

Foot & Ankle Research Review™

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Issue 20 – 2014

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Abbreviations used in this issue

ED = emergency department
EMG = electromyography
HR-QOL = health-related quality of life
LLLT = low-level laser therapy
RA = rheumatoid arthritis

Welcome to the latest issue of Foot & Ankle Research Review.

I have included three articles that will be of interest to clinicians, relating to foot problems associated with common problems often encountered in New Zealand: diabetes and gout. Gout is the most common form of inflammatory arthritis and has significant functional, social and financial impacts. The high and increasing hospital admission rates with gout, combined with the burden of co-morbidities such as diabetes, chronic kidney disease and cardiovascular disease are important current and future issues for the New Zealand health care system. The first article looks at clinical characteristics of foot ulceration in gout (Rome K et al., International Wound Journal 2014). The second article evaluates patients' experience of therapeutic footwear whilst living at risk of neuropathic diabetic foot ulceration (Paton JS et al. Journal of Foot & Ankle Research 2014). The final article observes the reduction of major lower extremity amputations after the introduction of a multidisciplinary team for the diabetic foot (Rubio JA, et al., International Journal of Lower Extremity Wounds 2014).

I hope you enjoy reading Foot & Ankle Research Review and any feedback will be most welcome.

Kind Regards,

Professor Keith Rome

keithrome@researchreview.co.nz

Clinical characteristics of foot ulceration in people with chronic gout

Authors: Rome K et al.

Summary: This New Zealand study recruited six patients from rheumatology clinics in Auckland to examine wound characteristics in patients with foot ulceration associated with gout, and the effect on foot pain, disability and health-related quality of life (HR-QOL). Mean duration of foot ulceration was 4 months and most foot ulcers were ≤ 0.5 cm² superficial thickness with surrounding callus, although partial- and full-thickness ulcers were also observed. Two patients had multiple ulcer sites, one ulcer was infected and gouty tophi were present in most wounds. In most cases, the dorsal aspect of the third toe was ulcerated. Moderate foot pain, disability, impairment and HR-QOL scores were present and most patients wore poor shoes.

Comment: The New Zealand study demonstrates the clinical and foot characteristics of toe ulceration in this high risk group. Gout is on the increase and New Zealand has the highest rates in the world. However, our knowledge of foot ulceration in people with gout is limited. The case series illustrates the complexity of the condition with associated co-morbidities. The 'gout tribeca' of diabetes and cardiovascular problems is illustrated with the chronicity of the condition. A limitation of the study is only 6 patients are included; therefore, the results cannot be generalised to all gout patients. Biomechanical factors such as foot function were not assessed, and it is possible that abnormal biomechanical loading may have contributed to the delay in wound healing. Inappropriate or poor footwear may play an important role in the development of foot ulceration and future research needs to be undertaken to evaluate the predictive relationship between foot ulceration and poor footwear. It was not always possible to determine whether the wounds assessed in this study were progressing, deteriorating or static. Further research is required to evaluate wound care management strategies to reduce the incidence of foot ulceration in this patient group. The article does illustrate foot ulceration in people with gout.

Reference: *Int Wound J. 2014;Mar28 [Epub ahead of print]*

[Abstract](#)

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Foot Science
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Comparison of the pressure-relieving properties of various types of forefoot pads in older people with forefoot pain

Authors: Lee PY et al.

Summary: This study compared the effect of forefoot pads on forefoot plantar pressure in 37 older people (mean age 73.5 years) with forefoot pain. Compared to a shoe-only control, a metatarsal dome 10 mm proximal to the metatarsal heads, a metatarsal dome 5 mm distal to the metatarsal heads, a metatarsal bar, and a plantar cover all significantly reduced peak forefoot pressure and maximum force. The most effective interventions for reducing peak pressure were the metatarsal dome 5 mm distal to the metatarsal heads (17%, $p < 0.001$) and the plantar cover (19%, $p < 0.001$).

