

Foot & Ankle Research Review™

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Issue 23 – 2015

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Abbreviations used in this issue

HRQoL = Health-Related Quality of Life
RA = Rheumatoid arthritis
RCT = randomised controlled trial

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

Happy New Year to all our readers. In the latest issue I have included articles that have been published from New Zealand and Australia. The New Zealand article (Stewart S et al: The effect of good and poor walking shoe characteristics on plantar pressure and gait in people with gout. Clin Biomech. 2014;29:1158-63) evaluates plantar pressures and gait parameters of good and poor footwear characteristics in people with gout. New Zealand has one of the highest prevalence rates of gout in the world. Furthermore, the prevalence is rising in New Zealand and is matched by a rising number of hospital admissions for gout. Gout, the most common form of inflammatory arthritis, has significant functional, social and financial impacts. The two Australian articles relate to a consensus study on foot orthoses for adults with flexible flatfeet (Banwell HA et al: Consensus-based recommendations of Australian podiatrists for the prescription of foot orthoses for symptomatic flexible pes planus in adults. J Foot Ankle Res 2014;25: 49) and the impact of depression in people with diabetic ulcers (Pearson S et al: Depression symptoms in people with diabetes attending outpatient podiatry clinics for the treatment of foot ulcers. J Foot Ankle Res 2014;7:47). Both articles are clinically relevant and topical. I recommend you read both of the articles.

I hope you enjoy reading the latest issue and any feedback is most welcome.

Kind Regards,

Professor Keith Rome

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Foot posture, range of motion and plantar pressure characteristics in obese and non-obese individuals

Authors: Butterworth PA et al.

Summary: This multiple regression analysis evaluated plantar loading patterns in 68 obese and non-obese participants (mean age 52.6 years; 68% female). The obese participants had flatter feet, a reduced inversion-eversion range of motion, and higher walking peak-plantar pressures. When foot structure and walking speed were controlled for, bodyweight was associated with elevated foot loading, particularly in the fore- and mid-foot.

Comment: Obesity is a world-wide health problem, and its prevalence is increasing in both developed and developing countries. The findings from this Australian study indicate that obese adults were more likely to have foot pain, a relatively pronated foot posture, flatter feet, reduced ankle inversion-eversion range of motion and increased plantar loading under the foot. The implications of these findings are that bodyweight appears to be the main driver of increased loading under the foot, and that foot structure characteristics are of secondary importance. This suggests that weight reduction may be a more effective strategy than mechanical interventions for reducing plantar loading to treat foot pain in obese people. Previous studies have found that weight loss results in a significant improvement in foot pain. While the effects of weight loss on foot pain has been demonstrated in these observational studies, the causal effect of weight loss is yet to be evaluated in randomised clinical trials. It is also not known whether weight loss in obese individuals has a beneficial effect on foot structure and function. This is an interesting article and should be read in conjunction with the following article published by Song et al.

Reference: *Gait Posture* 2014;Nov 24 [Epub ahead of print]

[Abstract](#)

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Foot Science
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Effects of weight loss on foot structure and function in obese adults: A pilot randomized controlled trial

Authors: Song J et al.

Summary: The effects of weight reduction on foot structure, gait and dynamic plantar loading in obese adults was investigated in this 3-month RCT involving 41 adults (mean age 56.2 years; 32 female; BMI 35.9±4.2kg/m²). Individuals received either a weight loss intervention based on portion-controlled meals or a delayed-treatment (controls). Measurements of Arch Height Index (AHI), Malleolar Valgus Index (MVI), plantar peak pressure, spatial and temporal gait parameters and weight were undertaken at baseline, 3 months and 6 months. After 3 months, those undergoing the weight-loss intervention exhibited significantly greater weight loss than the control group (5.9±4.0kg vs 1.9±3.2kg, $p = 0.001$). While anatomical foot structure and gait did not differ between the two groups at this time point, the intervention group exhibited a significantly reduced plantar peak pressure than the control group beneath the lateral arch and the metatarsals. At 6 months, the change in PP correlated significantly with the change in weight at the metatarsal 2 ($r = 0.57$, $p = 0.0219$), metatarsal 3 ($r = 0.56$, $p = 0.0064$) and the medial arch ($r = 0.26$, $p < 0.0001$).

