



Foot & Ankle Research Review

Making Education Easy

Issue 4 - 2010

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Welcome to the fourth edition of Foot and Ankle Research Review.

With the forthcoming FIFA World Cup soccer tournament commencing in South Africa later this year, I have included two articles that will be of interest to those who deal with soccer sports injuries. The first article deals with metatarsal stress fractures (Foot Ankle Int 2010;31(3):203-11), while the second article relates to ankle injuries (Br J Sports Med 2009;43:1119-1125).

The Foot & Ankle Review has been established to help make life easier for New Zealand professionals working in this area. Every month around 10,000 scientific publications are printed worldwide containing a multitude of new studies. Many are devoted entirely to the foot and ankle. In short, keeping up is hard and requires significant time to screen out what is irrelevant to your practice or your country. In essence we aim to save you time sorting the 'wheat from the chaff' so you can spend more time doing what you're best at. The Foot & Ankle Review is a summary of what we think are some of the most significant new papers, plus a local commentary on why they are important and how they can potentially affect practice.

The Review also provides website links to the abstract or fully published papers where possible so you can make your own judgements. The creation of this publication would not have been possible without support from our sponsors and to them we give our thanks. If you have discovered or been involved in what you think is significant global research please let us know and we will consider it for inclusion next time. If you have colleagues or friends within New Zealand who would like to receive our publication, send us their contact email and we will include them next issue.

I hope you find the fourth edition of Foot & Ankle Research Review stimulating reading, and we welcome your feedback.

Kind regards,

Professor Keith Rome

keithrome@researchreview.co.nz

Analysis of foot structure in athletes sustaining proximal fifth metatarsal stress fracture

Authors: Hetsroni I et al

Summary: This study investigated whether athletes who sustain proximal fifth metatarsal stress fractures exhibit exceptional static foot structure or dynamic loading patterns. Independent variables including static evaluation of foot and arch structure and dynamic plantar foot pressure evaluation were undertaken in ten professional soccer players who had experienced a unilateral proximal fifth metatarsal stress fracture and in ten matched controls. The injured players had all regained full professional activity following their injuries. Each of the measured variables was compared between injured and contralateral uninjured feet and the feet of matched controls. Plantar pressure evaluation revealed relative unloading of the fourth metatarsal in both uninjured and injured limbs of injured athletes compared with controls, while the fifth metatarsal revealed pressure reduction only in the injured limbs. There was no significant difference between the groups in static measurements of foot and arch structure. The findings indicate that while athletes who sustained proximal fifth metatarsal stress fracture were not characterised by an exceptional static foot structure, lateral metatarsal unloading during stance appears to occur in these individuals.

Comment: Many clinicians undertake both static and dynamic foot measurements. From a research perspective the measurement of static foot function is somewhat limited and does not necessarily relate to dynamic function. The results of the current study suggest that dynamic plantar pressure may play a role in the development of the injury or represent an adaptive process. The use of plantar pressure measurement only explains a small component of a gait assessment and therefore measures including kinematics (joint motion) and kinetics (forces) should be included. The inclusion of only ten subjects should be viewed with caution. Although the results are promising, further work is required before management plans can be implemented.

Reference: *Foot & Ankle International* 2010;31(3):203-11

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The epidemiology of ankle injuries occurring in English Football Association academies

Authors: Cloke DJ et al

Summary: The objective of this retrospective UK study was to determine the epidemiology of ankle injuries in elite youth football. Data from 41 English Football Association academies between 1998 and 2006 was reviewed and a total of 14 776 players in the U9 to U16 age category were found to be registered for the complete seasons investigated; a mean of 2463 players per year. A total of 2563 ankle injuries that were sufficient to miss ≥ 48 hours of training were reported. The main outcome measures were the incidence and burden of ankle injuries in the studied population and factors associated with the injury. Analysis revealed a mean incidence of one ankle injury per player per year and a mean of two matches and 20 training days missed per injury; 3.4% of injuries required a lay-off of ≥ 3 months and 0.7% of injured players did not return to training. In total, 5182 match appearances and 52 290 training days were lost due to ankle injury. While the majority of injuries were sprains, 3.9% of injuries were severe and included fractures, ligament ruptures, chondral or osteochondral injuries, or ankle instability; a total of 20 cases required surgery. An increased rate of injury was seen in older players and peaks in injury were seen early in the season and after the winter break. The frequency at which ankle injuries appear to occur in this population has far-reaching implications, both on and off the field.

