from Phyllanthus Amarus Relieves Pain by Reducing Oxidative Stress and Pro-Inflammatory Markers in Adults with Knee Osteoarthritis. **Chin J Integr Med**. 2019, September; 25 (9): 691-695.

DULOXETINE AND GABAPENTIN FOR KNEE OSTEOARTHRITIS

Pain is a major symptom among patients with osteoarthritis (OA). As both duloxetine and gabapentin have been found to be useful for the treatment of pain from other conditions, this study compared these

two medications for the treatment of OA related pain.

This blinded, randomized, controlled trial included 150 patients with moderate to severe knee OA, all between 45 and 75 years of age. The subjects were randomly allocated to receive duloxetine, gabapentin or acetaminophen, titrated to a maximum of 60mg, 600mg and 2,000mg daily, respectively. The participants were assessed at baseline, two, four and 12 weeks after the intervention. Evaluations included a Visual Analog Scale (VAS) for pain severity and assessment of physical status using the Western Ontario and McMaster University's Osteoarthritis (WOMAC) questionnaire.

Both the gabapentin and duloxetine groups had significantly lower VAS scores as compared to the acetaminophen group in the first ($p<001$) and third months ($p<0.001$), with no significant difference between the two groups. Those in the gabapentin group had significantly better WOMAC total scores than did those in the duloxetine ($p= 0.006$) and acetaminophen ($p= 0.002$) groups, with no significant difference between the duloxetine and acetaminophen groups ($p= 0.77$).

Conclusion: This study of patients with moderate to severe osteoarthritis of the knee found that gabapentin and duloxetine have similar effects in reducing pain, with both superior to acetaminophen.

Enteshari-Moghaddam, A., et al. Efficacy of Duloxetine and Gabapentin in Pain Reduction in Patients with Knee Osteoarthritis. **Clin Rheum.** 2019, October; 38 (10):2873-2880.

ANTIBIOTICS FOR LOW BACK PAIN WITH MODIC CHANGES

Among patients with low back pain (LBP), those who have signal changes in the vertebral bone, extending from the endplate as visualized on magnetic resonance imaging (MRI) are described as having Modic changes. As some have speculated that these indicate a low-grade bacterial discitis, this study examined the efficacy of antibiotic treatment for patients with this finding.

This multicenter, randomized, double blind, placebo controlled Norwegian trial recruited adults 18-65 years of age with chronic LBP, lumbar disc herniation, and type I or type II Modic changes. The patients were randomized to receive amoxicillin 750 mg three times per day or placebo for three months. All patients were assessed with the Norwegian version of the Roland-Morris Disability Questionnaire (RMDQ) as well as the Oswestry Disability Index, low back pain intensity and health-related quality of life.

At one year the mean RMDQ scores had improved by 3.7 points in the amoxicillin group and 2.1 points in the placebo group ($p=0.04$). Among those assigned to the amoxicillin group 12% discontinued or paused treatment because of adverse events compared with 2% in the placebo group.

Conclusion: This study of patients with chronic low back pain and Modic changes on MRI found that those treated with amoxicillin had a statistically significant, though clinically small, improvement in disability scores as compared to those treated with placebo.

Braten, L., et al. Efficacy of Antibiotic Treatment in Patients with Chronic Low Back Pain and Modic Changes (the AIM Study): Double-Blind, Randomized, Placebo Controlled Multicentre Trial. **BMJ**. 2019 doi: 10.1136/bmj.l5654.

PLATELET RICH PLASMA FOR REFRACTORY LATERAL EPICONDYLITIS

Lateral epicondylitis (LE) has a prevalence of one to three percent in the United States. This study reviewed the long-term outcomes of patients with recalcitrant LE who were treated with platelet rich plasma (PRP).

This prospective study included 34 patients with refractory LE. All had received an autologous PRP injection between November of 2011 and May of 2013. Injections were of four to seven mL of PRP, with the shoulders immobilized in a sling for 48 hours post-injection. All were evaluated with the Oxford Elbow Score (OES), from which a minimal clinically important difference (MCID) was calculated.

