Abstracts Feb. 11 – FMT

Pain perception after isometric exercise in women with fibromyalgia. Hoeger Bement MK, Weyer A, Hartley S, Drewek B, Harkins AL, Hunter SK

Archives of physical medicine and rehabilitation Add to My Journals List
201101 92(1):89-95 Language: eng Country: United States Department of Physical Therapy, Marquette University, Milwaukee, WI.

UNLABELLED: Hoeger Bement MK, Weyer A, Hartley S, Drewek B, Harkins AL, Hunter SK. Pain perception after isometric exercise in women with fibromyalgia.

OBJECTIVE: The purpose of this study was to identify exercise protocols incorporating isometric contractions that provide pain relief in women with fibromyalgia.

DESIGN: A before-after trial.

SETTING: A physical therapy department in an academic setting.

PARTICIPANTS: Fifteen women (mean ± SD, 52±11y) with fibromyalgia.

INTERVENTIONS: Subjects completed 4 sessions: 1 familiarization and 3 experimental. The following randomized experimental sessions involved the performance of isometric contractions with the elbow flexor muscles that varied in intensity and duration: (1) 3 maximal voluntary contractions (MVCs), (2) 25% MVC held to task failure, and (3) 25% MVC held for 2 minutes.

MAIN OUTCOME MEASURES: Experimental pain (pain threshold and pain rating), Fibromyalgia Impact Questionnaire, and fibromyalgia pain intensity (visual analog scale).

RESULTS: After all 3 isometric contractions, there was considerable variability between subjects in the pain response. Based on the changes in experimental pain, subjects were divided into 3 groups (increase, decrease, no change in pain). Multiple regression analysis revealed that age, baseline experimental pain, and change in fibromyalgia pain intensity were significant predictors of the experimental pain response after the isometric contractions.

CONCLUSIONS: We identified subgroups of women with fibromyalgia based on how they perceived pain after isometric contractions. The greatest pain relief for women with fibromyalgia occurred at a younger age and in women with the greatest experimental pain before exercise. Additionally, we established a link between experimental and clinical pain relief after the performance of isometric contractions.

Osseous deficits after anterior cruciate ligament injury and reconstruction: a systematic literature review with suggestions to improve osseous homeostasis. **Nyland J, Fisher B, Brand E, Krupp R, Caborn DN**

Arthroscopy : the journal of arthroscopic & related surgery : official publication of the Arthroscopy Association of North America and the Internation Add to My Journals List

201009 26(9):1248-57 Language: eng Country: United States Department of Orthopaedic Surgery, University of Louisville, Kentucky 40202, USA. john.nyland@louisville.edu PURPOSE: This systematic review was performed to improve our understanding of the current evidence regarding the influence of anterior cruciate ligament (ACL) injury and reconstruction on involved lower extremity apparent bone mineral density, bone content, or bone area mass (bone integrity). METHODS: Two independent reviewers performed a Medline search from 1966 to January 2010 using the terms "anterior cruciate ligament" or "ACL" combined with "wound" or "injury" and "bone density" or "osteoporosis." Study inclusion criteria were English-language human studies. Reference sections of selected studies were also reviewed. RESULTS: Ten studies were identified that met our inclusion criteria. Eight studies performed ACL reconstruction with bone-patellar tendon-bone autografts and interference screw fixation. One study performed ACL reconstruction by use of Achilles tendon allografts with interference screw and staple fixation. Two ACL injury studies either did not involve ACL reconstruction or attempted primary repair with sutures. All studies reported varying levels of decreased bone mineral density, bone content, or bone area mass (bone integrity) at the involved lower extremity after ACL injury that did not return to premorbid levels even with ACL reconstruction and rehabilitation. Sites of reduced bone integrity included the proximal and distal femur, proximal tibia, patella, and calcaneus. Bone loss was increased with limited weight bearing and prolonged disuse or immobilization; however, significant improvements were not observed with accelerated rehabilitation. Some studies reported relations between Lysholm, Tegner, International Knee Documentation Committee survey, or function scores and bone integrity, whereas others reported no or poor relations. CONCLUSIONS: Involved lower extremity bone integrity is decreased after ACL injury. Current evidence suggests that premorbid bone integrity is not re-established after ACL reconstruction even when accelerated rehabilitation is performed. Recommendations to improve osseous homeostasis and bone health after ACL injury and reconstruction are provided.

Effects of combined whole-body vibration and resistance training on muscular strength and bone metabolism in postmenopausal women.

Bemben DA, Palmer IJ, Bemben MG, Knehans AW

Bone Add to My Journals List
201009 47(3):650-6 Language: eng Country: United States Bone Density Research Laboratory, Department of Health and Exercise Science, University of Oklahoma, Norman, OK 73019, USA. dbemben@ou.edu Whole-body vibration (WBV) has been shown to be osteogenic in animal models; however, its application in humans is not clear. The purpose of this study was to examine the effects of an 8-month program involving WBV plus resistance training on bone mineral density (BMD) and bone metabolism in older postmenopausal women. Fifty-five estrogen-deficient postmenopausal women were assigned to a resistance training group (R, n=22), a WBV plus resistance training group (WBVR, n=21), or a control group (CON, n=12). R and WBVR performed upper and lower body resistance exercises 3 days/week at 80% 1 Repetition Maximum (1RM). WBVR received vibration (30-40 Hz, 2-2.8 g) in three different positions preceding the resistance exercises. Daily calcium intake, bone markers (Bone alkaline phosphatase (Bone ALP); C-terminal telopeptide of Type I collagen (CTX), and BMD of the spine, dual femur, forearm, and total body (DXA) were measured at baseline and after the intervention. At baseline, there were no significant group differences in strength, BMD, or bone marker variables. After 8 months of R or WBVR, there were no significant group or time effects in Bone ALP, CTX, or total body, spine, left hip or right trochanter BMD. However, right total hip and right femoral neck BMD significantly ($p<0.05$) decreased in all groups. A group x time interaction ($p<0.05$) was detected at radius 33% BMD site, with CON slightly increasing, and WBVR slightly decreasing. R and WBVR significantly ($p<0.05$) increased 1RM strength for all exercises, while CON generally maintained strength. WBVR had significantly ($p<0.05$) greater percent increases in muscular strength than R at 4 months for lat pull down, seated row, hip abduction and hip adduction and at 8 months for lat pull down, hip abduction and hip adduction. Bone metabolism in postmenopausal women was not affected by resistance training either with or without WBV. In contrast, the addition of WBV augmented the positive effects of resistance training on muscular strength in these older women.

Update on the relation between pain and movement: consequences for clinical practice. **Cote JN, Hoeger Bement MK**

The Clinical journal of pain Add to My Journals List
2010 Nov-Dec 26(9):754-62 Language: eng Country: United States Department of Kinesiology and Physical Education, McGill University, Montreal, Quebec, Canada. julie.cote2@mcgill.ca

It is generally thought that exercise is beneficial to alleviate pain. However, prolonged movement may lead to the development of painful injuries, because of the overload of low-threshold motor units. Especially in individuals with a pain condition, exercise prescription and the impact of fatigue is less clear. This may be because of the dual effects, aggravation and relief, which fatigue has on pain. The purpose of this review is to ascertain the relation between pain and the motor system, both in the development and management of pain. Recent studies show that fatigue alters pain-induced increases in corticomotor excitability and leads to within and between-muscle adaptations. Studies of acute pain have shown complex adaptations such as increased movement variability, which may be because of a search for motor solutions to prolong overall task performance. In contrast, chronic pain seems to limit movement duration, speed, and variability which could be protective in the short term but also counterproductive over time. Owing to these adaptations in movement strategies, pain chronicity may help to dictate exercise prescription. For example, the correct dosage of multimuscle, dynamic exercises would act to promote movement variability. Thus, it seems that exercise involving the use of different movement strategies could be effective in helping people to obtain exercise-induced benefits while avoiding injury and pain reaggravation.

Participating in and delivering the ATEAM trial (Alexander technique lessons, exercise, and massage) interventions for chronic back pain: A qualitative study of professional perspectives. **Beattie A, Shaw A, Yardley L, Little P, Sharp D**

Complementary therapies in medicine Add to My Journals List
2010 Jun-Aug 18(3-4):119-27 Language: eng Country: Scotland Department of Social Medicine, Canynge Hall, University of Bristol, 39 Whatley Road, Bristol BS8 2PR, United Kingdom. Angela.Beattie@bristol.ac.uk

OBJECTIVES: To outline professionals' experiences of participation, perceived benefits and acceptability of the interventions delivered in the ATEAM trial (Alexander technique lessons, exercise, and massage), for patients with chronic or recurrent back pain. DESIGN: Qualitative study using in-depth interviews was conducted with a purposeful sample of twenty professionals (general practitioners (GPs), nurses, Alexander technique teachers, and massage therapists). Data were recorded, transcribed, and analysed thematically using the constant comparison method. RESULTS: Evidence of effectiveness GPs wanted an evidence base for the interventions, whilst nurses, Alexander technique teachers and massage therapists perceived patient reports of benefit as evidence. Professionals' perception of the acceptability of the intervention: professional perspectives differed, with GPs and nurses viewing the structured nature of exercise prescription and Alexander technique lessons as more beneficial and acceptable than massage in alleviating patients' back pain. Economic cost: the cost to patients pursuing Alexander technique lessons and massage was perceived to be a barrier outside the trial. Inter-professional communication: there was little communication between the professionals groups within the trial. CONCLUSIONS: Valuable insights have been gained into the perceived benefits and acceptability of exercise, Alexander technique lessons and massage as interventions for chronic back pain. Lessons in the Alexander technique with or without exercise, was perceived as more beneficial and acceptable than massage by professionals who participated and delivered the ATEAM trial interventions.

