

# Foot & Ankle Research Review™

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Issue 10 – 2011

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## Welcome to the tenth edition of Foot & Ankle Research Review.

In this latest edition I have put together a collection of articles relating to foot orthoses and footwear. There are three articles that may be of interest to all clinicians. The first article relates to the effects of three different types of footwear on pain and injury in women runners and will lead to much debate (Ryan et al: *The effect of three different levels of footwear stability on pain outcomes in women runners; a randomised control trial*). The second article relates to the use of simple insoles to reduce loading at the knee and demonstrates concerns in using healthy people (Creaby et al: *Insole effects on impact loading during walking*). Finally, the third article describes the standards of care for rheumatoid patients and illustrates good practice in using foot orthoses and adequate footwear (Williams et al: *Guidelines for the management of the foot health problems associated with rheumatoid arthritis*).

I hope you enjoy reading the latest edition of Foot and Ankle Research Review and any feedback is most welcome.

Kind regards,

**Professor Keith Rome**

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## Relationship between foot sensation and standing balance in patients with multiple sclerosis

**Authors:** Citaker S et al

**Summary:** This study, performed in 27 patients with multiple sclerosis (MS; Expanded Disability Status Scale 1.0-3.5) and 10 healthy volunteers, was undertaken in order to determine the foot sensation that best predicts standing balance. The duration of static one-leg standing balance, threshold pressure of light touch, duration of vibration and distance of two-point discrimination of the sole were significantly ( $p < 0.05$ ) decreased in MS patients. Multiple regression analysis indicated that the best predictors of static standing balance in patients with MS, predicting 47.6% of the variance in duration of one-leg standing balance, were two-point discrimination of the heel ( $r^2 = 0.359$ ,  $p = 0.001$ ) and vibration sensation of the first metatarsal head ( $r^2 = 0.118$ ,  $p = 0.029$ ).

**Comment:** The measurement of foot sensation is an integral part of a clinician's role in dealing with high-risk foot conditions such as diabetes. This Turkish study evaluates foot sensation associated with balance in patients with MS. The study illustrates that both two-point discrimination and vibration sensation are the best predictors of the duration of static standing balance. The article will be of interest to those clinicians who deal with neuromuscular conditions. Although the evidence is limited on foot and ankle characteristics in many neuromuscular conditions, the current work illustrates the need to ensure that neurological testing of the plantar surface of the feet is undertaken. It is interesting to note that previous studies have used contoured and textured insoles to enhance postural stability in this high-risk group. The current work complements the previous work conducted on foot orthoses in patients with MS.

**Reference:** *Gait Posture* 2011;34(2):275-8

<http://www.gaitposture.com/article/S0966-6362%2811%2900170-6/abstract>

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## Dynamic splinting for postoperative hallux limitus: a randomized, controlled trial

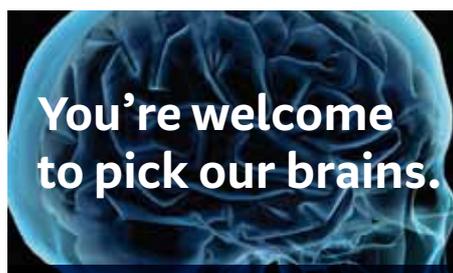
**Authors:** John MM et al

**Summary:** The efficacy of dynamic splinting in treating patients with postoperative hallux limitus (HL) was investigated in this randomised, controlled trial involving 55 patients (aged 29–69 years) who had undergone cheilectomy or bunionectomy. All of the patients received non-steroidal anti-inflammatory drugs (NSAIDs), orthotics and instructions for a home-exercise programme. Patients in the experimental group also underwent three 60-minute sessions of dynamic splinting for first metatarso-phalangeal joint extension each day; the duration of the study was 8 weeks. A significant ( $p < 0.001$ ) difference in change in active range of motion (AROM) was seen in experimental patients compared with controls ( $T = 4.224$ ;  $n = 48$ ). A mean 250% improvement in AROM was seen in patients who had undergone dynamic splinting compared with controls indicating that the technique was effective in reducing contracture of postoperative HL. The study authors concluded that the procedure should be considered for standard of care in treating postoperative HL.