Comment: Obesity is a major risk factor for heart disease, diabetes, diminished quality of life, and increased mortality. Obesity can have a profound impact on mobility. The strength of this American article is that this is the first prospective RCT designed to explore the effects of weight loss on foot structure, gait and plantar pressure. This study was limited to asymptomatic obese adults with no significant musculoskeletal disabilities or pain. Small sample size, modest weight loss, and short follow up period limit the clinical utility of the study. While no significant and clinically meaningful change was noted on foot structure and gait parameters, the results showed that even a modest weight reduction can yield significant reduction in plantar loading. These dynamic plantar load alterations that accompanied moderate weight loss did not occur uniformly throughout the foot but rather specific to certain regions of the foot in this group of participants with planus foot type. Additional studies are needed to examine the prevalence of foot pain/disability in obese subjects, the role of specific footwear and exercise program, and the significance of foot disability on adherence to healthy lifestyle.

Reference: *Gait Posture* 2015;41(1):86-92

[Abstract](#)

Movement of the human foot in 100 pain free individuals aged 18–45: implications for understanding normal foot function

Authors: Nester CJ et al.

Summary: This study in 100 healthy and pain free individuals assessed 3D foot kinematics based on a 5-segment foot model. The modelled foot segments showed the greatest range of motion in the sagittal plane, but large ranges of movement were observed in all planes. All the foot segments experienced movement throughout the gait cycle, although the least motion occurred between the mid-foot and calcaneus. Evidence of movement coupling between joints was inconsistent. The data derived in this study differs significantly to other foot segment models in the literature.

Comment: Characterisation of motion in the normal healthy foot is a prerequisite for understanding the effects of pathology on foot function and setting targets for mechanical interventions such as orthoses. This UK study sets out to define normal kinematic (motion) patterns across a full range of functional units in the foot and to better understand how different joints contribute to the overall role of the foot during walking. The kinematic data confirm that the normal pain free foot of those aged 18-45 is a highly compliant and multi articular mechanism whose function relies upon a range of contributions from all segments and movement in all three body planes. There are several limitations to the study. The participants were pain free but this does not mean all feet were entirely free of changes in foot structure (e.g. sub-clinical arthritic changes). The cohort was relatively young and does not represent sub-clinical structural changes such as arthritis, and changes associated with ageing. The multi-segment foot model chosen was developed from results of prior invasive and cadaver studies and differs in some respects from others published. The article is interesting for those who have an interest in foot and ankle biomechanics.

Reference: *J Foot Ankle Res.*

[Abstract](#)

Depression symptoms in people with diabetes attending outpatient podiatry clinics for the treatment of foot ulcers

Authors: Pearson S et al.

Summary: This Australian study assessed the prevalence of symptoms of depression, diabetes self-management measures, and HRQoL in 60 diabetic patients with foot ulcers. Mild depression symptoms (Patient Health Questionnaire [PHQ] score 5–9) were reported by 14 (23.3%) patients and moderate to severe depressive symptoms (PHQ score >9) by 17 (28.3%) patients. Previously recognised depression (use of antidepressants and/or a diagnosis of depression in the last 12 months) occurred in 21 (35%) patients and 17 (28.3%) had depression not previously recognised (PHQ >4). Antidepressant treatment had been received by 17 (28%) patients for a median of 104 weeks; despite treatment, 12 participants (70.6%) had moderate to severe depressive symptoms. Poorer adherence to diabetes self-care activities including general diet, exercise, blood sugar monitoring and foot care were observed in those with PHQ scores >4 versus those with PHQ scores <5. There was no association between physical functioning and depressive symptoms. Increasing depressive symptoms was associated with decreasing mental wellbeing. After 6 months of follow-up, three deaths and three amputations occurred in those with PHQ scores >4 versus no deaths and two amputations in those with PHQ scores <5. No association was observed between depressive symptoms and ulcer healing or recurrence at 6 months.