Changes in muscle activation patterns and subjective low back pain ratings during prolonged standing in response to an exercise intervention. **Nelson-Wong E, Callaghan JP**

Journal of electromyography and kinesiology : official journal of the International Society of Electrophysiological Kinesiology Add to My Journals List
201012 20(6):1125-33 Language: eng Country: England Regis University, School of Physical Therapy, Denver, CO, USA. BACKGROUND:

Low back pain (LBP) development has been associated with occupational standing. Increased hip and trunk muscle co-activation is considered to be predisposing for LBP development during standing in previously asymptomatic individuals. The purpose of this work was to investigate muscle activation and LBP responses to a prescribed exercise program. Pain-developing (PD) individuals were expected to have decreased LBP and muscle co-activation following exercise intervention. METHODS: Electromyography (EMG) data were recorded from trunk and hip muscle groups during 2-h of standing. An increase of >10mm on visual analog scale (VAS) during standing was threshold for PD categorization. Participants were assigned to progressive exercise program with weekly supervision or control (usual activity) for 4weeks then re-tested. RESULTS: Forty percent were categorized as PD on day 1, VAS=24.2 (±4.0)mm. PD exercisers (PDEX) had lower VAS scores (8.93±3.66mm) than PD control (PDCON) (16.5±6.3mm) on day 2 ($p=0.007$). Male PDEX had decreased gluteus medius co-activation levels ($p<0.05$) on day 2. DISCUSSION: The exercise program proved beneficial in reducing LBP during standing. There were changes in muscle activation patterns previously associated with LBP. Predisposing factors for LBP during standing were shown to change positively with appropriate exercise intervention.

Acute effect of labile surfaces during core stability exercises in people with and without low back pain. **Desai I, Marshall PW**

Journal of electromyography and kinesiology : official journal of the International Society of Electrophysiological Kinesiology Add to My Journals List
201012 20(6):1155-62 Language: eng Country: England Department of Sport and Exercise Science, University of Auckland, New Zealand.

OBJECTIVE: The purpose of this study was to measure trunk muscle activity, whole body balance, and lumbar range of motion during core stability exercises in individuals with and without low back pain (LBP) on and off a labile surface. DESIGN: Descriptive cross-sectional study. SETTING: University laboratory. PARTICIPANTS: Ten individuals with chronic non-specific LBP and 10 matched control subjects. MAIN OUTCOME MEASURES: Bilateral trunk muscle activity was measured using surface electromyography (EMG); whole body balance was measured by quantifying the dispersion of the centre of pressure (CoP); lumbar range of motion (LROM) was measured with single-axis inclinometers. RESULTS: Individuals with LBP had adaptive recruitment patterns during the side-bridge and modified push-up exercises. CoP dispersion and LROM were not different between groups for any exercise. The labile surface did not change the difference between groups, and only increased muscle activity during the side-bridge ($p<0.05$). The labile surface increased LROM ($p=0.35$) and CoP dispersion ($p<0.001$) during the quadruped, decreased LROM during squats ($p=0.05$), and increased CoP dispersion during push-ups ($p=0.04$). CONCLUSION: Individuals with LBP exhibited adaptive trunk muscle activity levels while maintaining similar levels of balance and lumbar movement to healthy controls. Since research suggests no one mode of exercise is more beneficial in LBP rehabilitation, the practicality and safety of labile surfaces for LBP exercise rehabilitation must be questioned from this study.

Atlantoaxial facet locking: treatment by facet manipulation and fixation. Experience in 14 cases. **Goel A, Shah A**

Journal of neurosurgery. Spine Add to My Journals List
201101 14(1):3-9 Language: eng Country: United States Department of Neurosurgery, K.E.M. Hospital and Seth G.S. Medical College, Parel, Mumbai, India.

The authors report their experience with 14 children in whom acute torticollis or a fixed flexion neck deformity developed. Other than neck deformity, there was no other significant functional or neurological symptom. Although several possible pathogenetic factors have been speculated, the exact cause remains unknown. Conservative observation and/or attempts at closed reduction failed to effect deformity resolution. Investigations revealed "locking" of facets that resulted in rotatory or translatory atlantoaxial dislocation depending on the nature of facet dislocation. The management issues in such cases are evaluated. The authors discuss the validity of atlantoaxial facet distraction and manipulation/reduction and fixation under direct visualization. In all cases recovery from neck deformity was significant immediately after surgery. The deformity resolution was sustained during a mean follow-up period of 23 months (range 3-52 months), although the range of neck movements remained marginally restricted. The craniovertebral realignment is demonstrated by images and clinical photographs.

Vitamins C and E treatment combined with exercise modulates oxidative stress markers in blood of patients with fibromyalgia: a controlled clinical pilot study. **NazÄ±roÄŸlu M, AkkuÅŸ S, Soyupek F, Yalman K, Celik O, EriÅŸ S, Uslusoy GA**

Stress (Amsterdam, Netherlands) Add to My Journals List
201011 13(6):498-505 Language: eng Country: England Department of Biophysics, Medical Faculty, Suleyman Demirel University, Isparta, Turkey. mnaziroglu@med.sdu.edu.tr We aimed to investigate effects of vitamins C and E (VCE) supplementation with exercise (EX) on antioxidant vitamin and lipid peroxidation (LP) levels in blood of patients with fibromyalgia (FM). A controlled study was performed on blood samples from 32 female FM patients and 30 age-matched controls. The patients were divided into three groups namely EX (n = 10), VCE (n = 11), and EX plus VCE (n = 11) after taking basal blood samples. After 12 weeks of EX and VCE supplementation, blood samples were taken once more from the patients. LP levels in plasma and erythrocytes were higher in the patients at baseline than those in controls, whereas LP levels were lower in the VCE and EX groups at the end of 12 weeks than those at baseline. Plasma concentrations of vitamins A and E and reduced glutathione were lower in the patients than those in controls and their concentrations were increased by VCE and EX. Glutathione peroxidase activity in erythrocytes was increased by VCE supplementation, with or without EX. Concentrations of ß-carotene in the groups did not change with treatment. Despite the measured effects on anti-oxidative mechanisms, FM symptoms were not improved by the treatments. In conclusion, VCE with EX may protect against FM-induced oxidative stress by up-regulation of an antioxidant redox system in the plasma and erythrocytes of patients with FM. Such protective effects of VCE in the patients seemed to be greater in combination with EX than EX alone.

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CASE REPORT

Carpal Tunnel Syndrome: Ultrasonographic Imaging and Pathologic Mechanisms of Median Nerve Compression

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Median nerve compression is a well-known cause of carpal tunnel syndrome (CTS). Yet, reasons why the most common idiopathic form of CTS develops in certain individuals are not well understood. To further understand the compressive mechanisms at work in CTS development, the authors used ultrasonographic imaging of the median nerve to evaluate 2 patients with CTS. Findings were compared to those of 2 control subjects who did not have CTS. In the patients who had CTS, the transverse carpal ligament was pulled taut by thenar muscle contraction as the flexor tendons tightened, compressing the median nerve between the ligament and tendons. No such compression was observed with the control subjects. Thus, a pathologic mechanism of median nerve compression was confirmed in the patients with CTS. Demonstration of such pathologic mechanisms during prehensile hand movement may improve understanding of how to treat patients with CTS and prevent nerve injury.

Carpal tunnel syndrome (CTS) is generally considered to be caused by median nerve compression at the wrist.[1] The carpal tunnel is a narrow and relatively unyielding space that readily entraps the median nerve between the tough fibrous transverse carpal ligament ventrally and carpal bones dorsally. Because the median nerve is the softest structure within the carpal tunnel, it usually sustains injury first. Repetitive finger activity is believed to contribute to CTS—either because pressure from the flexor tendons irritates the adjacent median nerve or because inflammatory swelling of the tendon sheaths increases compartment pressure within the carpal tunnel.[1,2]

Previous studies have measured intracarpal pressure in patients with CTS and in subjects without CTS, demonstrating higher pressures in those with CTS.[1,2] However, no known previous studies have directly imaged the median nerve during activity to identify direct mechanical compression. High-resolution diagnostic ultrasonography is now available to readily observe the response to hand maneuvers that might challenge the median nerve.

The present case report demonstrates how the median nerve responds to prehensile hand activity in patients with CTS and in individuals without CTS, providing improved understanding of the pathologic mechanisms responsible for nerve compression.

Reports of Cases

Carpal Tunnel Syndrome Case 1

The patient in CTS case 1 was a man aged 24 years with a several-week history of pain, numbness, tingling, and weakness in his right hand, primarily involving the first three digits. Physical examination

revealed positive results in Tinel's test and Phalen's test over the right carpal tunnel, as well as palpatory restriction over the right carpal tunnel.

Electrodiagnostic (EDX) studies confirmed median neuropathy at the right wrist. The median distal motor latency was 6.0 milliseconds, and the median distal sensory latency to the index finger was 5.3 milliseconds. Results of comparative radial and ulnar studies were normal, with ulnar distal motor latency at 3.0 milliseconds and ulnar distal sensory latency at 3.7 milliseconds and with all response amplitudes normal. Motor distances were 8 cm, and sensory distances were 14 cm. Needle electromyographic examination yielded normal results except for increased membrane irritability within the right thenar muscles—consistent with mild denervation. These findings were compatible with a diagnosis of moderate-to-severe CTS.

Immediately after EDX, the median nerve in the patient's right wrist was imaged transversely with high-resolution ultrasonography (13 MHz M-Turbo system; SonoSite Inc, Bothell, Washington) to measure the cross-sectional area in the proximal carpal tunnel at the level of the pisiform (*Figure 1*). Images revealed median nerve enlargement, with a cross-sectional measurement of 14 mm^2 (compared with the normal upper limit of 11 mm^2).[3,4]

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Figure 1. *Transverse ultrasonographic image of the right wrist of a 24-year-old man with carpal tunnel syndrome (case 1). Image is at the proximal carpal tunnel at the level of the pisiform, showing the cross-sectional area measurement of the median nerve (outlined with white dots to the left of the "A") at 14 mm^2 (0.14 cm^2).*

The median nerve was then imaged longitudinally and transversely at the mid-distal tunnel in a neutral relaxed position. Imaging was repeated during dynamic stress testing (DST), which involves a sustained isometric contraction of the thumb tip against the tips of the second and third digits using a hard rubber ball for resistance (*Figure 2*). Longitudinal imaging (*Figure 3A*) and transverse imaging (*Figure 3B*) in the neutral, prestress position showed normal results. However, longitudinal imaging during DST showed obvious flattening of the median nerve, with a segment of the nerve compressed in the mid-distal carpal tunnel (*Figure 4A*). Similar findings were noted in the transverse plane, with median nerve elongation and flattening during DST (*Figure 4B-4C*).