Comment: This Australian study reviews a common problem that is often presented to clinicians in older people with forefoot pain. This is a very interesting paper that reports a well conducted study which is refreshingly relevant and applicable to core podiatric clinical practice. The authors have covered all bases with regards to quality assurance measures for this experimental protocol. The results are well presented and discussed in the context of previous research findings and the implications for clinical practice. The authors also correctly identify the limitations of the protocol and suggest future areas for investigation. Each of the forefoot pads evaluated in this study was effective for reducing forefoot peak pressure in older people with forefoot pain. However, the metatarsal dome positioned 5 mm distal to the metatarsal heads and the plantar cover were the most effective. Due to the availability of prefabricated metatarsal domes and their smaller size, the authors cautiously recommended the use of such pads, positioned 5 mm distal to the metatarsal heads, to reduce forefoot plantar pressures in older people with forefoot pain. Further comfort and pain assessment, alongside plantar pressure evaluation, in long-term clinical trials could be undertaken. It would also be interesting to evaluate metatarsal domes in inflammatory arthritis such as rheumatoid arthritis.

Reference: *J Foot Ankle Res.* 2014;7:18

[Abstract](#)

Patients' experience of therapeutic footwear whilst living at risk of neuropathic diabetic foot ulceration: an interpretative phenomenological analysis (IPA)

Authors: Paton JS et al.

Summary: This qualitative study used in-depth semi-structured interviews to examine personal thoughts and feelings influencing daily footwear choice in 4 people with diabetes and neuropathy. Four interacting and overlapping themes appear to determine footwear choice; self-perception dilemma (balancing looking and feeling normal and protection from foot ulceration), reflective adaption (modification and individualisation of footwear usage values), adherence response (alignment of therapeutic footwear adherence behaviour with personal values) and reality appraisal (current appraisal of personal benefit on emotional and physical wellbeing, with consideration of the benefits of therapeutic footwear).

Comment: This UK study aimed to explore the psychological influences and personal experiences behind the daily footwear selection of individuals with diabetes and neuropathy. It is a well-written article and clinicians who deal with diabetic patients and therapeutic footwear should read it. Participants' decisions to choose to wear therapeutic footwear are influenced by their perception of immediate risk of ulceration. The authors suggest that rather than talking to diabetic people about adhering to footwear advice, it might be helpful for professionals and diabetic people to reflect on how they might use their therapeutic footwear to control and reduce the risk of foot ulceration. Of concern, is that the authors recommend that the provision of therapeutic house shoes or slippers, in addition to therapeutic footwear, might better meet the needs of people with diabetes and neuropathy. There is limited evidence on the benefits to detrimental effects of slippers and the reader should be aware of these issues. However, the authors conclude that the footwear product would need to meet the following criteria; lightweight, made of comforting materials, quick and easy to put on, suitable for use after bathing, relatively disposable and readily available.

Reference: *J Foot Ankle Res.* 2014 Feb 22;7(1):16

[Abstract](#)

Contaminants in human nail dust: an occupational hazard in podiatry?

Authors: Tinley PD et al.

Summary: An Australian study used nasal swabbing and fungal culture to determine whether nail drilling increases the risk of respiratory tract infection in 50 podiatrists and 45 non-podiatry health professionals. Although controls had greater overall numbers of organisms in their nasal cavities, podiatrists had a greater range of microbes. *Aspergillus fumigatus* was the most common fungus found in the podiatric group (44%). Almost all nail drills had some form of dust extraction, but 17% of podiatrists did not use a mask and appeared unaware of infection control issues. Only half of the podiatrists changed their disposable masks between patients, increasing the cross infection risk.

Comment: This Australian study is an interesting and important article for the podiatry profession. Podiatrists reduce thickened toe-nails using high speed drills as part of their general practice, which creates fine airborne particles of dust that can be inhaled by practitioners. Previous studies have found an association between asthma and the increasing number of years podiatrists have been in practice. Conjunctivitis, rhinitis and eczema have also been linked with exposure to nail dust. It is interesting to note the majority of podiatrists in the study used a mask whilst operating a nail drill, the efficacy of the type of masks mainly worn may not be adequate to filter the particle size of human nail dust. A disturbing finding was that eight podiatrists did not wear a mask. Limitations of the study that clinicians should be aware of are that the high levels of *A. fumigatus* may be related to certain parts of Australia and not applicable to New Zealand. A further limitation to practitioners in New Zealand is the finding of a rare dermatophyte that is the cause of tinea capitis, invading the skin and hair rather than the nails, and questions the risks of inhaling airborne dust and matter from skin during debriding the skin with a high speed sanding disc such as the Moore's disc, which is commonly used in clinical practice.