Comment: This study found a high prevalence of depressive symptoms. The results are generally higher than the prevalence of depression reported in people with diabetes without foot ulcers. Higher prevalences in participants with foot ulcers may be explained in part by the increased burden associated with having a foot ulcer. The study also found an association between depressive symptoms and poorer diabetes self-management. With the increasing incidence of diabetes globally, identification of previously unrecognised depression (mild and moderate to severe) in people with diabetes either before the onset of complications or those with existing complications is important as it provides the opportunity for early intervention. From a public health perspective the provision of evidence-based therapies for those with depression and foot ulceration should form part of the holistic management of this group with complex medical and psychosocial needs. For clinicians who deal with diabetes on a regular basis the article will be of interest to you.

Reference: *J Foot Ankle Res.* 2014;7:47

[Abstract](#)

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Consensus-based recommendations for the prescription of foot orthoses for symptomatic flexible pes planus in adults: development of the FootPROP proforma

Authors: Banwell HA et al.

Summary: The Australian FootPROP (Foot orthosis Prescription Recommendations for symptomatic flexible Pes planus in adults) recommendations were developed based on a Delphi survey of 24 podiatric experts (70% agreement required for acceptance) to determine current use and the rationale for prescription of customised foot orthoses in adults with symptomatic flexible pes planus. Consensus was established for two prescription variables, the shell material, polyolefin, and in what circumstances to use a forefoot post balanced to perpendicular. In addition, 52 statements on the rationale for individual prescription variables were agreed, including when to prescribe: an inverted cast pour (inverted heel position), an inverted rear-foot post, a forefoot post, a medial heel (Kirby) skive, a medial flange, minimal/maximal arch fill and other common orthotic accommodations.

Comment: This Australian study will be of interest to the majority of clinicians who prescribe foot orthoses for people with pes planus. Foot orthoses (FOs) are the most commonly cited intervention for flexible pes planus. However, guidelines for prescribing customised FOs for specific foot types, including symptomatic flexible pes planus, are yet to be established, and the literature that is available offers minimal direction or consistency. This study has resulted in the first consensus-based recommendations for the prescription of customised FOs for symptomatic flexible pes planus in adults. Both clinicians and researchers may use these recommendations to guide their practice and research. Although the findings of this study suggest that existing prescription habits of expert podiatrists for this condition are not universal, they do indicate that there is agreement on the rationale for use of individual prescription variables. There are several limitations to the study. Firstly, there is no universally accepted definition or classification for flexible pes planus, nor a consensus on what or when intervention may be required. Secondly, although the findings are a good starting point, they are based on expert opinion, which in the context of evidence-based practice constitutes low-level evidence. I strongly recommend you read the article as the findings reflect clinical practice.

Reference: *J Foot Ankle Res.* 2014;7:49

[Abstract](#)

Limited ankle dorsiflexion increases the risk for mid-portion Achilles tendinopathy in infantry recruits: a prospective cohort study

Authors: Rabin A et al.

Summary: An Israeli study in 70 healthy male military recruits (mean age 19.6 years, body mass 71.5 kg) examined the role of ankle dorsiflexion range of motion and lower extremity movement pattern as risk factors in the pathogenesis of mid-portion Achilles tendinopathy during 6 months of army basic training. Five of the recruits developed Achilles tendinopathy; these participants had a more limited non-weight-bearing ankle dorsiflexion range of motion (27.40 vs 21.10, $p = 0.025$) than uninjured participants, but lower extremity movement quality did not differ between groups ($p = 0.361$).