Comment: This study represents a large series of ankle injury data based upon youth football. With the success of the 'All-Whites' at the World cup qualifying stage, there has been an upsurge in interest in soccer from young adults and there is a possibility of clinicians assessing more patients with acute ankle injuries. Those clinicians working within a sports team should be aware of issues such as tiredness and loss of muscle coordination. Assessment should not only include biomechanical parameters such as range of motion, but should include a thorough training history that looks at previous and current injuries, the number of training sessions and the number of competitive games.

Reference: *British Journal of Sports Medicine* 2009;43:1119-25

<http://bjsm.bmj.com/content/43/14/1119.abstract>



Independent commentary by Professor Keith Rome, School of Podiatry, AUT University, Auckland.

The gait and balance of patients with diabetes can be improved: a randomised controlled trial

Authors: Allet L et al

Summary: This randomised controlled trial, conducted in Switzerland, assessed whether gait and balance in diabetic patients can be improved with the use of a specific exercise training programme. Seventy one patients with type 2 diabetes were randomised to either an intervention group (n = 35; mean age 63 years) or a control group (n = 36; mean age 64 years). The intervention group partook in 60 minute physiotherapeutic group training sessions twice weekly for 12 weeks. The sessions consisted of gait and balance exercises with function-orientated strengthening. Following the 12 week period, subjects in the intervention group were encouraged to continue with the prescribed exercises for a further 6 months. Subjects in the control group received no treatment. Primary outcome measures were gait speed and coefficient of variation of gait cycle time (CVGCT), while secondary measures were muscle strength, joint mobility, balance control (dynamic and static) and fear of falls. All outcome measures were assessed at baseline, after intervention and at 6-months. At the end of the 12 week training period, the intervention group had significantly (p < 0.001) increased their habitual walking speed by a mean of 0.149 m/s (0.54 km/h) compared with the control group. The intervention group also exhibited significant (p < 0.003) improvements in their dynamic balance, static balance, performance-oriented mobility, hip and ankle plantar flexor strength, hip flexion mobility and fear of falling compared with controls. At 6-months' follow-up, all these outcomes remained significant (p < 0.003) except for ankle plantar flexor strength and static balance.

Comment: Gait and balance measurements are important parameters that should be included in the assessment of patients with diabetes. Although the study uses laboratory-based equipment that is not available to all clinicians, the results indicate that gait balance and muscle strength improved. There is a tentative link between loss of muscle strength and falling from the recent literature relating to falls. A number of initiatives originating from New Zealand, including the Otago Falls prevention programme and the Tai-Chi exercise programme have been recently reported for patients with a history of falls. Foot and lower limb strengthening programmes together with undertaking weight-bearing exercises should be encouraged by all clinicians working with high-risk groups.

Reference: *Diabetologia* 2010;53(3):458-66

<http://tinyurl.com/y5fh67c>

Validity of plantar surface visual assessment as an estimate of foot arch height

Authors: Swedler DI et al

Summary: This study, involving 3968 US Army recruits (2697 men and 1271 women; mean age 23 years) entering Basic Combat Training, aimed to determine if plantar surface morphology is a surrogate for measuring the height of the medial longitudinal arch (MLA). The study participants had their plantar foot surfaces assessed visually as low, normal, or high by two raters who viewed plantar surface footprints. Subjects then underwent measurement of their bony MLA with digital calipers; MLA was determined as distance from the standing surface to the inferior medial border of the navicular tuberosity. The effectiveness of visual inspection as a means of arch height classification was determined by comparing the two findings. Overall agreement between plantar shape and measured MLA height was 65% for both genders combined. In addition, a higher BMI decreased the overall chance of correct assessment of MLA height based on visual assessment.