Reference: *J Foot Ankle Res.* 2014;7(1):15

[Abstract](#)

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Disclaimer: This publication is not intended as a replacement for regular medical education but to assist in the process. The reviews are a summarised interpretation of the published study and reflect the opinion of the writer rather than those of the research group or scientific journal. It is suggested readers review the full trial data before forming a final conclusion on its merits.

Research Review publications are intended for New Zealand health professionals.

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

Keith is currently leading podiatric research at AUT University and his current research interests relate to chronic gout, rheumatoid arthritis and the effects of foot orthoses/footwear on postural stability in long-term chronic conditions.



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An exploration of emergency department presentations related to high heel footwear in Victoria, Australia, 2006-2010

Authors: Williams CM and Haines TP

Summary: This Australian retrospective analysis of the Victorian Emergency Minimum Dataset (VEMD) between 2006-10 reports the emergency department (ED) presentation of injuries directly attributed to wearing high-heeled footwear and the associated estimated costs. In total, 240 injuries were directly attributed to high-heeled footwear; 236 of these were women and all were less than 55 years old. More injuries presented in November, December and January (n = 80) and more presented on Sunday (n = 83) and in the 8 am-12 pm time bracket (n = 64). Ankles were the most commonly injured body part (n = 123). Estimated ED cost was almost \$72,000 (\$317 per presentation).

Comment: This Australian study investigated the pattern and estimated cost of injuries attributed to high-heel wearing presenting to EDs in Victoria, between 2006 and 2010. This is the first study to look at the relationship between high-heel wear and injuries using an epidemiological approach. Overall, the paper is clear and well written and has a sound rationale. The methodology appears rigorous and appropriate. The article was reliant on hospital ED presentations, suggesting they only captured the more severe end of the spectrum of injuries arising. The authors wrote a very good section on the limitations of the study that related to triage staff within each ED that did not enquire of, or record the role of high-heeled footwear in the mechanism of injury field in the patient notes. It is also possible that the injured patient did not mention footwear as the mechanism for injury or, if there was also alcohol involved, intoxication may have been recorded as the primary cause of injury rather than the combination of high-heel footwear and intoxication. High-heel footwear has been directly related to lower limb injuries and this study illustrates the consequences of high-heel shoes on a busy accident and emergency department.

Reference: *J Foot Ankle Res.* 2014;7(1):4

[Abstract](#)

Low-level laser therapy for the treatment of chronic plantar fasciitis: A prospective study

Authors: Jastifer JR et al.

Summary: This US study examined the use of low-level laser therapy (LLLT) twice weekly for 3 weeks (total of six treatments) for acute and chronic pain in 30 patients with chronic plantar fasciitis. The mean Visual Analog Scale score for heel pain improved from 67.8 out of 100 at baseline to 6.9 out of 100 at 12-month follow-up. Mean Total Foot Function Index score decreased from 106.2 at baseline to 32.3 at 12 months.

Comment: The painful heel is frequently seen in general practice, rheumatology and podiatry clinics, in patients seeking a quick and effective treatment. A review of the literature illustrates the range of conservative treatment options for plantar fasciitis which include rest, stretching, strengthening, massage, physical therapy, orthotics and shoe inserts, heel cups, night splints, plantar strapping, non-steroidal anti-inflammatories, steroid and corticosteroid injections and iontophoresis. In this American study of 30 patients, LLLT showed a significant reduction in pain over the 12 months. Although effectiveness of laser therapy is still controversial, it could be a reasonable alternative or adjunct to other treatment modalities for chronic plantar fasciitis. The authors reported the benefits of low-level laser therapy that included no reported side effects, no pain associated with the treatment and in clinical practice, patients do not need to alter their activities. The current study lacked a placebo group, which introduced the potential bias of the placebo effect. The costs involved were not described and it would be interesting to compare traditional interventions such as exercise and foot orthoses with LLLT.