Comment: Achilles tendinopathy (AT) is a common injury among runners and military personnel. This Israeli study found that ankle dorsiflexion range of motion measured with the knee bent was predictive of the development of AT in a sample of 70 military recruits. The study has several important limitations. First, the number of cases of AT was low ($n = 5$). The lack of use of imaging for the diagnosis of AT could be considered a limitation. However, the diagnostic criteria were compatible with current clinical practice guidelines. The findings may also be limited to a relatively young population, undergoing rigorous physical training. Nutritional regimen, hours of sleep, training terrains, loads carried and shoe wear may also differ between a military and a civilian population, thus presenting another possible limitation. This is an interesting article; however, the reader should be aware of the limitations of the study such as the effects of other variables such as ankle dorsiflexion range of motion with the knee extended, subtalar mobility, endurance or strength of various muscle groups.

Reference: *J Foot Ankle Res.* 2014;7:48

[Abstract](#)

The associations of leg lean mass with foot pain, posture and function in the Framingham foot study

Authors: McLean R et al.

Summary: Using data from the population-based Framingham Foot Study ($n = 1,795$; mean age 67 years), researchers explored the association of leg lean mass and foot pain, posture and function. Age- and BMI-adjusted logistic regression models suggest that an increase of 1-standard deviation or more in leg lean mass is associated with reduced foot pain (OR 0.76; 95% CI 0.68-0.86) and pronation (OR 0.76; 95% CI 0.67-0.85), and increased supination (OR 1.17; 95% CI 1.04-1.31). These associations were attenuated by adjustments for sex. Before and after adjustment for sex, greater leg lean mass lowered the odds of a high arch (OR 0.73; 95% CI 0.60-0.89).

Comment: This study from America found that in the overall population, higher leg lean mass was associated with lower odds of foot pain, lower odds of pronation, and higher odds of supination, but these associations were completely explained by sex. Higher leg lean mass was, however, associated with lower odds of high (cavus) arch in the overall cohort after adjusting for sex, as well as in men and women separately. These findings suggest that low muscle mass may be associated with high arch foot posture in the general community of older adults. The findings from the study suggest that while muscle mass is not associated with foot pain or function in older adults, reduced muscle mass may contribute to extreme foot posture in older adults, perhaps playing a role in the aetiology of physical limitations and disability due to foot disorders. Muscle mass and strength are potentially modifiable and could be considered as targets for intervention to prevent or improve foot problems and consequent physical impairments in older adults. Prospective studies that can evaluate the mass and strength of the muscles specific to foot posture and function are needed to gain a better understanding of the aetiology of foot problems and the associated consequences.

Reference: *J Foot Ankle Res.* 2014;7(1):46

[Abstract](#)

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.

For full bio [CLICK HERE](#)

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Effects of off-the-shelf foot orthoses on plantar foot pressures in patients with early rheumatoid arthritis

Authors: Santos D et al.

Summary: A study of 35 RA patients explored the effects of off-the-shelf orthoses on plantar foot pressures in early RA. Forefoot peak plantar pressure values increased between barefoot and shod conditions and between barefoot and orthoses wearing conditions ($p < 0.01$). However, forefoot peak plantar pressure values declined over 6 months when wearing orthoses versus with shoes only ($p < 0.01$). Foot orthoses also significantly reduced the forefoot pressure-time integral over 6 months ($p < 0.01$) and increased in hallux and lesser toe ($p < 0.01$) and midfoot ($p < 0.01$) contact areas.

Comment: This UK study will be of interest to clinicians who manage people with RA. There have been a number of studies evaluating plantar pressures in RA over the last two decades. The reader should be cautious of the findings from this study as there was no control group to compare the findings and although the study was conducted over 6-months this was not a clinical trial. The authors report that the off-the-shelf foot orthoses increased the lesser toe contact area at 6 months. Unfortunately, the authors incorrectly suggest that the toe deformity has decreased and that the claw toes have become straighter and more functional. A statement that requires further clarification. However, the study has reported a reduction in plantar pressures, similar to previous studies. A limitation of the study is that no health-related patient reported outcome measures were used. For example, the use of scales to measure foot pain, impairment and disability would give a better insight from a patient's perspective of the value of the foot orthoses. What would be helpful is how cost-effective are foot orthoses in people with early RA.