Comment: The study illustrates that over 30% of plantar shapes being misclassified compared with measured arch height, especially among individuals with higher BMI. Two issues from the current study are highlighted. Firstly, the use of static measurements does not allow clinicians to understand dynamic function. Secondly, misclassifying foot type may have serious consequences for prescribing and fabricating foot orthoses or the issuing of footwear. Wearing of incorrect shoes can cause biomechanical imbalance, foot problems, pain and possibly induce falls. Although the current study evaluated US combat soldiers the study does illustrate problems with identifying foot shape in overweight people.

Reference: *Medicine & Science in Sports & Exercise* 2010;42(2):375-80

<http://tinyurl.com/24kg3zy>

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Hallux ulceration in diabetic patients

Authors: ElMakki Ahmed M

Summary: This prospective cohort study assessed risk factors associated with hallux ulceration and the incidence of healing or amputation in 122 diabetic patients (92 male; 30 female; mean age 57.9 years) who were treated for ulceration of the hallux at the Jabir Abu Eliz Diabetic Centre, Khartoum City, Sudan, between September 2004 and March 2005. A total of 103 patients (84.4%) presented with an ulcer rather than a blister or a wound with an intact overlying skin barrier. Peripheral sensory neuropathy was the most prevalent risk factor for hallux ulceration, being present in 85.7% of the cohort. A total of 68.9% of hallux ulcers developed either spontaneously or in association with new shoes. Complete healing within 8 weeks was evident in 53% of patients and 43% experienced ulcer healing within 20 weeks; overall mean healing time 16 ± 8 weeks. Osteomyelitic bone was removed in 32 patients (26.2%). Hallux amputation was undertaken in 17 (13.9%) patients, and was followed by forefoot amputation in 2 patients (1.6%) and below-the-knee amputation in 7 patients (5.7%).

Comment: The study illustrates a common problem often associated with diabetes. Clinicians that have to deal with hallux problems need to address biomechanical risk factors that include range of motion of key joints in the foot. A number of studies have reported the range of active first metatarsophalangeal joint dorsiflexion is significantly lower and that ankle dorsiflexion, subtalar joint range of motion and angle of gait differed from non-diabetic feet. Foot type is also important and again previous studies have reported that a more pronated foot type is associated with hallux ulceration in diabetic feet. Further studies are required to evaluate the efficacy of footwear and orthoses in altering foot posture to manage hallux ulceration.

Reference: *Journal of Foot & Ankle Surgery* 2010;49(1):2-7

<http://tinyurl.com/2ewa3hz>

Changes in ankle mechanical stability in those with knee osteoarthritis

Authors: Hubbard TJ et al

Summary: These US researchers aimed to determine if patients with mild-to-moderate osteoarthritis (OA) of the knee have significantly impaired motion in the ankle-subtalar joint complex. A total of 15 such patients (5 men and 10 women; mean age 60.3 years) and 15 matched healthy controls were included in the analysis. Knee OA was confirmed by radiographic assessment. An instrumented arthrometer was used to determine mechanical ankle-subtalar joint stability. Mean anterior and posterior ankle-subtalar joint displacement was found to be significantly less in the knee OA group compared with controls (7.4mm vs 10.5mm and 2.2mm vs 4.2mm, respectively). Furthermore, in individuals with knee OA, mean anterior and posterior ankle-subtalar joint displacement was found to be significantly ($p < 0.05$) less in the affected side compared with the unaffected side (7.4mm vs 9.5mm and 2.2mm vs 2.6mm, respectively). The knee OA group also exhibited significantly ($p < 0.05$) less mean inversion and eversion rotation than the control group (25.4° vs 31.1° and 13.2° vs 20.1° , respectively).