At a mean long-term follow-up of 5.2 years, 87.1% exhibited a MCID in pain scores, while 90% had a MCID in function. Of the original group, two underwent a repeat injection and one underwent surgery. Significant improvement was noted in OES scores between baseline and post- operative, as well as long term follow up for overall OES scores as well as the three OES domains of Pain, Elbow Function and Psycho-Social ($p<0.001$ for all comparisons).

Conclusion: This study of patients with refractory lateral epicondylitis found that a single injection of autologous platelet rich plasma may be effective in providing long-term pain relief.

Brkljac, M., et al. Long-Term Follow-Up of Platelet Rich Plasma Injections for Refractory Lateral Epicondylitis. **J Ortho.** 2019, Nov-Dec; 16(6): 496-499.

HIP SURGERY AND ANTICOAGULATION

The incidence of total hip arthroplasty (THA) is expected to continue to rise as the population ages. While the international normalized ratio (INR) has historically been associated with the risk of bleeding, a clear association between that risk and INR level has not yet been established. This study examined the association between INR level and postoperative bleeding and mortality among patients undergoing a primary THA.

This prospective, cohort study included data from the American College of Surgeons' National Surgical Quality Improvement Program. Data were extracted for adults undergoing primary THA between 2005 and 2016. Only patients with a preoperative INR value obtained within two days of surgery were included in the analysis. The subjects were divided into groups by INR level, including; <1, INR 1- $\leq$1.25, INR 1.25-1.5, and INR $\geq$1.5. The primary outcome measure was bleeding that required a transfusion within 72 hours of surgery. Secondary outcomes included mortality, length of stay, pneumonia and infection.

Data were obtained for 17,567 patients. Mortality increased from 0.3% for INRs of <1 to 4.9% for INRs of $\geq$1.5 ($p<0.001$). Bleeding requiring transfusion increased from 13.2% for INRs <1, to 29.3% for INRs of 1.5 or greater ($p<0.001$). Independent risk factors for bleeding requiring transfusion included a preoperative INR of 1.25-1.5 (OR 1.55) and an INR of >1.5 (OR 1.55). In the adjusted analysis, the only group with an increased risk of mortality was that with an INR of 1.5 or greater (OR 2.69).

Conclusion: This study of patients undergoing total hip arthroplasty found an increased risk of bleeding with an INR of 1.25 or higher at the time of surgery, as well as an increased risk of death among those with an INR of 1.5 or higher.

Rudasill, S., et al. Revisiting the International Normalized Ratio Threshold for Bleeding Risk and Mortality in Primary Total Hip Arthroplasty. **J Bone Joint Surg.** 2019, Oct 11. doi: 10.2106/JBJS.19.00160.

PARAVERTEBRAL BLOCK FOR COMPLEX REGIONAL PAIN SYNDROME

For patients with intractable complex regional pain syndrome (CRPS) involving the upper extremities (UEs), a stellate ganglion block (SGB) has been a frequent therapeutic intervention. In clinical practice, this block is performed at the middle sympathetic ganglion located at the level of C6-C7. This study compared the efficacy of a T2 paravertebral block (T2PV) with that of a standard SGB for the treatment of CRPS.

Subjects were adult patients with unilateral CRPS of the upper extremity, randomized to either a T2PV or an SGB group. Those receiving SGB were injected with five mL of one percent lidocaine under ultrasound guidance. Those in the paravertebral group received 10 mL of one percent lidocaine. Temperature was measured at the volar aspect of the index finger in both hands before the procedure and up to 20 minutes after the procedure. The primary outcome variable was the difference in temperature increase between the treated and the contralateral UE. Pain was assessed with the numerical rating scale (NRS).

The change in temperature was 2.37° in the T2PV group, and 0.77° in the SGB group ($p<0.0001$). There was no significant change in temperature in the contralateral hand in either group. A Horner's sign was observed in 53% of those in the SGB group and in 86.7% of those in the T2PV group. At 20 minutes, the NRS pain scores were significantly better in the T2PV patients than in those in the SGB group ($p=0.007$). The duration of pain relief was greater among those in the T2PV group than among those in the SGB group (9.26 versus 37.2 hours; $p=0.015$).