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Figure 2. *A hard rubber ball is used to provide resistance to thumb and digit flexion in dynamic stress testing, allowing thenar muscle fixation during isometric contraction to challenge, or stress, the median nerve in the carpal tunnel. The relatively unyielding ball maintains separation of the thumb from the fingertips, preventing the thenar mass from moving medially and pushing the ultrasonography transducer off the nerve.*

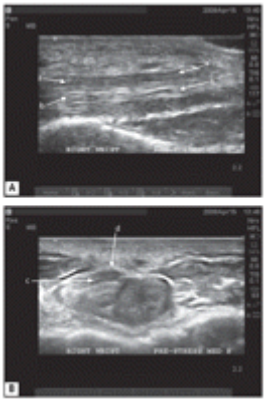

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Figure 3. *Prestress ultrasonographic images of the right wrist of a 24-year-old man with carpal tunnel syndrome (case 1). In the longitudinal view (A), the median nerve is the darker, hypoechoic linear structure traversing from the left side of the image, almost reaching the right side (arrow a). The brighter, hyperechoic linear structure with a fibrillar pattern just below the nerve is the flexor tendon (arrow b). In the transverse image (B), the median nerve is the ellipsoid darker structure in the central upper left (arrow c), just below the brighter linear transverse carpal ligament (arrow d).*

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Figure 4. *Stress ultrasonographic images of the right wrist of a 24-year-old man with carpal tunnel syndrome (case 1). In the longitudinal image (A), the small upward-pointing arrow (a) indicates the region of median nerve compression, seen as a depression or flattening along the median nerve to the left of the white arrow and beneath the downward-pointing red arrows (b). In the transverse image (B), the median nerve is elongated and flattened (arrows c) as the transverse carpal ligament bulges dorsally (arrow d). The thenar muscle mass (dark wedge-shaped area on left) contracts and pulls the ligament to the left (arrow e), which flattens the portion of the ligament directly above the median nerve. Note that a small dark area located centrally above the ligament in* Figure 3B *is slightly larger in* Figure 4B *and has moved more dorsally as it pushes the edge of the ligament further into the carpal tunnel and against the median nerve (arrow d). In the transverse image of maximum stress (C), additional median nerve flattening is seen as the patient increases the intensity of thumb and digit flexion contraction. The edge of the thenar*

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muscle and the transverse carpal ligament can be seen intruding further dorsally into the carpal tunnel against the ventral surface of the median nerve.

These findings indicated that as the thenar muscle mass contracted and tightened the transverse carpal ligament, a portion of the muscle bulged dorsally into the carpal tunnel (*Figure 4B-4C*). Simultaneously, the contracting flexor muscles tightened the flexor tendons ventrally, adding to the compressive effect by creating a more rigid and unyielding tunnel floor—essentially "sandwiching" the median nerve between the transverse carpal ligament and the flexor tendons.

Carpal Tunnel Syndrome Case 2

The patient in CTS case 2 was a woman aged 56 years with a 4-month history of numbness and tingling in her right upper extremity. Physical examination was unremarkable except for revealing positive results in Tinel's test and Phalen's test over the right carpal tunnel, as well as palpatory restriction over the right carpal tunnel.

Electrodiagnostic studies confirmed median neuropathy at the right wrist. The median distal motor latency was 4.0 milliseconds (with 2.7 milliseconds to the ulnar distal motor latency), and the median distal sensory latency to the thumb, at 10 cm, was 3.2 milliseconds. The radial distal sensory latency to the thumb was 2.5 milliseconds (at 10 cm), and all response amplitudes were normal. Results of the needle electromyographic examination were normal.

As with the patient in case 1, ultrasonographic imaging was obtained with the patient in case 2 after EDX. This imaging revealed an enlarged right median nerve, with a cross-sectional measurement of 16 mm^2, at the level of the pisiform. Longitudinal imaging (*Figure 5*) revealed right median nerve compression during DST. This compression was documented with prestress and stress diameter measurements, showing that the median nerve diameter decreased from a prestress measurement of 0.26 cm to a measurement of 0.19 cm during stress—representing a 27% compressive narrowing.

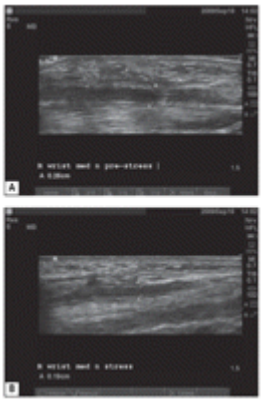

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Figure 5. *Ultrasonographic images of the right wrist of a 56-year-old woman with carpal tunnel syndrome (case 2). Longitudinal images of the median nerve at prestress (A) and during stress (B) depict nerve diameter measurements between the "A" markers. The measurements show the initial nerve diameter of 0.26 cm decreasing to 0.19 cm during stress compression. Slight indentation or flattening can be seen along the upper (ie, ventral) surface of the nerve as the thenar muscle bulges downward (ie, dorsally).*

Control Cases

The subject in control case 1 was a woman aged 39 years with symptoms of pain, numbness, tingling, and weakness in her left upper limb. Electrodiagnostic studies yielded a positive result for CTS on the left side—though EDX on the right side showed normal results. Ultrasonographic imaging revealed an enlarged left median nerve diameter of 18 mm^2 and a normal right median nerve diameter of 8 mm^2. Longitudinal imaging of the right wrist during DST (*Figure 6A-6B*) revealed no nerve compression, with the right median nerve diameter increasing from a prestress measurement of 0.24 cm to a stress measurement of 0.25 cm—representing a 4.2% increase.

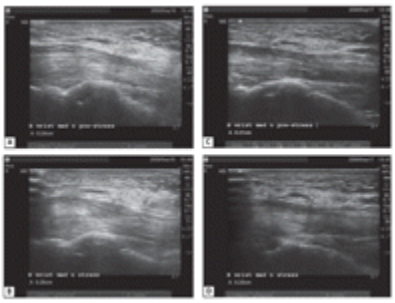

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Figure 6. *Ultrasonographic images of the right wrists of two control subjects without carpal tunnel syndrome. Longitudinal images of the first control subject's median nerve at prestress (A) and during stress (B) depict nerve diameter measurements between the "A" markers. These measurements show the initial nerve diameter of 0.24 cm increasing to 0.25 cm during stress—revealing a lack of compression. Longitudinal images of the second control subject's median nerve at prestress (C) and during stress (D) also depict nerve diameter measurements between the "A" markers. These measurements show the initial nerve diameter of 0.21 cm increasing to 0.23 cm during stress—revealing a lack of compression.*

The subject in control case 2 was a woman aged 40 years with symptoms of numbness and tingling in her right upper limb. However, EDX showed normal results. Ultrasonographic imaging also revealed normal results, with a right median nerve size of 10 mm^2 at the pisiform. Imaging during DST (*Figure 6C-6D*) revealed no nerve compression, with the right median nerve diameter increasing from a prestress measurement of 0.21 cm to a stress measurement of 0.23 cm—representing a 9.5% increase.

Discussion

Static ultrasonographic imaging to measure median nerve enlargement at the level of the pisiform has been described as a pathologic finding in CTS.[3,4] Other findings, such as median nerve flattening or "notching" in the distal carpal tunnel, have also been observed in CTS—though less consistently than proximal nerve enlargement.[3,4]

Some previous studies have used ultrasonographic imaging to identify a decrease in nerve "sliding" within the carpal tunnel during passive index finger motion.[5] For example, Nakamichi and Tachibana[5] observed that in normal control subjects, the median nerve slides transversely to a position in the carpal tunnel that is "freer" (ie, has reduced pressure), but in subjects with CTS, the median nerve has restricted motion (ie, decreased sliding) and increased exposure to compression. In another study,[6] active contraction with fingertip loading was used to demonstrate an increase in pressure within the carpal tunnel during index finger pinch gripping. However, none of these previous studies challenged or imaged the median nerve

directly during active muscle contraction and tendon tightening to observe nerve compression dynamically within the carpal tunnel in patients with CTS.

Prehensile hand movement requires fixation of the primary thumb movers (ie, abductor pollicis brevis and opponens pollicis) at their base of attachment, where they anchor to the transverse carpal ligament.[7,8] Such fixation allows muscle contraction to pull the thumb toward the other digits for controlled grasping functions. A solid immobile base of attachment prepares the muscles to freely move the thumb.

When more powerful and sustained grasping or pinching functions are required, such as firmly holding a tool or pencil (the most common form of prehension[7]), the thumb tip becomes immobile and the anchor becomes the mobile segment. As a result, thenar muscle contraction pulls the transverse carpal ligament taut—instead of moving the thumb—and the muscle bulges dorsally into the carpal tunnel. At the same time, the flexor tendons to the thumb and digits are pulled taut, and the tendons "bowstring" toward the underside of the transverse carpal ligament, "sandwiching" the median nerve between the tendons and transverse carpal ligament (*Figure 4B-4C*). Ultrasonographic images also demonstrate apparent flattening or compression of the median nerve during DST maneuvers, as seen in *Figure 3A*, *Figure 4A, and Figure 5A-5B*.

A classic "squeeze play" appears to be at work in this mechanism, with the roof (ie, transverse carpal ligament) of the carpal tunnel tightening and lowering and the floor (ie, flexor tendons) of the carpal tunnel tightening and rising—thereby compressing the median nerve.

In dynamic studies using digital video recording of several patients with CTS, the author demonstrated that the median nerve is actively compressed during pinch activity. This compression is particularly obvious with transverse ultrasonographic imaging in the mid-tunnel region. However, maintaining such imaging can be challenging because the thenar muscle contracts and pushes the ultrasonography transducer off the nerve.

It is interesting to note that in individuals without CTS, the median nerve simply "slides" out of the way, avoiding compression and often allowing the nerve to enlarge (*Figure 6*). This observation supports the theories of Hunter[9] and Phalen[10] regarding fibrous fixation of the median nerve in patients with CTS. Thus, fibrosis within the carpal tunnel of patients with CTS may prevent the median nerve from sliding out of harms way during routine hand activity. In fact, this author previously suggested that manipulation and stretching may be successful in alleviating symptoms of CTS by breaking up adhesions or fibrous fixations.[8]

Implications of understanding the pathologic mechanisms leading to development of CTS may include improved treatment of patients as well as potential prevention of median nerve injury. Reasons why CTS develops in some individuals who perform repetitive or vigorous hand activities but not in others are not clearly understood. Some researchers have observed contractile cells in the transverse carpal ligaments of patients with CTS, suggesting that the ligaments in these patients were in a constant state of contraction.[11] This author previously observed relative mechanical restriction over the carpal tunnel in patients with CTS, as measured by quantitative palpation—a finding that could correlate with tightness in the transverse carpal ligament.[8] It is unknown if these patients had preexisting abnormalities that contributed to the development of CTS or if the specific patterns of movement in these patients created the abnormalities that subsequently led to median nerve injury.