**Comment:** This randomised clinical study from the US will be of interest to those clinicians that deal with this very common musculoskeletal foot condition. There are currently a number of different modalities available to clinicians and the current study illustrates that dynamic splinting can reduce contracture and increase range of motion after surgery. The study illustrates that standard care, postoperatively, included the use of NSAIDs, orthotics and a home-exercise programme. It would be of interest to observe the effects if different foot orthoses were used and if the home-exercise programme was changed to group exercises. I would also like to see if advice on adequate footwear made a difference. Interestingly, no adverse events were reported in the experimental group. This is a good paper to read for both experienced clinicians and students.

**Reference:** *J Am Podiatr Med Assoc.* 2011;101(4):285-8

<http://www.japmaonline.org/content/101/4/285.abstract>



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## The Correlation between plantar fascia thickness and symptoms of plantar fasciitis

**Authors:** Mahowald S et al

**Summary:** These researchers set out to ascertain whether changes in plantar fascia thickness are a reliable gauge of the efficacy of treatment protocols for plantar fasciitis. Their study involved 30 patients (39 feet) with plantar fasciitis in whom pain was assessed using the visual analogue scale and in whom an ultrasound was undertaken in order to measure the thickness of the medial band of the plantar fascia. Subjects then underwent various treatments for plantar fasciitis followed by repeat plantar fascia thickness measurement via ultrasound. At that time, pain level was again subjectively assessed. In total, 29 feet (74.4%) exhibited a reduction in plantar fascia thickness and a decrease in pain, while one foot (2.6%) exhibited a decrease in fascia thickness, but no change in pain level. An increase in plantar fascia thickness and pain occurred in one foot (2.6%), four feet (10.3%) exhibited an increase in thickness, but no change in pain level, and three feet (7.7%) had minor increases in fascia thickness, but reported a decrease in pain level. Additionally, one foot (2.6%) exhibited no change in fascia thickness, but reported a decrease in pain. The average improvement in pain was  $3.64 \pm 2.7$  ( $p < 0.005$ ) and this correlated with an average reduction in plantar fascia thickness of  $0.82 \text{ mm} \pm 1.04 \text{ mm}$ . The study authors concluded that changing thickness of the plantar fascia is a valid objective measurement to assess the efficacy of existing or new treatment protocols for plantar fasciitis.

**Comment:** This US study will be of interest to those clinicians who deal with a very common musculoskeletal condition. Ultrasound is often used in podiatric practice to evaluate plantar fascia pathology and is the most widely reported imaging modality utilised for this condition. Previous studies have been performed that have evaluated the thickness of the plantar fascia before and after a given treatment regimen to prove that treatment's efficacy. These studies have assumed that an intimate relationship exists between the plantar fascia thickness and the patient's pain level. While this correlation is assumed to exist, the precise relationship between the plantar fascia thickness and pain level is not well established in the literature. The results from this study showed a decrease in plantar fascia thickness and a decrease in pain. Future studies could be conducted that evaluate high-risk chronic foot conditions such as diabetes or rheumatoid arthritis. However, dealing with such high-risk groups needs to take into account other systematic factors such as age, gender and ethnicity.

**Reference:** *J Am Podiatr Med Assoc.* 2011;101(5):385-9

<http://www.japmaonline.org/content/101/5/385.abstract>

## Use of conservative and surgical foot care in an inception cohort of patients with rheumatoid arthritis

**Authors:** Backhouse MR et al

**Summary:** This study looked at conservative and surgical foot care in a cohort of 1237 patients with rheumatoid arthritis (RA) recruited from nine rheumatology centres across England between 1986 and 1998. The use of podiatry and type of foot surgery had been recorded and factors predicting the type of foot care received were assessed. The mean age of disease onset was 54.36 years, 66.9% of the subjects were female, the median disease activity score (DAS) was 4.09 and the median health assessment questionnaire score was 1. Only 364/1218 (30%) patients received podiatry and 47/1237 (4%) underwent foot surgery. Gender, age at disease onset and baseline DAS were independently associated with the odds of undergoing foot surgery. At baseline, increasing age at onset of disease, female gender, a higher DAS and rheumatoid factor positivity were independently associated with increased odds of seeing a podiatrist. Younger patients were more likely to access foot surgery and older females were more likely to access podiatry care. However, the majority of the RA population did not access any foot care.