Comment: Subjects with knee OA demonstrated significant decreases in anterior and posterior displacement as well as inversion and eversion rotation within the ankle-subtalar joint complex compared with healthy matched controls. OA of the knee is a common condition that can cause considerable pain and disability. Use of foot insoles, such as lateral wedging, as a non-pharmacological treatment of osteoarthritis of the knee medial compartment has been reported. The current study may endorse the importance of assessing the foot when assessing the knee. Foot impairments may be the result of alterations in ankle-subtalar joint alignment secondary to structural changes and deviations that exist at the knee. These mechanical stability changes at the ankle may manifest into larger kinematic changes occurring to the ankle-subtalar joint complex that will certainly impair overall walking gait (either during level walking or on stairs) and other daily functional activities, and may lead to early onset and premature development of ankle OA.

Reference: *Archives of Physical Medicine & Rehabilitation* 2010;91(1):73-7

<http://tinyurl.com/y3fef87>

Research Review publications are intended for New Zealand health professionals.

A randomized controlled trial to compare two techniques for partial digital local anesthetic blocks

Authors: Whiteley B et al

Summary: Injection of anaesthetic into the great toe is often associated with significant difficulty. This randomised, controlled, single-blind, parallel group UK clinical trial assessed whether injecting a small amount of local anaesthetic throughout the injection site prior to the main injection may reduce pain intensity and duration. A total of 50 participants received each injection method (1 or 2 stage) to either the lateral or medial side of their great toe; the 2-stage method involved initially injecting a small quantity of the anaesthetic solution throughout the injection site with the remainder being administered after a 2-minute interval. Pain duration (recorded by the patient with a stopwatch) and pain intensity (measured by scores on a Visual Analogue Scale) were the primary end points. Findings showed that the 2-stage method of anaesthetic administration was associated with significantly less intense pain (reduced from moderate to mild Visual Analogue Scale level) of a significantly shorter duration, compared with the 1-stage method. The study authors recommend the 2-stage method for adults.

Comment: This study found that a 2-stage method was associated with less intense pain of a shorter duration. The authors report that this new technique differs from raising a traditional bleb where a small amount of anaesthetic is infiltrated into superficial tissue. Regardless of the technique, patients will be anxious or refuse treatment. The delivery of local anaesthetic injections also produces anxiety among clinicians and, although related to dentistry, a study showed that 19% of dentists reported administration of local anaesthesia caused them distress with 6% considering this problem serious.¹ Another study investigating attitudes of US university students toward dental treatment, reported that 19% had high rates of dental fear and that those who were dental injection naive (13% of study participants) were less likely to accept an injection than those with experience of such injections.² Similar findings may be found with clinicians who injected into the foot.

1. Meechan JG. Differences between men and women regarding attitudes toward dental local anesthesia among junior students at a United Kingdom Dental School. *Anesth Prog.* 2005;52(2):50-5.

2. Kaakko T et al. Dental fear among university students: implications for pharmacological research. *Anesth Prog.* 1998;45:62-7.

Reference: *Journal of Foot & Ankle Surgery* 2010;49(2):143-6

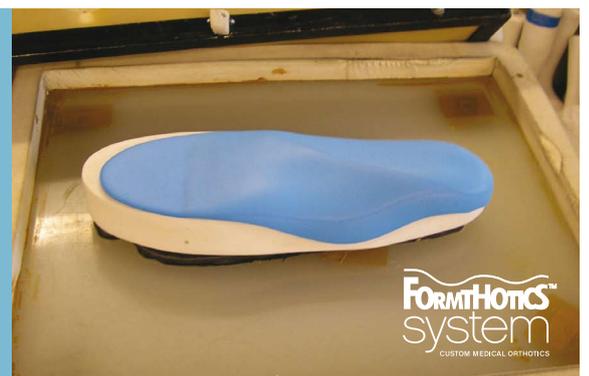
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Development of a novel stocking for foot sole pain in patients with rheumatoid arthritis

Authors: Matsuno H et al

Summary: The clinical efficacy of the Fuß-sole (Kuroda, Osaka, Japan), a newly developed stocking with a plantar insole made of breathable fabric, was assessed in 20 patients with severe foot pain attributable to rheumatoid arthritis. The Japanese Orthopaedic Association's foot-scoring system was used to evaluate clinical efficacy. Patients were evaluated before and after a 1 month trial of the Fuß-sole stocking. The use of the Fuß-sole stocking resulted in significant improvements in foot pain, activities of daily living, and total scores.