However, repetitive or sustained contractions of the thenar muscles, combined with possible contraction of myofibroblasts within the transverse carpal ligament, causes relatively increased tightness in the transverse carpal ligament, leading to further foreshortening and pressure on the median nerve. In

addition, perpetual contraction of the thenar muscles contributes to their hypertrophy, leading these muscles to protrude into the carpal tunnel during activity.[8,11]

These observations suggest a multifactorial causation in CTS, including increased intracarpal pressure[2,5]; decreased median nerve mobility (from fibrous fixation)[5,10]; median nerve deformation (ie, compression, stretching, traction)[9]; increased stiffness of the synovium and flexor retinaculum (ie, transverse carpal ligament)[5]; relative thenar muscle hypertrophy or increased thenar muscle mass with intrusion into the carpal tunnel; and flexor tendon thickening and tightening during activity. The latter two processes would substantially contribute to compression by tightening and lowering the transverse carpal ligament at the same time that the floor (ie, flexor tendons) is tightened and raised during prehensile activity (ie, thenar flexion and opposition to the first two digits).

This "squeeze play" action may be supportive evidence suggesting that most cases of CTS are not idiopathic, as previously claimed.[1] In fact, CTS may simply be a self-defensive mechanism in which excessive activity of the hand causes thenar muscle movement and flexor tendon movement to compress the nerve supplying the muscle that generates the activity—leading to weakness and atrophy that cause the compression to "back-off," allowing the nerve to recover.

Previous studies[8,12-14] demonstrated that osteopathic manipulative treatment (OMT) of the wrist led to increase in size of the carpal tunnel and alleviation of CTS symptoms as nerve conductions improved. A primary maneuver used for OMT in patients with CTS is a myofascial technique that involves thenar muscle abduction and extension, which applies traction to the transverse carpal ligament, most likely elongating the ligament and increasing space within the carpal tunnel.[12] A secondary effect of this maneuver, not previously elucidated, probably involves elongation of the thenar muscles, releasing focal "mounding" and prominence that could intrude into the carpal tunnel during active contraction. Another primary maneuver used for OMT in patients with CTS is a myofascial technique that involves wrist and digit hyperextension to stretch and elongate the flexor tendons.[12]

The present case study using high-resolution diagnostic ultrasonography suggests that the mechanism of carpal tunnel release with OMT impacts several of the suspected factors causing CTS. Stretching of the transverse carpal ligament reduces tension in that structure and leads to increased space within the carpal tunnel, decreasing pressure on the median nerve. At the same time, release of thenar muscle tightness leads to decreased muscle intrusion into the carpal tunnel. Elongation of the flexor tendons should decrease thickening and tightening on the other side of the carpal tunnel and also decrease pressure on the median nerve.

These effects of OMT could prepare a normal carpal tunnel for improved activity tolerance, thereby making OMT a valuable component of a program of CTS prevention.

Conclusion

Diagnostic ultrasonographic imaging of the carpal tunnel adds a new dimension to understanding the pathologic mechanisms involved in the development of CTS. It is now possible to directly image median nerve compression during prehensile hand activity—heretofore unconfirmed as a contributory cause of nerve injury. In addition, observation of thenar muscle intrusion into the carpal tunnel indicates that this intrusion may be a factor previously unsuspected in CTS causation.

The results of the present study regarding etiologic mechanisms of CTS add evidence to support previous findings[8,12-14] that suggested effectiveness of aggressive OMT and stretching approaches to CTS management. Furthermore, the new findings indicate that application of ultrasonography during DST can open a window to prevention of CTS.

Footnotes

The author has no relevant financial relationships or conflicts of interest to disclose.

Editor's Note: A video clip of the live dynamic stress test described in the present study has been posted online to the *JAOA*`s Web site at http://www.jaoa.org/cgi/content/full/109/12/641.

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CASE REPORT

Musculoskeletal Dysfunction and Drop Foot: Diagnosis and Management Using Osteopathic Manipulative Medicine

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Drop foot arises from dysfunction within the anatomic, muscular, or neurologic aspects of the lower extremity. The authors describe a patient with drop foot who had a compressed common peroneal nerve caused by posterior fibular head dysfunction. One 15-minute session of osteopathic manipulative treatment resolved the patient's symptoms. It is important for physicians to use osteopathic manipulative medicine to diagnosis and manage this condition, particularly when it results from fibular head dysfunction.

Drop foot can arise from various musculoskeletal or neurologic etiologic processes. The condition involves the muscles of foot dorsiflexion (tibialis anterior, extensor hallucis longus, and extensor digitorum longus) and the nerves that supply them, primarily the common peroneal nerve. Common causes of drop foot include compartment syndrome, diabetes, stroke, lumbar disc protrusions, musculoskeletal compression, myopathies, neuropathies, and peripheral nerve injuries.[1-3]

During the swing phase of heel-toe gait cycle, the muscles of dorsiflexion work as agonists and allow the foot to clear the ground. During heel strike of the stance phase, these muscles work as antagonists and control plantar flexion of the foot. Injury to the muscles of dorsiflexion or their nervous supply can cause drop foot and corresponding steppage gait—also known as *drop-foot gait*. In individuals with drop foot, the plantar flexors have no resistance and cause the foot to remain in plantar flexion during swing phase, therefore not allowing the toes to clear the ground and causing them to slap to the ground during heel strike. To avoid foot drag, an individual with steppage gait will walk with exaggerated hip and knee flexion to clear his or her affected foot from the ground during swing phase.[4,5]

As noted by Pritchett,[6] "Peroneal neuropathy caused by compression at the fibular head is the most common compressive neuropathy in the lower extremity. Footdrop is its most notable symptom." In the present report, we describe a patient who developed drop foot secondary to posterior fibular head

dysfunction. However, unlike many published reports of drop foot,[1,2,7] the condition was diagnosed and managed using osteopathic manipulative medicine.

Report of Case

A 47-year-old white man presented to the primary care office noticeably dragging his left foot. He stated that he could not lift up his left foot. He had no trauma to his left leg. However, he had driven 5 straight hours in his automatic transmission car the night before and stated that his left leg was bent for most of the car ride. On exiting the car, he noticed some numbness and tingling in his left leg. When he awoke the next morning, he was unable to raise his left foot.

The patient denied having any similar episodes in the past and denied any pain. He had not taken any pain medication for the numbness and tingling. Attempts at stretching his leg muscles gave no relief.

The patient had no history of diabetes or muscular, neurologic, or vascular problems. His medical history included hypertension and hypercholesterolemia, which were managed with lisinopril and atorvastatin calcium, respectively. The patient did not smoke tobacco and had no hypersensitivities.

Physical examination revealed a physically fit man with a pleasant disposition and stable vital signs (blood pressure, 124/78 mm Hg; body temperature, 98.2°F; heart rate, 67 beats per min; respiratory rate, 14 breaths per min). He ambulated with a steppage gait. Heart, lung, and abdomen examinations were unremarkable.

On musculoskeletal examination of the extremities, the patient had normal pulse on palpation (2+ pulses) bilaterally in the upper and lower extremities. Manual testing revealed 5/5 muscle strength throughout the right lower extremity and 1/5 muscle strength in the left lower extremity with ankle dorsiflexion and eversion. Sensation was absent to light touch and two-point discrimination along the dorsum of the left foot at the L5 and S1 dermatomes. Deep tendon reflexes were 1/4 at the Achilles and patellar tendons on the left lower extremity and 2/4 on the right lower extremity.

On osteopathic musculoskeletal examination, the patient had left posterior fibular head dysfunction with tenderness on palpation of the left common peroneal nerve. The patient had tight biceps femoris muscle with lateral hamstring Jones' tender points,[8] bilaterally. The patient also had hypertonic psoas major and minor muscles bilaterally.

The patient was diagnosed as having drop foot secondary to common peroneal nerve impingement from posterior fibular head dysfunction. With the patient in a prone position, osteopathic manipulative treatment (OMT) was applied using muscle energy for the psoas and hamstring muscles and deep articulation for the posterior fibular head.

While the fibular head was articulated, the patient noted discomfort but then stated that his foot was getting "warm and tingly." Articulation was continued for about 1 minute. Total OMT lasted approximately 15 minutes. On re-evaluation, the patient had improved sensation along the dorsum of his foot and demonstrated left foot dorsiflexion with 4/5 motor function.

The patient was directed to use exercise band routines to strengthen the dorsiflexors and evertors of his left ankle. He was able to walk out of the office without steppage gait. The next day, he telephoned the office and stated that he had complete range of motion, strength, and sensation in his left foot.

Comment

Drop foot may occur with injury to the muscles of dorsiflexion or along the nervous pathway of these muscles. The sciatic nerve develops at the lumbrosacral plexus and travels through the greater sciatic foramen, located 80% of the time beneath the piriformis muscle, and continues along the posterior aspect of the thigh. It divides to form the common peroneal and tibial nerves above the popliteal fossa of the knee.

The common peroneal nerve travels laterally to wind over the posterior aspect of the fibular neck, dividing into the superficial and deep peroneal nerves. The superficial peroneal nerve supplies the peroneus longus and brevis muscles and provides sensation to the anterolateral aspect of the leg and the dorsum of foot.[9] The deep peroneal nerve supplies the anterior tibial, extensor digitorum longus, and extensor hallucis longus muscles and supplies sensation to the web space between the first and second toes.[10]

The common peroneal nerve runs a superficial course, close to the periosteum of the fibular neck for approximately 6 cm, covered by only skin and subcutaneous tissue, making it vulnerable to direct insult.[1,6,10] For example, it could become compressed at the fibular neck after prolonged squatting.[11] Although the patient in the present report was not squatting and denied leaning his left leg against the car door, we believe that the prolonged bent position of his left leg may have caused drop foot.

The fibula has reciprocal movements of the fibular head proximally and the stylus of the fibula distally. When the fibular head translates posteriorly, the stylus of the fibula translates anteriorly. This motion occurs when the foot is in plantar flexion. If the fibular head was maintained in a posterior position, then the ankle would be restricted in dorsiflexion.[12,13] As described in the present report, the patient was unable to dorsiflex his foot, providing evidence that he had a posterior fibular head dysfunction.