**Comment:** This UK study illustrates that patients with RA have a high prevalence of foot pathologies, but do not access podiatrist's services. Similar findings have also been reported in New Zealand. The paper will be of interest to rheumatologists and health care professionals. The surgical component is of interest, with younger patients accessing surgery. Surgery may be considered when severe symptoms persist and do not respond to conservative treatment. People with progressive foot problems may require specialist surgical opinion with the facility for immediate surgical referrals (e.g. those with nerve compression or tendon ruptures). This article highlights an area where clinicians can do a better job of education of both patients and referring physicians. It would be of interest to observe if the findings of this article are similar to practice here in New Zealand.

**Reference:** *Rheumatology (Oxford)* 2011;50(9):1586-95

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3157630/?tool=pubmed>

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## Insole effects on impact loading during walking

**Authors:** Creaby MW et al

**Summary:** The effect of two insole designs on impact-related loading during walking was assessed in this study involving 22 healthy adults. Impact forces at the ground were measured in the subjects as they walked along a 10 m walkway in three different insole conditions; no insole, flat material insole or heel-cup insole. Impact forces at the knee were measured in 14 of the subjects. Compared with no insole and heel-cup insole, the flat material insole was associated with a significant ( $p = 0.001$ ) reduction in peak vertical ground reaction force (vGRF). There were no differences in vGRF loading rate between the three insole types. Peak impact force at the knee was significantly ( $p < 0.05$ ) reduced with the heel-cup and flat material insoles. The study authors concluded that their findings suggest that insole use may be beneficial for various musculoskeletal disorders, including osteoarthritis.

**Comment:** Shock-absorbing insoles are frequently reported to aid in reducing loads during walking and running. This Australian study involving healthy subjects is another study illustrating that impact loads are reduced with shoe insoles during walking. An issue with the article is that there is a speculative link between the progression of knee pathologies, such as osteoarthritis and the current findings. It is difficult to speculate a link from the current work and the reader should be aware of these issues. From a research perspective the only way to demonstrate that shoe insoles reduce the progression of knee osteoarthritis is to conduct a longitudinal (over time) study of a large group of people. Such studies will give us a global picture of the use of insoles in prevention of musculoskeletal disorders. Although the study has limitations to pathological conditions, the methodology and discussion sections are well written and would be of interest to clinicians.

**Reference:** *Ergonomics* 2011;54(7):665-71

<http://www.tandfonline.com/doi/abs/10.1080/00140139.2011.592600>

## Influence of contouring and hardness of foot orthoses on ratings of perceived comfort

**Authors:** Mills K et al

**Summary:** This study looked at features of orthoses (design and hardness) that may influence the perception of comfort. A total of 20 subjects were consecutively allocated to two experiments consisting of five sessions of repeated measures. Comfort measures (100 mm visual analogue scale [VAS; experiment 1] and ranking scale [experiment 2]) were undertaken while wearing prefabricated orthoses (four during each session). During experiment 1, subjects rated each orthosis relative to their own shoe, using a criterion scale. Measurements were undertaken during both jogging and walking. Overall, using both the VAS and ranking scale, a soft-flat orthosis was reported to be significantly more comfortable than all contoured orthoses, including one of the same hardness. Subject's perception of orthotic comfort significantly differed between jogging and walking on the VAS, but this difference was not found to be clinically meaningful. VAS measures revealed clinically meaningful differences between the soft-flat and contoured orthoses for dimensions of overall comfort and arch cushioning ( $>10.2$  mm). A VAS difference of 17.49 mm was found between orthoses judged as comfortable as my shoe and slightly less comfortable than my shoe, while a VAS difference of 11.34 mm was found between orthoses judged as comfortable as my shoe and slightly more comfortable than my shoe. It appears that healthy subjects prioritise contouring over hardness when judging the comfort of orthoses.

**Comment:** This article demonstrates that comfort is an important factor when considering foot orthotic therapy. Although the results demonstrated that asymptomatic subjects perceived hardness of foot orthoses, there are a number of issues that have not been addressed by this article. It is important to understand that there are other factors that one needs to consider and they include client acceptability of the foot orthoses, fit and very importantly costs. Also, the paper only highlights issues with 20 healthy subjects and therefore cannot be generalised to all healthy people. A different scenario may also be seen with clinical conditions such as rheumatoid arthritis or diabetes and elements such as fit, light weight, cushioning and stability may also influence comfort.