Reference: *Foot Ankle Int.* 2014;Feb 7 [Epub ahead of print]

[Abstract](#)

Effects of barefoot and barefoot inspired footwear on knee and ankle loading during running

Author: Sinclair J

Summary: This study assessed knee and ankle loading in 30 recreational male runners during barefoot and barefoot-inspired footwear use compared to conventional running shoes. Barefoot and barefoot-inspired footwear were associated with significantly lower patellofemoral kinetic contact force and pressure than conventional shoes, whereas Achilles tendon force was significantly increased.

Comment: Recently, barefoot running has been the focus of much attention in footwear biomechanical research. The rise in popularity of barefoot locomotion is borne out of the hypothesis that running without shoes is associated with a reduced incidence of chronic running injuries. Numerous barefoot-inspired footwear models are currently available and vary in design characteristics from minimalistic (e.g. Inov-8 Evoskin and VibramFive Fingers) to more structured designs which offer some midsole interface (e.g. Nike Free). The American study illustrated that differences occurred chiefly between conventional/Nike Free running shoes in comparison to barefoot running, whereas inconsistent deviations were found for the minimalist barefoot-inspired footwear models. It is likely that this finding relates to the greater divergence in midsole characteristics between conventional and Nike Free footwear compared to barefoot running, which results in the distinct running mechanics that lead to variations in knee and ankle kinetics. This also reinforces the notion that barefoot-inspired footwear models are not analogous to barefoot running, but most importantly shows that they may not necessarily replicate the characteristics of running barefoot. However, taking into account the corresponding increase in Achilles tendon force during barefoot running and minimalist footwear, this may in turn enhance the likelihood of chronic injuries to Achilles tendon. It is clear that additional analyses are required in order to provide prospective epidemiological analyses of barefoot running and minimalist footwear in relation to conventional running footwear and the influence of different knee and ankle load patterns on the aetiology of running injuries.

Reference: *Clin Biomech.* 2014;Feb 23

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[Abstract](#)

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Kinematic, kinetic and electromyographic response to customized foot orthoses in patients with tibialis posterior tenosynovitis, pes plano valgus and rheumatoid arthritis

Authors: Barn R et al.

Summary: The authors of this study aimed to examine the effect of customised foot orthoses on kinematic, kinetic and EMG features in 10 patients with rheumatoid arthritis (RA), tibialis posterior tenosynovitis and associated pes plano valgus. Patients had moderately active disease states with moderate levels of foot pain and foot-related impairment and disability. Soleus ($p = 0.05$) and medial gastrocnemius ($p = 0.02$) timing were altered and the magnitude of tibialis anterior was increased ($p = 0.03$) when barefoot was compared with shod foot orthoses. Foot motion characteristics differed between barefoot and shod with orthoses for peak rearfoot eversion ($p = 0.01$), peak rearfoot plantarflexion ($p < 0.001$) and peak forefoot abduction ($p = 0.02$).

Comment: This UK study will be of interest to clinicians who deal with RA. Pathology affecting the tibialis posterior tendon is common in RA and is frequently associated with a progressive flat foot deformity. Treatment options are varied and the evidence base for interventions is limited although foot orthoses have been found to be clinically effective in reducing pain, impairment and disability. The response of the tibialis posterior tendon and lower limb muscles to the foot orthoses was variable, but there was a trend towards reduced activity of tibialis posterior in the contact period; however, this did not reach statistical significance. It is an interesting article as there is limited information about leg muscle activation related to people with RA. The study has some limitations of which the reader should be aware. It was a small sample and it is difficult to draw robust conclusions from the data due to lack of power. The patients in the study had moderate levels of foot pain and foot-related impairment and disability in conjunction with moderately active disease. The analysis compared only barefoot and shod with foot orthoses, due to the complexities of the protocol, which does not separate the effect of the footwear from the foot orthoses. Similar to many studies relating to people with inflammatory arthritis, the authors recommended a large-scale intervention study, using kinematic data to identify potential therapeutic targets and optimising foot orthoses design to provide targeted, personalised, early interventions.