The biceps femoris muscle has a long head, which originates from the ischial tuberosity and sacrotuberous ligament, and a short head, which originates from the linea aspera and the lateral supra condyle of the femur.[14] Insertion of this muscle is on the head of the fibula and the lateral condyle of the tibia. In normal functioning, the biceps femoris muscle provides flexion and lateral rotation of the leg at the knee.[14] However, hypertonicity of this muscle could place a posterior draw on the fibular head, causing the common peroneal nerve to be compressed,[15] as described in our patient.

In the present report, muscle energy to the psoas and hamstring muscles and deep articulation to the fibular head resolved the patient's symptoms. Therefore, the cause of this patient's symptoms was likely secondary to his tight bicep femoris muscle, causing the fibular head to be pulled posteriorly. The posterior fibular head then caused compression of the common peroneal nerve, leading to drop foot.

Conclusion

In the present report, proper musculoskeletal examination identified areas of dysfunction, therefore avoiding the use of unnecessary diagnostic studies such as laboratory tests, radiography, magnetic resonance imaging, nerve conduction studies, and electrophysiologic tests.[16] The patient had immediate relief of symptoms and normalization of his gait from a simple yet precise OMT technique without the need of more expensive treatment modalities, such as ankle foot orthosis, medications, or invasive treatments (eg, nerve root blocks, spinal decompression, tendon transposition).[1,3] Osteopathic physicians with a strong knowledge of anatomy will be able to optimize osteopathic diagnosis and OMT, which can provide cost-effective patient care.

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A review of the literature examining the physiological processes underlying the therapeutic benefits of Hatha yoga. **Dunn KD**

Advances in mind-body medicine Add to My Journals List
2008 23(3):10-8 Language: eng Country: United States George Mason University, Fairfax, Virginia, USA. An estimated 7.4 million Americans currently practice Hatha yoga. Moreover, 64% of individuals who practice yoga report doing so for well-being. Previous research has reported an association between yoga practice and subjective well-being; however, few studies have investigated the physiological mechanisms involved. The following review provides an historical overview of the field of integrative medicine, which conceptualizes yoga as a mind-body practice. A brief description of Hatha yoga is provided that describes the purported relationship between yoga and the relaxation response. A review of the emerging literature related to nitric oxide and oxidative stress as potential mechanisms in the relationship between yoga and well-being also is included. The article concludes with a brief discussion of the state of the research and provides suggestions for future studies.

Restoration of disk height through non-surgical spinal decompression is associated with decreased discogenic low back pain: a retrospective cohort study.
(PMID:20615252)

Apfel CC,
Cakmakkaya OS,
Martin W,
Richmond C,
Macario A,
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BMC Musculoskeletal Disorders [2010, 11:155]

Type: Journal Article, Randomized Controlled Trial

DOI: 10.1186/1471-2474-11-155

Abstract

BACKGROUND: Because previous studies have suggested that motorized non-surgical spinal decompression can reduce chronic low back pain (LBP) due to disc degeneration (discogenic low back pain) and disc herniation, it has accordingly been hypothesized that the reduction of pressure on affected discs will facilitate their regeneration. The goal of this study was to determine if changes in LBP, as measured on a verbal rating scale, before and after a 6-week treatment period with non-surgical spinal decompression, correlate with changes in lumbar disc height, as measured on computed tomography (CT) scans.

METHODS: A retrospective cohort study of adults with chronic LBP attributed to disc herniation and/or discogenic LBP who underwent a 6-week treatment protocol of motorized non-surgical spinal decompression via the DRX9000 with CT scans before and after treatment. The main outcomes were changes in pain as measured on a verbal rating scale from 0 to 10 during a flexion-extension range of motion evaluation and changes in disc height as measured on CT scans. Paired t-test or linear regression was used as appropriate with $p < 0.05$ considered to be statistically significant.

RESULTS: We identified 30 patients with lumbar disc herniation with an average age of 65 years, body mass index of 29 kg/m2, 21 females and 9 males, and an average duration of LBP of 12.5 weeks. During treatment, low back pain decreased from 6.2 (SD 2.2) to 1.6 (2.3, $p < 0.001$) and disc height increased from 7.5 (1.7) mm to 8.8 (1.7) mm ($p < 0.001$). Increase in disc height and reduction in pain were significantly correlated ($r = 0.36$, $p = 0.044$).

CONCLUSIONS: Non-surgical spinal decompression was associated with a reduction in pain and an increase in disc height. The correlation of these variables suggests that pain reduction may be mediated, at least in part, through a restoration of disc height. A randomized controlled trial is needed to confirm these promising results.

Effects of preoperative neuromuscular electrical stimulation on quadriceps

strength and functional recovery in total knee arthroplasty. A pilot study.
Walls RJ, McHugh G, O'Gorman DJ, Moyna NM, O'Byrne JM
BMC musculoskeletal disorders Add to My Journals List
2010 11:119 Language: eng Country: England Department of Orthopaedic Surgery, Cappagh National Orthopaedic Hospital, Finglas, Dublin, Ireland. raywalls1@hotmail.com BACKGROUND: Supervised preoperative muscle strengthening programmes (prehabilitation) can improve recovery after total joint arthroplasty but are considered resource intensive. Neuromuscular electrical stimulation (NMES) has been shown to improve quadriceps femoris muscle (QFM) strength and clinical function in subjects with knee osteoarthritis (OA) however it has not been previously investigated as a prehabilitation modality. METHODS: This pilot study assessed the compliance of a home-based, NMES prehabilitation programme in patients undergoing total knee arthroplasty (TKA). We evaluated its effect on preoperative and postoperative isometric quadriceps femoris muscle (QFM) strength, QFM cross-sectional area (CSA) and clinical function (subjective and objective). Seventeen subjects were recruited with 14 completing the study (NMES group n = 9; Control group n = 5). RESULTS: Overall compliance with the programme was excellent (99%). Preoperative QFM strength increased by 28% ($p > 0.05$) with associated gains in walk, stair-climb and chair-rise times ($p < 0.05$). Early postoperative strength loss (approximately 50%) was similar in both groups. Only the NMES group demonstrated significant strength (53.3%, $p = 0.011$) and functional recovery ($p < 0.05$) from 6 to 12 weeks post-TKA. QFM CSA decreased by 4% in the NMES group compared to a reduction of 12% in the control group ($P > 0.05$) at 12 weeks postoperatively compared to baseline. There were only limited associations found between objective and subjective functional outcome instruments. CONCLUSIONS: This pilot study has shown that preoperative NMES may improve recovery of quadriceps muscle strength and expedite a return to normal activities in patients undergoing TKA for OA. Recommendations for appropriate outcome instruments in future studies of prehabilitation in TKA have been provided.

Feasibility of neuromuscular training in patients with severe hip or knee OA: the individualized goal-based NEMEX-TJR training program. **Ageberg E, Link A, Roos EM**

BMC musculoskeletal disorders Add to My Journals List
2010 11:126 Language: eng Country: England Department of Orthopedics, Clinical Sciences Lund, Lund University, Sweden. eva.ageberg@med.lu.se BACKGROUND: Although improvements are achieved by general exercise, training to improve sensorimotor control may be needed for people with osteoarthritis (OA). The aim was to apply the principles of neuromuscular training, which have been successfully used in younger and middle-aged patients with knee injuries, to older patients with severe hip or knee OA. We hypothesized that the training program was feasible, determined as: 1) at most acceptable self-reported pain following training; 2) decreased or unchanged pain during the training period; 3) few joint specific adverse events related to training, and 4) achieved progression of training level during the training period. METHODS: Seventy-six patients, between 60 and 77 years, with severe hip (n = 38, 55% women) or knee OA (n = 38, 61% women) underwent an individualized, goal-based neuromuscular training program (NEMEX-TJR) in groups for a median of 11 weeks (quartiles 7 to 15) prior to total joint replacement (TJR). Pain was self-reported immediately after each training session on a 0 to 10 cm, no pain to pain as bad as it could be, scale, where 0-2 indicates safe, > 2 to 5 acceptable and > 5 high risk pain. Joint specific adverse events were: not attending or ceasing training because of increased pain/problems in the index joint related to training, and self-reported pain > 5 after training. The level of difficulty of training was registered. RESULTS: Patients with severe OA of the hip or knee reported safe pain (median 2 cm) after training. Self-reported pain was lower at training sessions 10 and 20 ($p = 0.04$) and unchanged at training sessions 5 and 15 ($p = 0.170$, $p = 0.161$) compared with training session 1. There were no joint specific adverse events in terms of not attending or ceasing training. Few patients (n = 17, 22%) reported adverse events in terms of self-reported pain > 5 after one or more training sessions. Progression of training level was achieved over time ($p < 0.001$). CONCLUSIONS: The NEMEX-TJR training program is feasible in patients with severe hip or knee OA, in terms of safe self-reported pain following training, decreased or unchanged pain during the training period, few joint specific adverse events, and achieved progression of training level during the training period. PMID: 20565735

Results from the balance rehabilitation unit in benign paroxysmal positional vertigo. **Kasse CA, Santana GG, Scharlach RC, Gazzola JM, Branco FC, DonÃi F**

Brazilian journal of otorhinolaryngology Add to My Journals List
201010 76(5):623-9 Language: eng Country: Brazil Federal University of São Paulo, Body Balance and Social Inclusion Program of Uniban - Brazil.

UNLABELLED: Posturography is a useful new tool to study the influence of vestibular diseases on balance.

AIM: to compare the results from the Balance Rehabilitation Unit (BRU) static posturography in elderly patients with Benign Paroxysmal Positional Vertigo (BPPV), before and after Epley's maneuver.

MATERIALS AND METHODS: a prospective study of 20 elderly patients with a diagnosis of BPPV. The patients underwent static posturography and the limit of stability (LE) and ellipse area were measured. We also applied the Dizziness Handicap Inventory (DHI) questionnaire to study treatment effectiveness.

RESULTS: 80% were females, with a mean age of 68.15 years. After the maneuver, the LE increased significantly ($p=0.001$). The elliptical area of somatosensory, visual and vestibular conflicts (2,7,8,9 situations) in BRU and the DHI scores decreased significantly ($p<0.05$) after treatment.

CONCLUSION: the study suggests that elderly patients with BPPV may present static postural control impairment and that the maneuver is effective for the remission of symptoms, to increase in the stability and improvement in postural control in situations of visual, somatosensory and vestibular conflicts.