Conclusion: This study of patients with upper extremity, complex regional pain syndrome found that better and longer pain relief was achieved with a paravertebral block at the T2 level than with a standard stellate ganglion block at the C6-7 level.

Kim, Y., et al. A Prospective, Randomized, Crossover Trial of T2 Paravertebral Block as a Sympathetic Block in Complex Regional Pain Syndrome. **Pain Phys.** 2019; 22: E417-E424.

SHOCKWAVE VERSUS STEROID INJECTION FOR CARPAL TUNNEL SYNDROME

For patients with carpal tunnel syndrome (CTS), many will choose conservative treatments before considering surgical intervention. This study compared the clinical efficacy of steroid injection with that of extracorporeal shockwave therapy (ESWT) for patients with CTS.

Subjects were patients 26 years of age or older with CTS verified by electrodiagnostic evaluation. The participants were randomized to receive either ESWT, three times per week, for three consecutive weeks, or 40 mg of betamethasone, injected once into the carpal tunnel, adjacent to the median nerve. The median sensory and motor distal latencies and amplitudes were evaluated at baseline and at follow-up.

The visual analog scale (VAS) for pain and paresthesia, and the Boston Carpal Tunnel Questionnaire (BQ) scores, at both the three- and nine- week follow-ups were improved in both groups. The ESWT group demonstrated better recovery on the visual analog scale (VAS) for pain and paresthesia and the Boston Carpal Tunnel Questionnaire (BQ) at week 12, as compared with the steroid group. The ESWT group had an improvement in the distal latency of the sensory nerve action potential at nine- and 12-week follow-ups, with significantly better improvement than the steroid group at 12 weeks ($p<0.05$).

Conclusion: This study found that nine sessions of extracorporeal shockwave therapy significantly improved symptoms and function in patients with carpal tunnel syndrome, with better recovery as compared to an injection with corticosteroids.

Xu, D., et al. A Randomized, Controlled Trial Comparing Extracorporeal Shockwave Therapy versus Local Corticosteroid Injection for the Treatment of Carpal Tunnel Syndrome. **Intern Ortho.** (SICOT) (2019). https://doi.org/10.1007/s00264-019-04432-9.

RADIOFREQUENCY ABLATION FOR CHRONIC KNEE PAIN

Previous studies have suggested that radiofrequency ablation of the geniculate nerve may be effective for the treatment of pain due to osteoarthritis (OA) of the knee. Some have proposed that pain relief may be greater with cooled radiofrequency ablation (CRFA). This retrospective study examined "real-life" data demonstrating the effects of CRFA for a heterogeneous group of patients treated for OA of the knee.

Consecutive patients seen for OA of the knee between July 2014 and July 2017 were eligible for inclusion. Baseline data included a visual analog scale (VAS) for pain. The CRFA procedure included sensory stimulation at 50 Hz, conducted at less than 0.5 V, for reproduction of the target pain, followed by ablation at a temperature of 60°C. All procedures were completed under sedation, using a 17-gauge cooled RF introducer under fluoroscopic visualization. Pain scores were obtained before and after treatment. The use of pain medications was followed over time.

The average baseline CRFA pain score improved from 8.5/10 cm to 4.2/10 cm after treatment. A total of 65% of the patients had at least a 50% reduction in pain scores. The mean duration of at least 50% pain relief was 12.5 months. There was, however, no significant decrease in opioid use during that time.

Conclusion: This study of patients with chronic pain due to osteoarthritis of the knee found that cooled radiofrequency ablation resulted in significant and long-lasting pain relief.

Kapural, L., et al. Long-Term Retrospective Assessment of Clinical Efficacy of Radiofrequency Ablation of the Knee Using a Cooled Radiofrequency System. **Pain Physician**. 2019, September; 22(5): 489-494.