Reference: *J Am Podiatr Med Assoc.* 2014;104(6):610-6

[Abstract](#)

The effect of good and poor walking shoe characteristics on plantar pressure and gait in people with gout

Authors: Stewart S et al.

Summary: The effect of good and poor footwear characteristics on plantar pressure and spatiotemporal parameters of gait was investigated in this cross-sectional repeated measures study. Thirty-six individuals with gout underwent recording of plantar pressure and spatiotemporal parameters under two shoe conditions: (1) the participants own footwear, and (2) either a new pair of walking shoes with good footwear characteristics ($n = 21$) or poor characteristics ($n = 15$). Footwear with good characteristics significantly reduced peak pressure at metatarsal 3 and 5, reduced pressure time integrals under the heel and metatarsals 3 and 5, and increased pressure time integrals beneath the midfoot compared with participant's own footwear. Compared to participant's own shoes, footwear with poor characteristics significantly increased peak pressure beneath the heel and lesser toes, reduced peak pressure at metatarsal 3 and reduced pressure time integrals in the midfoot. Walking velocity, stride length and step length were significantly increased in both good and poor footwear compared to participant's own shoes.

Comment: This New Zealand study has shown that new commercially-available walking shoes influence plantar pressures and spatiotemporal parameters of gait in people with gout compared to their own shoes. Walking shoes with good footwear characteristics resulted in significantly different plantar pressure values compared to shoes with poor footwear characteristics for certain areas of the foot. This study should be considered in light of limitations. Participants wore their own footwear and therefore resulted in unstandardised measurements taken in this shoe condition. The high percentage of males in the current study reflects the greater prevalence of gout in the male population; it limits the generalisability of the results to both genders. This study was conducted in New Zealand where severe gout is frequently observed in Māori and Pacific people suffering from tophaceous gout, which may also limit the generalisability to other populations. Further longitudinal investigations would be beneficial in evaluating the effect of specific footwear characteristics on functional and biomechanical parameters of the foot in people with gout over a longer period of time.

Reference: *Clin Biomech.* 2014;29(10):1158-63

[Abstract](#)



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Effectiveness of customised foot orthoses for Achilles tendinopathy: a randomised controlled trial

Authors: Munteanu SE et al.

Summary: This participant-blinded, parallel-group RCT undertaken at La Trobe University, Melbourne, Australia was designed to evaluate the effectiveness of customised foot orthoses in chronic mid-portion Achilles tendinopathy. The study involved 140 such patients aged 18-55 years who were randomised to receive eccentric calf muscle exercises with either customised foot orthoses (intervention; $n = 67$) or sham foot orthoses (control; $n = 73$). At baseline, 1, 3, 6 and 12 months, participants undertook the Victorian Institute of Sports Assessment-Achilles (VISA-A) questionnaire (3 months was the primary end point). No significant differences between groups were observed at any time point. At 3 months, the mean (SD) VISA-A scores were 82.1 (16.3) and 79.2 (20.0) points for the customised and sham foot orthosis groups, respectively.

Comment: This Australian study will be of keen interest to clinicians who prescribe foot orthoses for people with mid-portion Achilles tendinopathy. The findings may be disappointing to many clinicians as there were no statistically significant differences between the intervention groups (customised vs sham) in the primary outcome measure at any time point during the study. The authors conclude that customised foot orthoses were no more effective than sham foot orthoses for reducing pain and improving function and activity in people with mid-portion Achilles tendinopathy undertaking an eccentric calf muscle programme. The authors conclude that the current study provides evidence against clinicians prescribing customised foot orthoses for mid-portion Achilles tendinopathy. The second statement states that customised foot orthoses are not recommended for mid-portion Achilles tendinopathy in the setting of patients undertaking prescribed eccentric exercises. The use of a 'sham' foot orthoses is controversial as previous studies suggest that any foot orthotic intervention may lead to clinical differences. I strongly recommend your read this article.

Reference: *Br J Sports Med.* 2014;Sept 22 [Epub ahead of print]

[Abstract](#)

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