Voluntary running prevents progressive memory decline and increases adult hippocampal neurogenesis and growth factor expression after whole-brain irradiation. **Wong-Goodrich SJ, Pfau ML, Flores CT, Fraser JA, Williams CL, Jones LW**

Cancer research Add to My Journals List
20101101 70(22):9329-38 Language: eng Country: United States Department of Psychology and Neuroscience, Duke University, Durham, North Carolina 27708, USA.

Whole-brain irradiation (WBI) therapy produces progressive learning and memory deficits in patients with primary or secondary brain tumors. Exercise enhances memory and adult hippocampal neurogenesis in the intact brain, so we hypothesized that exercise may be an effective treatment to alleviate consequences of WBI. Previous studies using animal models to address this issue have yielded mixed results and have not examined potential molecular mechanisms. We investigated the short- and long-term effects of WBI on spatial learning and memory retention and determined whether voluntary running after WBI aids recovery of brain and cognitive function. Forty adult female C57Bl/6 mice given a single dose of 5 Gy or sham WBI were trained 2.5 weeks and up to 4 months after WBI in a Barnes maze. Half of the mice received daily voluntary wheel access starting 1 month after sham or WBI. Daily running following WBI prevented the marked decline in spatial memory retention observed months after irradiation. Bromodeoxyuridine (BrdUrd) immunolabeling and enzyme-linked immunosorbent assay indicated that this behavioral rescue was accompanied by a partial restoration of newborn BrdUrd+/NeuN+ neurons in the dentate gyrus and increased hippocampal expression of brain-derived vascular endothelial growth factor and insulin-like growth factor-1, and occurred despite irradiation-induced elevations in hippocampal proinflammatory cytokines. WBI in adult mice produced a progressive memory decline consistent with what has been reported in cancer patients receiving WBI therapy. Our findings show that running can abrogate this memory decline and aid recovery of adult hippocampal plasticity, thus highlighting exercise as a potential therapeutic intervention.

Active, passive and proprioceptive neuromuscular facilitation stretching are comparable in improving the knee flexion range in people with total knee replacement: a randomized controlled trial. **Chow TP, Ng GY**
Clinical rehabilitation Add to My Journals List

201010 24(10):911-8 Language: eng Country: England Department of Physiotherapy, Tai Po Hospital and Department of Rehabilitation Sciences, Hong Kong Polytechnic University. Objective: To compare the immediate and medium-term effects of three stretching methods on the knee flexion range in people with a total knee replacement. Design: Randomized clinical trial. Setting: Rehabilitation hospital. Subjects: 117 patients were recruited and 100 (mean age: 68.43 ± 7.95 years) of them completed the study. Interventions: Patients receiving total knee replacement due to knee osteoarthritis were randomly assigned into 3 groups of: active stretching (group 1, n =32), passive stretching (group 2, n =35) and proprioceptive neuromuscular facilitation stretching (group 3, n =33). Main measures: The immediate change in both active and passive knee flexion range after the first treatment session and the pattern of change in these ranges throughout the 2-week study period were compared among the three groups. Results: All groups demonstrated significant improvement in knee ranges with time. The active range of group 1 improved by 19.9°, group 2 by 25.3° and group 3 by 22.5° throughout the 2-week period, whereas the improvements in the passive range were 18.8°, 24.5° and 22.7°, respectively. For between-group comparisons, no significant difference was found in both active (P = 0.647) and passive (P = 0.501) knee range immediately after stretching. For the changes at 2 weeks, there was also no significant difference among the groups in both active (P = 0.716) and passive (P = 0.959) knee ranges. Conclusion: This study revealed that all three modes of stretching were associated with an increase in the knee flexion range of patients after total knee replacement, with no statistically significant differences between the changes seen.

Central sensitization does not identify patients with carpal tunnel syndrome who are likely to achieve short-term success with physical therapy. **FernÃindez-de-Las-PeÃ±as C, Cleland JA, Ortega-Santiago R, de-la-Llave-Rincon AI, MartÃnez-Perez A, Pareja JA**

Experimental brain research. Experimentelle Hirnforschung. Expérimentation cérébrale Add to My Journals List

201011 207(1-2):85-94 Language: eng Country: Germany Esthesiology Laboratory of Universidad Rey Juan Carlos, Alcorcón, Madrid, Spain, cesar.fernandez@urjc.es.

The aim of the current study was to identify whether hyperexcitability of the central nervous system is a prognostic factor for individuals with carpal tunnel syndrome (CTS) likely to experience rapid and clinical self-reported improvement following a physical therapy program including soft tissue mobilization and nerve slider neurodynamic interventions. Women presenting with clinical and electrophysiological findings of CTS were involved in a prospective single-arm trial. Participants underwent a standardized examination and then a physical therapy session. The physical therapy sessions included both soft tissue mobilization directed at the anatomical sites of potential median nerve entrapment and a passive nerve slider neurodynamic technique targeted to the median nerve. Pressure pain thresholds (PPT) over the median, radial and ulnar nerves, C5-C6 zygapophyseal joint, carpal tunnel and tibialis anterior muscle were assessed bilaterally. Additionally, thermal detection and pain thresholds were measured over the carpal tunnel and thenar eminence bilaterally to evaluate central nervous system excitability. Subjects were classified as responders (having achieved a successful outcome) or non-responders based on self-perceived recovery. Variables were entered into a stepwise logistic regression model to determine the most accurate variables for determining prognosis. Data from 72 women were included in the analysis, of which 35 experienced a successful outcome (48.6%). Three variables including PPT over the C5-C6 joint affected side <137 kPa, HPT carpal tunnel affected side <39.6º and general health >66 points were identified. If 2 out of 3 variables were present (LR + 14.8), the likelihood of success increased from 48.6 to 93.3%. We identified 3 factors that may be associated with a rapid clinical response to both soft tissue mobilization and nerve slider neurodynamic techniques targeted to the median nerve in women presenting with CTS. Our results support that widespread central sensitization may not be present in women with CTS who are likely to achieve a successful outcome with physical therapy. Future studies are now necessary to validate these findings.

Quantifying the high-velocity, low-amplitude spinal manipulative thrust: a systematic review. **Downie AS, Vemulpad S, Bull PW**
Journal of manipulative and physiological therapeutics Add to My Journals List

201009 33(7):542-53 Language: eng Country: United States Department of Chiropractic, Macquarie University NSW 2109, Australia. aron.downie@mq.edu.au
OBJECTIVES: The purpose of this study was to systematically review studies that quantify the high-velocity, low-amplitude (HVLA) spinal thrust, to qualitatively compare the apparatus used and the force-time profiles generated, and to critically appraise studies involving the quantification of thrust as an augmented feedback tool in psychomotor learning. METHODS: A search of the literature was conducted to identify the sources that reported quantification of the HVLA spinal thrust. MEDLINE-OVID (1966-present), MANTIS-OVID (1950-present), and CINAHL-EBSCO host (1981-present) were searched. Eligibility criteria included that thrust subjects were human, animal, or manikin and that the thrust type was a hand-delivered HVLA spinal thrust. Data recorded were single force, force-time, or displacement-time histories. Publications were in English language and after 1980. The relatively small number of studies, combined with the diversity of method and data interpretation, did not enable meta-analysis. RESULTS: Twenty-seven studies met eligibility criteria: 17 studies measured thrust as a primary outcome (13 human, 2 cadaver, and 2 porcine). Ten studies demonstrated changes in psychomotor learning related to quantified thrust data on human, manikin, or other device. CONCLUSIONS: Quantifiable parameters of the HVLA spinal thrust exist and have been described. There remain a number of variables in recording that prevent a standardized kinematic description of HVLA spinal manipulative therapy. Despite differences in data between studies, a relationship between preload, peak force, and thrust duration was evident. Psychomotor learning outcomes were enhanced by the application of thrust data as an augmented feedback tool.

Comparison of ballistic and static stretching on hamstring muscle length using an equal stretching dose. **Covert CA, Alexander MP, Petronis JJ, Davis DS**

Journal of strength and conditioning research / National Strength & Conditioning Association Add to My Journals List

201011 24(11):3008-14 Language: eng Country: United States 1Mountain River Physical Therapy, Parkersburg, West Virginia; 2The PT Group, Jeannette, Pennsylvania; and 3Department of Human Performance and Exercise Science, Division of Physical Therapy, West Virginia University, Morgantown, West Virginia.

Covert, CA, Alexander, MP, Petronis, JJ, and Davis, DS. Comparison of ballistic and static stretching on hamstring muscle length using an equal stretching dose. J Strength Cond Res 24(11): 3008-3014, 2010-The purpose of this investigation was to determine which stretching technique, static or ballistic, is most effective for increasing hamstring muscle length when delivered at the same stretching dose over a 4-week training program. A single-blind, randomized controlled trial design was used in this investigation. Thirty-two participants (16 women and 16 men) between the ages of 18 and 27 years participated in the study. All participants who had a pre-training knee extension angle of less than 20° were excluded from the study. Subjects were randomly assigned to one of 3 groups: ballistic stretching, static stretching, or control group. Participants in the experimental stretching groups (ballistic and static stretching) performed one 30-second stretch 3 times per week for a period of 4 weeks. Statistical analysis consisted of a 2-way analysis of variance (group × sex) with an a priori alpha level of 0.05. No interaction between group and sex was identified ($p = 0.4217$). The main effect of sex was not statistically significant ($p = 0.2099$). The main effect for group was statistically significant at $p < 0.0001$. Post hoc analysis revealed that both static and ballistic stretching group produced greater increases in hamstring length than the control group. The static stretching group demonstrated a statistically greater increase in hamstring muscle length than the ballistic stretching group. No injuries or complications were attributed to either stretching program.