TRANSCRANIAL DIRECT CURRENT STIMULATION AND LOW BACK PAIN

Chronic low back pain (CLBP) is a common disorder, often resistant to effective treatment strategies. Transcranial direct current stimulation (tDCS) is a noninvasive brain stimulation technique which has shown benefits in treating patients with various pain disorders. This study evaluated the efficacy of tDCS on pain intensity among patients with CLBP.

This prospective, double-blind, randomized, sham controlled study recruited patients, 18 to 65 years of age, each with nonspecific CLBP. All subjects received 20 minutes of either real or sham tDCS. Pain intensity was measured by a Numerical Rating Scale (NRS) and low back muscle activity assessed using topical EMG, both before and after the treatment session. For both the tDCS and sham groups, the anode dry electrode was placed over the C3/C4 position and the cathode over M1. The tDCS was applied at a constant current of 2mA and was delivered for 20 minutes.

Data were gathered for 26 patients who received tDCS and 25 receiving sham tDCS. NRS scores decreased from 5.1 to 3.34 in the DCS group ($p<0.001$) and from 4.6 to 4.36 in the sham group ($p=0.670$). EMG

data revealed no difference between groups.

Conclusion: This study of patients with chronic low back pain found that a single episode of transcranial direct current stimulation could reduce back pain severity.

Jiang, N., et al. Effect of Dry, Electrode Based, Transcranial, Direct Current Stimulation on Chronic Low Back Pain and Low Back Muscle Activities: A Double-Blind, Sham Controlled Study. **Restor Neurol Neurosci.** 2020. 10.3233/RNN- 190922.

LUMBAR ARTIFICIAL DISCS

In the past decade, lumbar total disc replacement has been found to be safe and effective for the treatment of lumbar discogenic low back pain. This study compared the five-year outcomes of patients treated with a new more mobile disc, the activL, with those treated with the ProDisc-L (control).

This prospective, multicenter, randomized, controlled trial included patients with pain and dysfunction due to degenerative disc disease at a single symptomatic level. The participants were randomized to receive an activL or a ProDisc-L. Treatment success was defined as improvement on the Oswestry Disability Index of at least 15 points, maintenance or improvement in neurologic status, maintenance or improvement in range of motion and freedom from repeat surgery.

In the 324 patients, no difference was found between the groups in the primary, composite event at five years. At five years, the activL group had greater ROM for flexion-extension rotation (p=0.02) and flexion-extension translation (p=0.03), as compared with the control (ProDisc-L) group. Freedom from a serious adverse event through five years was 64% in the activL patients and 47% in the ProDisc-L group (p=0.0068).

Conclusion: This long-term follow -up of patients with degenerative disc disease found that a new artificial disc, the activL, produce similar improvement in pain to that with the ProDisc-L, with superior range of motion seen in the activL group.

Yue, J., et al. Five-Year Results of a Randomized, Controlled Trial for Lumbar Artificial Discs in Single-Level Degenerative Disc Disease. **Spine.** 2019, December 15; 44 (24): 1685-1696.

PULSED RADIOFREQUENCY FOR CHRONIC LUMBOSACRAL PAIN

Pulsed radiofrequency (PRF) was developed as an alternative to continuous radiofrequency for the treatment of pain disorders. This study evaluated the efficacy of high-voltage PRF in the treatment of lumbosacral radicular pain with neuropathic features.

Subjects were 41, consecutive, adult patients with single leg radiating pain, unresponsive to conservative treatment. The patients were randomized to receive a placebo or active PRF for two cycles of 240 seconds each, at two Hz, with voltage at 65 to 80 V. This treatment was followed by adhesiolysis (EA), performed with injection of hyaluronidase, 900 units, and betamethasone, eight mg, with a total volume of five ml. The control group underwent EA only. The primary outcome variable was pain intensity, measured with a Numerical Rating Scale (NRS) score. Secondary outcomes included the Oswestry Disability Index and the McGill Pain Questionnaire.