Comment: The study suggests that the newly developed stocking improved activities of daily living in patients with rheumatoid arthritis and foot pain attributable to callosities within 1 month. Previous studies have reported on the benefits of wearing cushioned hosiery. The current study has not addressed the wearing of hosiery with footwear. Rheumatoid patients often state that fit and comfort are important factors in choosing footwear, suggesting that patients prioritise fit due to their long-term disability. Shoe fastenings and shoe-weight are factors also described by rheumatoid patients as being important, suggesting that fastenings are likely to be important for patients with rheumatoid arthritis since the hand function is also commonly affected, as is their general mobility. Future studies may want to consider these factors.

Reference: *Journal of Podiatric Medical Association* 2010;100:10-3
<http://tinyurl.com/2eel9s8>



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Plantar pressure and foot pain in the last trimester of pregnancy

Authors: Karadag-Saygi E et al

Summary: This study evaluated plantar pressure changes and postural balance differences in pregnant women. Thirty-five women in their third trimester of pregnancy who had complaints of foot pain and 35 non-pregnant female controls were assessed; controls were age and BMI matched. All selected cases were overweight. A Visual Analogue Scale (VAS) was used to measure foot pain. Peak pressures at forefoot, midfoot and hindfoot were measured using dynamic pedobarography and percentages of pressure on hindfoot and forefoot were measured using static pedobarography. Pregnant patients had higher forefoot pressure on the right side with standing and walking compared with controls. In addition, significant increases in contact times under the forefoot and longer floor contact times were found in pregnant subjects. VAS pain scores were correlated with forefoot contact times during walking. The sway length from centre of pressure was higher in pregnant subjects than in controls.

Comment: The data from this study suggest that forefoot pressures increase in the last trimester of pregnancy during standing and walking. There is prominent increased postural sway in anterior-posterior (forward-backward) direction in this period. From a clinical perspective, foot pain associated with pregnancy may be due to changes in body mass and distribution within the foot and may be relieved by the prescription of cushioned insoles or advice of appropriate footwear during pregnancy. It would be interesting to note whether seasonal or diurnal changes have an impact on plantar pressure readings. A common complaint by many pregnant women is the issue of additional swelling during the summer months or by the end of the day. A further cautionary note is that different types of footwear may reflect different plantar pressure readings and there may be ethnic differences in plantar pressure measurements.

Reference: *Foot & Ankle Int* 2010;31:153-7
<http://tinyurl.com/y5tsp7x>

Podiatry services for patients with arthritis: an unmet need

Authors: Rome K et al

Summary: Podiatrists have a role to play in supporting patients with rheumatoid arthritis. This paper aimed to highlight the major issues related to foot care for patients with arthritis and provide key recommendations that should be implemented to improve access to podiatric services in New Zealand. The authors point out that ideally an integrated approach to the treatment of patients with foot problems associated with rheumatoid arthritis is needed, with podiatrists being the key practitioner in co-ordinating assessment and management of the foot and its related problems. The authors stress that education and training should be available to foot health care providers and primary care staff to enable them to understand the systemic consequences of musculoskeletal disorders on the feet. They also say that clear guidelines, protocols and referral pathways should be developed locally.

Comment: This New Zealand paper highlights the issues of how to address foot problems associated with rheumatological conditions such as rheumatoid arthritis and gout. Expertise in dealing with foot problems is often limited among rheumatologists and primary care practitioners, and it has been argued that better integration of podiatric services into rheumatology care would be beneficial. This paper focuses on the issues associated with the rheumatoid foot and acts as a catalyst for all stakeholders; service users, providers, commissioners and policy makers to work together to implement access to their local podiatric services and, crucially, to strive for integration of specialist podiatrists into the multidisciplinary team.

Reference: *New Zealand Medical Journal* 2010;123(1310):91-7
<http://www.ncbi.nlm.nih.gov/pubmed/20360783w>

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