Neurophysiological responses after short-term strength training of the biceps brachii muscle. **Kidgell DJ, Stokes MA, Castricum TJ, Pearce AJ**
Journal of strength and conditioning research / National Strength & Conditioning Association Add to My Journals List

201011 24(11):3123-32 Language: eng Country: United States 1School of Exercise and Nutrition Sciences, Deakin University, Melbourne, Australia; 2School of Psychology, Deakin University, Melbourne, Australia; and 3School of Sport and Exercise Science, Victoria University, Melbourne, Australia. Kidgell, DJ, Stokes, MA, Castricum, TJ, and Pearce, AJ. Neurophysiological responses after short-term strength training of the biceps brachii muscle. J Strength Cond Res 24(11): 3123-3132, 2010. The neural adaptations that mediate the increase in strength in the early phase of a strength training program are not well understood; however, changes in neural drive and corticospinal excitability have been hypothesized. To determine the neural adaptations to strength training, we used transcranial magnetic stimulation (TMS) to compare the effect of strength training of the right elbow flexor muscles on the functional properties of the corticospinal pathway. Motor-evoked potentials (MEPs) were recorded from the right biceps brachii (BB) muscle from 23 individuals (training group; n = 13 and control group; n = 10) before and after 4 weeks of progressive overload strength training at 80% of 1-repetition maximum (1RM). The TMS was delivered at 10% of the root mean square electromyographic signal (rmsEMG) obtained from a maximal voluntary contraction (MVC) at intensities of 5% of stimulator output below active motor threshold (AMT) until saturation of the MEP (MEPmax). Strength training resulted in a 28% ($p = 0.0001$) increase in 1RM strength, and this was accompanied by a 53% increase ($p = 0.05$) in the amplitude of the MEP at AMT, 33% ($p = 0.05$) increase in MEP at 20% above AMT, and a 38% increase at MEPmax ($p = 0.04$). There were no significant differences in the estimated slope ($p = 0.47$) or peak slope of the stimulus-response curve for the left primary motor cortex (M1) after strength training ($p = 0.61$). These results demonstrate that heavy-load isotonic strength training alters neural transmission via the corticospinal pathway projecting to the motoneurons controlling BB and in part underpin the strength changes observed in this study.

Efficacy of a functional restoration program for chronic low back pain: Prospective 1-year study. **Beaudreuil J, Kone H, Lasbleiz S, Vicaut E, Richette P, Cohen-Solal M, LiotÃ© F, de Vernejoul MC, Nizard R, Yelnik A, Bardin T, Orcel P**

Joint, bone, spine : revue du rhumatisme Add to My Journals List

201010 77(5):435-9 Language: eng Country: France Service de rhumatologie, groupe hospitalier Lariboisière-Fernand-Widal, Paris cedex 10, France. johann.beaudreuil@lrb.ap-hop-paris.fr OBJECTIVE: To evaluate the efficacy of a functional restoration program for patients with chronic low back pain, using overall disability and work ability as the primary evaluation criteria. PATIENTS AND METHODS: We prospectively studied patients aged 18 years or older who had been on sick leave because of nonspecific low back pain for at least 3 months and whose job position was still open. The program was delivered on a day-hospital basis 5 days a week for 5 weeks. Patients were followed up for 1 year. RESULTS: We included 39 patients, 11 females and 28 males with a mean (± SD) age of 43 ± 8 years and a mean sick-leave duration of 10 ± 7 months. After 1 year, 26 (67%) patients reported improvements and 25 (64%) had returned to work. Compared to the year before the program, the number of sick leave days was decreased by 51% (120 ± 140 vs. 244 ± 114, $P < 0.05$). The work-and-leisure-activities subscore of the validated French version of the Dallas Pain Questionnaire (DRAD) was significantly improved (57 ± 24 vs. 70 ± 17 at baseline, $P < 0.05$). The patients still on sick leave after 1 year were older and had greater alterations in baseline DRAD subscores for anxiety/depression and daily activities, compared to the patients who had returned to work. CONCLUSIONS: Our functional restoration program was effective and allowed two-thirds of patients to resume work. Factors associated with failure to resume work were well-known correlates of chronicity. Our results support the use of functional restoration programs in patients with incapacitating low back pain. They suggest that functional restoration may deserve to be started earlier, after only 3 months with chronic pain, in patients who are unable to work.

Multistation proprioceptive exercise program prevents ankle injuries in basketball. **Eils E, SchrÃ¶ter R, SchrÃ¶der M, Gerss J, Rosenbaum D**
Medicine and science in sports and exercise Add to My Journals List

201011 42(11):2098-105 Language: eng Country: United States Funktionsbereich Bewegungsanalytik (Movement Analysis Lab), Orthopaedic Department, University Hospital Muenster, Muenster, Germany. eils@uni-muenster.de PURPOSE: To investigate the effectiveness of a multistation proprioceptive exercise program for the prevention of ankle injuries in basketball players using a prospective randomized controlled trial in combination with biomechanical tests of neuromuscular performance. METHODS: A total of 232 players participated in the study and were randomly assigned to a training or control group following the CONSORT statement. The training group performed a multistation proprioceptive exercise program, and the control group continued with their normal workout routines. During one competitive basketball season, the number of ankle injuries was counted and related to the number of sports participation sessions using logistic regression. Additional biomechanical pre–post tests (angle reproduction and postural sway) were performed in both groups to investigate the effects on neuromuscular performance. RESULTS: In the control group, 21 injuries occurred, whereas in the training group, 7 injuries occurred. The risk for sustaining an ankle injury was significantly reduced in the training group by approximately 35%. The corresponding number needed to treat was 7. Additional biomechanical tests revealed significant improvements in joint position sense and single-limb stance in the training group. CONCLUSIONS: The multistation proprioceptive exercise program effectively prevented ankle injuries in basketball players. Analysis of number needed to treat clearly showed the relatively low prevention effort that is necessary to avoid an ankle injury. Additional biomechanical tests confirmed the neuromuscular effect and confirmed a relationship between injury prevention and altered neuromuscular performance. With this knowledge, proprioceptive training may be optimized to specifically address the demands in various athletic activities.

Role of physical exercise in low back pain rehabilitation: a randomized controlled trial of a three-month exercise program in patients who have completed multidisciplinary rehabilitation. **Henchoz Y, de GoumoÃ«ns P, Norberg M, Paillex R, So AK**

Spine Add to My Journals List
20100502 35(12):1192-9 Language: eng Country: United States Institut des sciences du sport et de l'éducation physique, Université de Lausanne, Suisse. yves.henchoz@unil.ch STUDY DESIGN: Randomized controlled trial with 1-year follow-up. OBJECTIVE: To analyze the effects of an exercise program or routine follow-up on patients with chronic low back pain who have completed functional multidisciplinary rehabilitation. The short- and long-term outcome in terms of symptoms and physical and social functioning was compared. SUMMARY OF BACKGROUND DATA: Systematic reviews have shown that functional multidisciplinary rehabilitation improves physical function and reduces pain in patients with chronic low back pain. However, long-term maintenance of these improvements is inconsistent and the role of exercise in achieving this goal is unclear. METHODS: One hundred five chronic patients with low back pain who had completed a 3-week functional multidisciplinary rehabilitation program were randomized to either a 3-month exercise program (n = 56) or routine follow-up (n = 49). The exercise program consisted of 24 training sessions during 12 weeks. Patients underwent evaluations of trunk muscle endurance, cardiovascular endurance, lumbar spine mobility (flexion and extension range-of-motion, fingertip-to-floor distance), pain and perceived functional ability at the beginning and the end of functional multidisciplinary rehabilitation, at the end of the exercise program (3 months) and at 1-year follow-up. Disability was also assessed at the same time points except at the beginning of functional multidisciplinary rehabilitation. RESULTS: At the end of the functional multidisciplinary rehabilitation, both groups improved significantly in all physical parameters except flexion and extension range-of-motion. At the 3 month and 1 year follow-up, both groups maintained improvements in all parameters except for cardiovascular endurance. Only the exercise program group improved in disability score and trunk muscle endurance. No differences between groups were found. CONCLUSION: A favorable long-term outcome was observed after functional multidisciplinary rehabilitation in both patient groups. Patients who participated in an exercise program obtained some additional benefits. The relevance of these benefits to overall health status need to be further investigated.

Influence of supplementation with branched-chain amino acids in combination with resistance exercise on p70(S6) kinase phosphorylation in resting and exercising human skeletal muscle. **AprÃ³ W, Blomstrand E**

Acta physiologica (Oxford, England) Add to My Journals List
201011 200(3):237-48 Language: eng Country: England Åstrand Laboratory, Swedish School of Sport and Health Sciences, Stockholm, Sweden Department of Clinical Sciences, Intervention and Technology, Karolinska Institutet, Stockholm, Sweden Department of Physiology and Pharmacology, Karolinska Institutet, Stockholm, Sweden. Aim: Skeletal muscle growth is thought to be regulated by the mammalian target of rapamycin (mTOR) pathway, which can be activated by resistance exercise and branched-chain amino acids (BCAA). The major aim of the present study was to distinguish between the influence of resistance exercise and BCAA on key enzymes considered to be involved in the regulation of protein synthesis, including p70(S6) kinase (p70(S6k)). Methods: Nine healthy subjects (four men and five women) performed unilateral resistance exercise on two occasions separated by 1 month. Subjects were randomly supplied either a mixture of BCAA or flavoured water. Muscle biopsies were taken from both resting and exercising muscle before, after and 1 h after exercise. Results: Phosphorylation of Akt was unaltered by either resistance exercise and/or BCAA supplementation whereas mTOR phosphorylation was enhanced ($P < 0.05$) to a similar extent in both exercising and resting muscle following exercise in the absence (70-90%) and presence of BCAA supplementation (80-130%). Phosphorylation of p70(S6k) was unaffected by resistance exercise alone; however, BCAA intake increased ($P < 0.05$) this phosphorylation in both legs following exercise. In resting muscle, a 5- and 16-fold increase in p70(S6k) was observed immediately after and 1 h after exercise, respectively, as compared to 11- and 30-fold increases in the exercising muscle. Phosphorylation of eukaryotic elongation factor 2 was attenuated 1 h after exercise ($P < 0.05$) in both resting (10-40%) and exercising muscle (30-50%) under both conditions. Conclusion: The present findings indicate that resistance exercise and BCAA exert both separate and combined effects on the p70(S6k) phosphorylation in an Akt-independent manner.

Restoration of locomotive function in Parkinson's disease by spinal cord stimulation: mechanistic approach. **Fuentes R, Petersson P, Nicolelis MA**

The European journal of neuroscience Add to My Journals List
201010 32(7):1100-8 Language: eng Country: France Department of Neurobiology, Duke Medical Center, 311 Research Drive, Durham, NC 27710, USA Department of Experimental Medical Science, NRC, Lund University, Lund, Sweden Center for Neuroengineering, Duke University, Durham, NC, USA Department of Biomedical Engineering, Duke University, Durham, NC, USA Department of Psychology and Neuroscience, Duke University, Durham, NC, USA Edmond and Lily Safra International Institute of Neuroscience of Natal (ELS-IINN), Natal RN, Brazil.