At one-month follow-up, 57% of the patients in the PRF-EA group experienced pain reduction of at least 50%, as compared with 25% in the EA group. At six months, 48% in the PRF-EA group reported continued improvement, compared with only 10% in the EA group.

Conclusion: This study of patients with chronic, lumbosacral, radicular pain found that high-voltage pulsed radiofrequency may be effective in reducing pain.

Vigneri, S., et al. Electrocatheter-mediated, High-Voltage Pulsed Radiofrequency of the Dorsal Root Ganglion in the Treatment of Chronic Lumbosacral Neuropathic Pain. A Randomized, Controlled Study. **CI J Pain**. 2020, January; 36 (1): 25-33.

NECK PAIN AND VERTIGO

Neck pain and vertigo often occur simultaneously. Previous studies have shown a bidirectional segmental nerve fiber connection between the cervical spine and sympathetic ganglia. This paper reports on two studies; a retrospective study of vertigo in patients who were treated with a cervical lamina block therapy, and a prospective animal study.

The retrospective study included 90 patients with vertigo and neck pain, randomized to a treatment or a control group. All were treated with a vasodilator. Those in the treatment group underwent a cervical lamina block. Outcome measures included the Dizziness Assessment Rating Scale (DARS), and the Visual Analog Scale (VAS) to assess changes of vertigo and neck pain symptoms. Ultrasound was used to measure bilateral vertebral artery flow. The prospective study included 98 rabbits randomized to a control group or to one of seven treatment groups, one with stimulation at each of the C2 through C8 spinal ganglion (n = 27 in each group). Animals in each experimental group then received either normal saline solution or phentolamine (an adrenergic blocker). The exposed ganglion received electric stimulus at 10V, frequency 30 Hz, and duration of five minutes. Vertebral artery flow was measured before and after stimulation.

In the retrospective control group, 81% reported significant improvement using the vasodilator only. Among those receiving a laminar block 89.6% demonstrated improvement in vertigo symptoms, though this did not meet statistical significance either in the VAS or the DARS. The treatment group had significant fewer hospital stays (p=0.000). In the animal study, a change in VA blood flow was noted with stimulation of the ipsilateral C2 to C3 or C6 to C8 spinal ganglia (p = 0.011 and p= 0.002), but not the C4 or C5. The block with phentolamine significantly inhibited this decrease of basilar artery (BA) flow.

Conclusion: This study of patients with cervical pain and vertigo found a potential connection between the cervical spinal and sympathetic ganglia and suggests that the adrenergic system may serve as a possible neurotransmitter.

Zhu, X., et al. Functional Pathway Between Cervical Spinal and Sympathetic Ganglion: A Neurochemical Foundation Between Neck Pain and Vertigo. **Pain Physician.** 2019:22: E627-E633.

LOW INTENSITY RESISTANCE AFTER HEAT STRESS

As studies have found that heat stress can induce muscle hypertrophy, this study evaluated the effect of low intensity resistance training when heat stress is applied prior to training.

Subjects were 30, healthy, male volunteers, assigned to resistance training at 30% of their one-repetition maximum, with three sets of eight repetitions, three days per

week for six weeks. Those randomly assigned to a heat stress group underwent a 20-minute application of a hot pack, heated to 75°C, and placed on the dominant upper arm. This process was completed just prior to the resistance training. The thickness of the triceps brachial muscle was measured using ultrasound at baseline and at follow-up.

No significant change was noted in the one-repetition maximum or muscle thickness (p=0.289) in the control group. However, in the heat stress group, a significant improvement was seen in both muscle strength (p=0.003) and muscle thickness (p=0.012).

Conclusion: This study of patients undergoing low intensity resistance training found that heating a muscle with a hot pack prior to resistance training resulted in greater increases in muscle thickness and strength.

Nakamura, M., et al. The Effect of Low Intensity Resistance Training after Heat Stress on Muscle Size and Strength of Triceps Brachii: A Randomized, Controlled Trial. **BMC Musculoskelet Disord**. 2019, December 12; 20: 603.