Reference: *Rheumatology* 2014;53(1):123-30

[Abstract](#)

Effectiveness of a heel cup with an arch support insole on the standing balance of the elderly

Authors: Chen TH et al.

Summary: This prospective study aimed to design a new insole and to explore its effectiveness on standing balance in 50 healthy elderly (over 65 years of age). Five did not complete the study; 25 patients in the good-stability group and 20 in the poor-stability group completed the trial. The stability index was significantly reduced for all 45 completers (3.244 versus 3.064; $p < 0.001$). The change in stability index was statistically significant ($p < 0.001$) in both in the good-stability group (2.764 vs 2.592) and the poor-stability group (3.845 vs 3.655). There were no statistically significant differences in stability index changes between the two groups.

Comment: Tests of standing balance are frequently included in neurological evaluations, but few objective data are available to indicate how well aged individuals are able to maintain a standing balance. The results of this study from Taiwan found the high-density polyurethane material had beneficial effects on the standing control of elderly individuals. Previous studies have investigated the use of different materials to enhance sensory feedback and have included textured foot orthoses, magnetic foot orthoses and vibrating foot orthoses. The authors report that the use of a heel cup with arch support may be of benefit in preventing falls. Unfortunately, there is no evidence to support the statement. The study was undertaken in 50 patients and no information is provided about falls history either currently or previously. The study was undertaken using standing balance and does not tell us about dynamic tasks. However, the study does add to the body of evidence that foot orthoses have a function in terms of postural stability. Further investigations are necessary in understanding the function of foot orthoses in affecting proprioceptive awareness of the limb position by stimulating the cutaneous mechanoreceptors when in contact with the plantar surface of the foot.

Reference: *Clin Interv Aging* 2014;9:351-6

[Abstract](#)

Reducing major lower extremity amputations after the introduction of a multidisciplinary team for the diabetic foot

Authors: Rubio JA et al.

Summary: This retrospective Spanish study examined the effect of multidisciplinary management of diabetic foot disease, by assessing the incidence of lower extremity amputations before (2001-07) and after (2008-11) the creation of a Multidisciplinary Diabetic Foot Unit. In total, 514 nontraumatic lower extremity amputations were performed, with 374 (73%) occurring in diabetics. The incidence declined significantly ($p = 0.020$) after introduction of the multidisciplinary team from 6.1 per 100 000 per year (95% CI 4.9-7.2) to 4.0 per 100 000 per year (95% CI 2.6-5.5). The incidence of minor or total amputations did not change in the diabetic population or the nondiabetic population. Joinpoint regression analysis indicated a significant reduction in the incidence of major lower extremity amputations in patients with diabetes with an annual percentage change of -6.6% (95% CI -10.2 to -2.8; $p = 0.003$).

Comment: This is a very interesting article that clinicians will be interested to read. Lower extremity amputations are a well-known and feared complication of diabetes mellitus, and up to 85% of all amputations are preceded by an ulcer. This Spanish study demonstrated that the introduction of a multidisciplinary diabetic foot unit, managed by an endocrinologist and a podiatrist, was associated with a reduction in the incidence of major amputations in patients with diabetes. A multidisciplinary approach to the diabetic foot involves the collaboration of general, orthopedic, and vascular surgeons and a specialist in infectious diseases in line with the recommendations of the International Consensus on the Diabetic Foot. Diabetes is a major cause of lower-extremity amputation in New Zealand. Education and careful daily foot inspection by the individual, early referral for medical review and early treatment of potentially damaging foot lesions have been shown to reduce the need for amputation by up to 80%. The article demonstrates that the introduction of a multidisciplinary team for managing the diabetic foot is associated with a reduction in the incidence of major lower extremity amputations in patients with diabetes.

Reference: *Int J Low Extrem Wounds* 2014;13(1):22-6

[Abstract](#)

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