Specific motor symptoms of Parkinson's disease (PD) can be treated effectively with direct electrical stimulation of deep nuclei in the brain. However, this is an invasive procedure, and the fraction of eligible patients is rather low according to currently used criteria. Spinal cord stimulation (SCS), a minimally invasive method, has more recently been proposed as a therapeutic approach to alleviate PD akinesia, in light of its proven ability to rescue locomotion in rodent models of PD. The mechanisms accounting for this effect are unknown but, from accumulated experience with the use of SCS in the management of chronic pain, it is known that the pathways most probably activated by SCS are the superficial fibers of the dorsal columns. We suggest that the prokinetic effect of SCS results from direct activation of ascending pathways reaching thalamic nuclei and the cerebral cortex. The afferent stimulation may, in addition, activate brainstem nuclei, contributing to the initiation of locomotion. On the basis of the striking change in the corticostriatal oscillatory mode of neuronal activity induced by SCS, we propose that, through activation of lemniscal and brainstem pathways, the locomotive increase is achieved by disruption of antikinetic low-frequency (<30 Hz) oscillatory synchronization in the corticobasal ganglia circuits.

Global Postural Re-education: an alternative approach for stress urinary incontinence? **Fozzatti C, Herrmann V, Palma T, Riccetto CL, Palma PC**

European journal of obstetrics, gynecology, and reproductive biology Add to My Journals List
201010 152(2):218-24 Language: eng Country: Ireland Department of Urology, Division of Female Urology, State University of Campinas, Campinas, São Paulo, Brazil. celinafozzatti@terra.com.br OBJECTIVE: The aim of this study was to evaluate the impact of Global Postural Re-education (GPR) on stress urinary incontinence symptoms and to compare it to Pelvic Floor Muscle Training (PFMT). STUDY DESIGN: Fifty-two women with stress urinary incontinence were distributed into two groups: Group 1 (G1) was submitted to weekly sessions of GPR for three months and Group 2 (G2) performed Pelvic Floor Muscle Training four times a week for three months. Patients were evaluated through the King's Health Questionnaire, a three-day voiding diary including daily pad use and a Functional Evaluation of the Pelvic Floor (FEPF), before treatment (T0), at the end of treatment (T1) and six months after treatment (T2). RESULTS: The number of leaking episodes dropped significantly in both groups at the end of treatment and at six months follow-up, with a significantly greater decrease in G1. Daily pad use dropped significantly in both groups. At the end of treatment, 72% of the patients in G1 and 41% of the patients in G2 needed no pads and at six-month follow-up, 84% and 50%, respectively. FEPF improved significantly in both groups, with no significant difference between the groups (P=0.628). The King's Health Questionnaire demonstrated significant improvement in both groups and in all domains. The GPR group presented higher adherence to treatment, with no dropouts. CONCLUSIONS: GPR could represent an alternative method to treat stress urinary incontinence in women, should the results be long lasting.

The development and application of an injury prediction model for noncontact, soft-tissue injuries in elite collision sport athletes. **Gabbett TJ**
Journal of strength and conditioning research / National Strength & Conditioning Association Add to My Journals List
201010 24(10):2593-603 Language: eng Country: United States Brisbane Broncos Rugby League Club, Brisbane, Australia. timg@broncos.com.au Limited information exists on the training dose-response relationship in elite collision sport athletes. In addition, no study has developed an injury prediction model for collision sport athletes. The purpose of this study was to develop an injury prediction model for noncontact, soft-tissue injuries in elite collision sport athletes. Ninety-one professional rugby league players participated in this 4-year prospective study. This study was conducted in 2 phases. Firstly, training load and injury data were prospectively recorded over 2 competitive seasons in elite collision sport athletes. Training load and injury data were modeled using a logistic regression model with a binomial distribution (injury vs. no injury) and logit link function. Secondly, training load and injury data were prospectively recorded over a further 2 competitive seasons in the same cohort of elite collision sport athletes. An injury prediction model based on planned and actual training loads was developed and implemented to determine if noncontact, soft-tissue injuries could be predicted and therefore prevented in elite collision sport athletes. Players were 50-80% likely to sustain a preseason injury within the training load range of 3,000-5,000 units. These training load 'thresholds' were considerably reduced (1,700-3,000 units) in the late-competition phase of the season. A total of 159 noncontact, soft-tissue injuries were sustained over the latter 2 seasons. The percentage of true positive predictions was 62.3% (n = 121), whereas the total number of false positive and false negative predictions was 20 and 18, respectively. Players that exceeded the training load threshold were 70 times more likely to test positive for noncontact, soft-tissue injury, whereas players that did not exceed the training load threshold were injured 1/10 as often. These findings provide information on the training dose-response relationship and a scientific method of monitoring and regulating training load in elite collision sport athletes.

Acute effect of different stretching methods on Illinois agility test in soccer players. **Amiri-Khorasani M, Sahebozamani M, Tabrizi KG, Yusof AB**

Journal of strength and conditioning research / National Strength & Conditioning Association Add to My Journals List
201010 24(10):2698-704 Language: eng Country: United States Sports Centre, University of Malaya, Malaysia. The purpose of this study was to examine the effects of static, dynamic, and the combination of static and dynamic stretching within a pre-exercise warm-up on the Illinois agility test (IAT) in soccer players. Nineteen professional soccer players (age = 22.5 ± 2.5 years, height = 1.79 ± 0.003 m, body mass = 74.8 ± 10.9 kg) were tested for agility performance using the IAT after different warm-up protocols consisting of static, dynamic, combined stretching, and no stretching. The players were subgrouped into less and more experienced players (5.12 ± 0.83 and 8.18 ± 1.16 years, respectively). There were significant decreases in agility time after no stretching, among no stretching vs. static stretching; after dynamic stretching, among static vs. dynamic stretching; and after dynamic stretching, among dynamic vs. combined stretching during warm-ups for the agility: mean ± SD data were 14.18 ± 0.66 seconds (no stretch), 14.90 ± 0.38 seconds (static), 13.95 ± 0.32 seconds (dynamic), and 14.50 ± 0.35 seconds (combined). There was significant difference between less and more experienced players after no stretching and dynamic stretching. There was significant decrease in agility time following dynamic stretching vs. static stretching in both less and more experienced players. Static stretching does not appear to be detrimental to agility performance when combined with dynamic warm-up for professional soccer players. However, dynamic stretching during the warm-up was most effective as preparation for agility performance. The data from this study suggest that more experienced players demonstrate better agility skills due to years of training and playing soccer.

From NOI monthly newsletter

TATTOOS LOSE THE ASHES FOR AUSTRALIA! (A HYPOTHESIS)

England has just soundly beaten Australia, on Australian soil, in a 5 game series of test cricket. This is the first time this has happened for nearly a quarter of a century. For our non cricketing audience, this competition is known as "The Ashes" and each game can last for 5 days. While deep down, we are quite fond of the "poms" as we call the English, we don't like losing to them at all, especially in games they invent such as cricket and rugby, even darts.

There has been quite a bit of clinical reasoning going on in Australia about this loss, but while watching a recent match I couldn't help ponder on the possible role of tattoos in Australia's dismal performance.

TATTOOS AND PERFORMANCE

Two poorly performed and inconsistent players in the Australian team during the test matches were the batsman and vice captain Michael Clarke (left) and the strike left arm fast bowler Mitchell Johnson on the right. They both have recent tattoos.

Clarke has a number of tattoos including one with the initials (LB) of an ex girlfriend tattooed on his shoulder. Johnson has a "sleeve" on his right arm and an abdominal tattoo.

Clarke and Johnson are world class cricketers with world class statistics but in recent years their form has suffered. Note in the graphs below, how their performance approximately relates to when the players had recent tattoos.

WHAT IS IT ABOUT A TATTOO?

Any hypothesis should be made on a foundation of basic sciences. Our suggestion is that a tattoo may alter the representation of the tattooed body part in the brain, essentially the" meaning" of the body part in the brain, leading to a motor sensory incongruence resulting in perturbed motor output. Clarke and Johnson have had perturbed cricket motor outputs this season which may well have recruited mirror neurone complexes in teammates and perhaps altered their performances.

Tattoos are usually done with great meaning, thought, expense and prior contemplation and they usually hurt, especially in areas that have large representations in the brain. Tattooed feet hurt more than shoulders. Large tattoos can take weeks to finish. No doubt the tattoo owner will have altered emotions and thoughts about the tattooed limb – perhaps, proud, excited, hypervigilant ,maybe a bit ashamed later on. The limb is surely embodied a little differently in the brain. Altered emotions and thoughts about the limb will be also be affected by other people's attitudes to the tattoo. While tattoos are increasingly regarded as cool, especially by younger people (Rooks et al 2000), a dragon tattoo on a young woman will still evoke more negativity about the person than if she was not tattooed (Resenhoeft et al 2008).

TATTOOS, THE BRAIN AND PERTURBED MOTOR OUTPUTS

When a person plans and executes a motor output such as bowling a cricket ball or playing a cricket shot (and there is an infinite variety of both which could be executed by these elite athletes) the brain calls on various sources of reference to execute the most appropriate output. References could be considered external such as state of the pitch, state of the match, opposing cricketers' actions and current climate. They could also be internal such as memories, cognitions, fatigue, and pain. The cricketer will not even be aware of some of references called upon and the brain will be continually seeking feedback from the references (How is that sore elbow, what is the opposing team doing, will it rain?) One of the references will be the somatosensory maps –i.e. the sensory neurotags representing the arm in the brain. Most readers will be aware that these brain maps change continually but may alos change significantly with altered inputs (Pascual-Leone and Torres 1993; Flor 2000; Duffau 2006). The suggestion here is that the altered inputs into the embodiment schema of the tattooed body part of the cricketers may be enough to create a sensory motor incongruence leading to perturbed output in cricket. It may only be minor to lead to significant perturbed output in a high performance athlete when dealing with a cricket ball travelling at 150Kph. Perturbed outputs may not only be altered motor performance, they could be sensory disturbances, even inflammation (?bursitis) which again impact on the embodiment of the arm in the brain.

I would even suggest that the current state of happiness with the tattoo and its meaning, may reflect on the sports performance at that moment. I also suggest that a much loved and integrated tattoo may even enhance the finery of the representation of the limb in the brain and even improve motor outputs. -David

YOUR TURN

Of course – this is all hypothesis. We are keen to hear reader's comments and also we will give a prize of an *Explain Pain* to

(a) the person who picks the best hole in the hypothesis and

(b) the person who provides the best supportive evidence for the hypothesis.