**Reference:** *Med Sci Sports Exerc.* 2011;43(8):1507-12

<http://tinyurl.com/4ykxlhg>

## Factors affecting gentamicin penetration in lower extremity ischemic tissues with ulcers

**Authors:** Zammit MC et al

**Summary:** The penetration of gentamicin in foot ulcers in patients with different severities of peripheral arterial disease (PAD), and significant parameters affecting lower limb tissue concentrations of the agent, were investigated in this study involving 61 patients (mean age 66 years) undergoing debridement of a wound or an amputation procedure. Prior to their procedure, patients received a 120 mg or 240 mg IV dose of gentamicin. Gentamicin concentrations were determined in serum and tissue samples collected at the time of the procedure. Twenty-six patients had severe PAD, nine had mild or moderate PAD and 19 had nil or borderline PAD. Eight patients had type 1 diabetes and 48 patients had type 2 diabetes. Analysis revealed that the concentration of gentamicin in peripheral skeletal muscle tissue was dependent on the serum concentration of the agent, degree of PAD, age and gender. The concentration of gentamicin was significantly ( $p = 0.01$ ) lower in patients with ischaemic lower extremity wounds (mild, moderate and severe PAD) than the concentration in non-ischaemic wounds. In peripheral subcutaneous tissue, the concentration of gentamicin was found to be 0.663 times the concentration in skeletal muscle ( $p < 0.001$ ). Male patients without PAD were found to have the greatest gentamicin penetration. Higher doses of gentamicin may be required to achieve the same effect in patients with severe PAD.

**Comment:** This study from Malta may be of interest to those clinicians who deal with lower extremity ulcers due to PAD. Clinicians are aware PAD is more prevalent in patients with diabetes and in smokers. PAD is often asymptomatic in diabetic patients because of the occurrence of peripheral neuropathy. These patients usually have a greater risk of amputation since they present at a later stage with more severe disease. Patients with lower extremity ischemia have an increased risk of developing chronic wounds and infections. Gentamicin is an aminoglycoside antibiotic with a concentration-dependent bactericidal activity. The results from the study indicate that gentamicin is an antibacterial with effective tissue penetration. However, for patients with severe PAD and for female patients with mild or moderate PAD, the concentration of gentamicin in ischemic wounds is lower than the serum concentration and may not be sufficient. The conclusion from the study is that clinicians should be aware that certain antibiotics may be beneficial to some patients, but they have limitations, especially in high-risk groups such as those with severe PAD. The article will be of interest to both clinicians and students.

**Reference:** *Int J Low Extrem Wounds* 2011;10(3):130-7

<http://ijl.sagepub.com/content/10/3/130.abstract>

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## The effect of three different levels of footwear stability on pain outcomes in women runners: a randomised control trial

**Authors:** Ryan MB et al

**Summary:** The injury status in female runners randomised to receive a neutral, stability or motion control running shoe was examined in this study involving 81 subjects. The women were categorised into three different foot posture types: neutral ( $n = 39$ ); pronated ( $n = 30$ ); highly pronated ( $n = 12$ ). The women underwent baseline testing to record training history and leg alignment before being allocated to one of the three shoe types and starting a 13-week half marathon training programme. In total, 194 missed training days were reported by 32% of the subjects; the stability shoe group reported the fewest missed days (51 days), while the motion control shoe group reported the most missed days (79 days). A significant ( $p < 0.001$ ) effect for footwear condition in both the pronated and neutral foot types was evident, with the motion control shoe reporting greater levels of pain in all three VAS items measured. In pronated feet, the stability shoe was associated with greater values of pain while running compared with the neutral shoe. In neutral feet, the neutral shoe was associated with greater values of pain while running compared with the stability shoe. There were no significant effects for the highly pronated group, however, the sample size was small.