SHOULDER ADHESIVE CAPSULITIS

Adhesive capsulitis (AC) occurs when excessive fibrous tissue and adhesions are formed across the glenohumeral joint, resulting in pain and restricted motion. While several interventions have been used for AC, there is no evidence-based consensus concerning the most effective treatment. This systematic review and meta-analysis was designed to compare the efficacy of various pharmacological treatment options.

Medical literature was reviewed for studies of adult patients with adhesive capsulitis that compared at least two pharmacological interventions, including oral and injected. The data analysis included subjects from 30, randomized, controlled trials.

Patients in the 30 selected trials were 789 males and 1,343 females. In the studies that focused on short-term outcome, compared with controls, intra-articular corticosteroid injections and distention with corticosteroids resulted in significantly greater improvement in pain scores than seen in the control condition. In the one trial that included ultrasound- guided rotator interval injection, this intervention was superior to all others. In studies looking at outcomes at two to six months, rotator-interval injection was superior to placebo. For composite outcomes, multiple-site corticosteroid injections were superior to placebo.

Conclusion: This meta-analysis of interventions for adhesive capsulitis found that intra-articular corticosteroid injection, administered alone or after distention of the shoulder capsule, was effective in providing pain relief.

Kitridis, D., et al. Efficacy of Pharmacological Therapies for Adhesive Capsulitis of the Shoulder: A Systematic Review and Network Meta-analysis. **Am J Sports Med.** 2019, December; 47 (14): 3552-3560.

BALANCE TRAINING AFTER HIP FRACTURE

Hip fractures in the elderly can significantly impact the ability to maintain independence. The effect of balance training for patients recovering from hip fracture is unknown. This meta-analysis explored the effect of this intervention on recovery after fracture of the hip.

A literature review was completed for studies of patients with hip fracture, with intervention including balance training, and functional outcomes. From this search, nine studies were chosen, all published between 1997 and 2018, including a total of 872 patients.

Patients receiving balance training had significantly better post-operative function than controls (p=0.001). In addition, compared to controls, gait speed was better among those in the balance training group (p=0.005), as were lower limb strength (p=0.000), activities of daily living (p=0.000), performance task scores (p=0.000) and health-related quality of life scores (p=0.000).

Conclusion: This meta-analysis found that balance training after a hip fracture can improve outcomes and quality of life.

Wu, J., et al. Efficacy of Balance Training for Hip Fracture Patients: A Meta-analysis of Randomized, Controlled Trials. **J Orthop Surg Res**. 2019; 14: 83.

KINESIOTAPE AND DRY NEEDLING FOR NECK PAIN

Neck pain is thought to be a major public health problem, with a lifetime prevalence of over 40%. Mechanical neck pain is defined as generalized neck pain and/or shoulder pain with mechanical features, aggravated by neck posture, movement, or palpation. This study assessed the efficacy of treatment with kinesiotape and dry needling for the symptoms of mechanical neck pain.

Patients presenting with mechanical neck pain were randomly assigned to receive either dry needling or kinesiotape therapy. Both groups were taught home-based exercises. The dry needling intervention focused on tender points identified on physical examination. These points were needled six to eight times, with sessions performed once a week for four weeks. The kinesiotape was applied to the area of the C3-6, stretched at 15% to 25% of its original length. Evaluations were made with the numeric rating scale (NRS) and the Short Form-36 Quality of Life Scale (SF-36).

At follow-up, both the dry needling and kinesiotape groups reported significant improvement in pain, depression and quality of life ($p=0.0001$ for all). In addition, the kinesiotape group demonstrated increased cervical range of motion ($p<0.05$).

Conclusion: This uncontrolled study of patients with mechanical neck pain found that both dry needling and kinesiotape can improve pain, quality of life and depression.

Onat, S., et al. Effect of Dry Needling Injection and Kinesiotaping on Pain and Quality of Life in Patients with Mechanical Neck Pain. **Pain Physician.** 2019, November; 22(6): 583-589.

PROGRESSIVE RETURN TO ACTIVITY AFTER CONCUSSION

For patients with concussion current best practices recommend a progressive return to activity (PRA). The Defense and Veterans Brain Injury Center developed a PRA clinical recommendation (CR) to assist primary care physicians with the management of patients with concussions. This study of military personnel assessed the effectiveness of the Defense and Veterans Brain Injury Center's Progressive Return to Activity Clinical Recommendation (PRA-CR).

Primary care managers caring for patients with concussion were recruited. Eligible patients sustained a concussion within 72 hours of the evaluation and were ineligible if they had a history of moderate or severe TBI. The study compared the recovery patterns of patients who receive treatment for concussion either before or after the clinic began using the PRA–CR. All underwent

(Continued from page 2)

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assessment with the Neurobehavioral Symptom Inventory (NSI).

The total NSI scores, as well as the cognitive and affective subscores were significantly better in the PRA- CR group than in the control group, when measured at one week, one month, and three months ($p<0.05$ for all comparisons). The significance had disappeared at six months.

Conclusion: This study of military personnel with acute concussions demonstrated that a progressive return to activity, encouraged by the primary care providers, may accelerate symptom recovery.

Bailie, J., et al. Use of the Progressive Return to Activity Guidelines May Expedite Symptom Resolution after Concussion for Active Duty Military. **Am J Sports Med.** 2019, December; 47 (14): 3505–3513.

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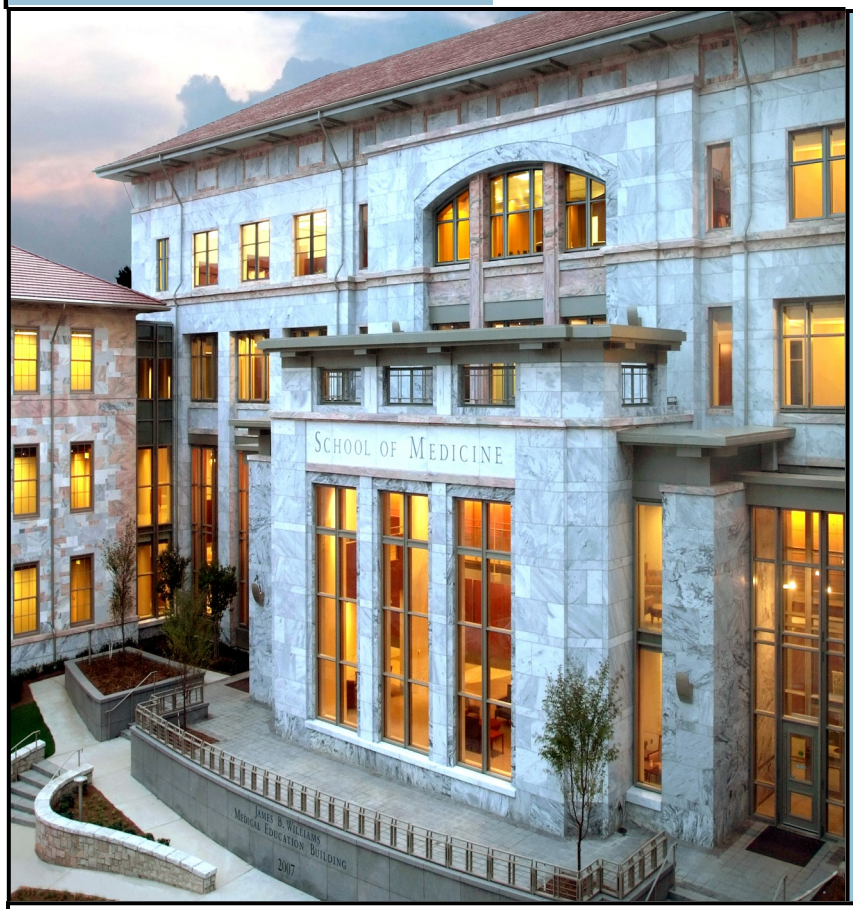

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