**Comment:** This Canadian study will be of interest to clinicians, footwear distributors and students who deal with sports injuries. The results from the study of female runners demonstrated that the motion control shoe resulted in both a greater number of injured runners and missed training days than the other two shoe categories (neutral and stability). Foot type was measured using the Foot Posture Index. The results reported a number of issues with the motion control shoe with participants with pronated foot type. Although the sample size was small in the highly pronated group, it is noteworthy that every runner who trained in the motion control shoe with a highly pronated foot posture reported an injury. However, there are a number of limitations to the study. There were low numbers in the highly pronated foot types and they were heavier in the motion control shoe. Body weight and BMI have been implicated as causative for running injuries by various studies with their direct effect on the occurrence of plantar fasciitis and tibial stress fractures previously reported. The authors concluded that the provision of motion control shoes to neutral or pronated foot types carries a significant risk of experiencing running-related pain in women training for a half marathon and suggested that the current study is unable to provide support for the convention that highly pronated runners should wear motion control shoes.

**Reference:** *Br J Sports Med.* 2011;45(9):715-21

<http://bjsm.bmj.com/content/45/9/715.short>



## Effectiveness of a multifaceted podiatry intervention to prevent falls in community dwelling older people with disabling foot pain: randomised controlled trial

**Authors:** Spink MJ et al

**Summary:** This parallel group, randomised controlled trial was undertaken in order to determine the effectiveness of a multifaceted podiatry intervention in preventing falls in community dwelling older people with disabling foot pain. A total of 305 such patients (mean age 74 years) were allocated to either a multifaceted podiatry intervention (foot orthoses, advice on footwear, a \$A100 footwear voucher, a home-based programme of foot and ankle exercises, a booklet on preventing falls and routine podiatry care for 12 months [ $n = 153$ ]) or to routine podiatry care (control group;  $n = 152$ ), and were followed up for 12 months. A total of 264 falls occurred during the study period and subjects in the intervention group experienced 36% fewer falls than participants in the control group; incidence rate ratio 0.64 (95% CI 0.45–0.91). The intervention group exhibited significant improvements in strength (ankle eversion), range of motion (ankle inversion/eversion and dorsiflexion) and balance (maximum balance range wearing shoes and postural sway on the floor when barefoot) compared with the control group.

**Comment:** This Australian randomised clinical study is a pivotal paper and I highly recommend people read it in full. As the New Zealand population is growing, clinicians are going to be treating increasing numbers of older adults with a history of falls. The study found a multifaceted podiatry intervention reduces the rate of falls in older adults with foot pain. The study illustrates that simple inexpensive interventions are successful and that good foot education and a falls prevention educational package, with exercises, reduces falls. The authors have used an evidence-based approach to formulate the podiatric package. This is an example of how evidence is used to support an intervention. An evidence-based approach for podiatric interventions can be used in other high-risk categories such as diabetes or rheumatoid arthritis.

**Reference:** *BMJ.* 2011 Jun 16;342:d3411. doi: 10.1136/bmj.d3411

<http://www.bmj.com/content/342/bmj.d3411.abstract>

## Guidelines for the management of the foot health problems associated with rheumatoid arthritis

**Authors:** Williams AE et al

**Summary:** The North West Clinical Effectiveness Group for the Foot in Rheumatic Diseases (NWCEG) set out to develop guidelines for the management of specific foot health problems associated with rheumatoid arthritis (RA) for both specialist and non-specialist podiatrists. The guideline development group reviewed the evidence for specific aspects of the assessment and management of foot problems. Expert opinion was obtained from the members of the NWCEG where evidence was lacking and was added as consensus on current and best practice. The guidelines cover the management of specific foot problems (nail pathology, callus, ulceration) and the use of specific interventions (foot orthoses, footwear, steroid injection therapy, patient education), and standards in relation to each are provided. The guidelines also include a diagrammatic screening pathway aimed at guiding non-specialist podiatrists through the complexity of assessing and managing these patients.

**Comment:** The aim of the UK guidelines is to provide both specialist and non-specialist health care professionals working either in the health service or private practice with essential and 'gold standard' requirements for assessment and management of callus and nail pathology, ulceration and infection for those people with RA. The guidelines will be very helpful in the effective management of people with RA-related foot problems. Any health care professional should be able to see them as part of their everyday practice to improve the assessment, care planning and treatment of patients with RA. This article will enhance clinician's knowledge and the recommendations will be useful for building upon their existing skills, improving their service regardless of whether they have been working for a number of years with this patient group, or have only recently started working with such patients.

**Reference:** *Musculoskeletal Care.* 2011;9(2):86-92

<http://onlinelibrary.wiley.com/doi/10.1002/msc.200/abstract>