

# Foot & Ankle Research Review™

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Issue 41 – 2019

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## Welcome to Issue 41 of Foot and Ankle Research Review.

What happens to foot structure and function following trans-metatarsal amputation? This was a question one of my colleagues challenged me with recently. Coincidentally, in the few days after I was asked this question the study by Humphrey et al., (reviewed in this issue) was published. Although it was an interesting study, I still don't have an answer for the question. The study by Hendry et al., also highlights the issue of multimorbidity, showing that multimorbidity was associated with poor foot health outcomes and lower rates of self-perceived improvement. I have also included two studies that pose a question I am particularly interested in. Do static measures of joint motion provide any insight into dynamic function?

I hope you enjoy this issue and please keep the feedback coming in.

Kind regards,

**Associate Professor Matthew Carroll**

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Research Review thanks Foot Science International for their sponsorship of this publication, and their support for ongoing education for healthcare professionals.

## The impact of multimorbidity on foot health outcomes in podiatry patients with musculoskeletal foot pain: a prospective observational study

**Authors:** Hendry GJ et al.

**Summary:** The impact of multimorbidity on foot health outcomes was evaluated in the prospective PROMFoot study involving adults with a new episode of foot pain attending the podiatry service within the NHS Greater Glasgow and Clyde health board. Among 115 participants (59% female; mean age 55 years) assessed in the study, multimorbidity was common, affecting 61 participants (53%); 28 (24.3%) and 26 (22.6%) reported single or no medical comorbidities, respectively. Patients with multimorbidity exhibited significantly worse foot health scores for all Foot Health Status Questionnaire (FHSQ) domains (pain, function, footwear and general foot health) at baseline, 3 and 6 months. Multimorbidity was associated with lower rates of self-perceived improvement in foot pain over 6 months following podiatric intervention.

**Comment:** Multimorbidity is defined as the coexistence of two or more medical conditions. The most common comorbidities in the study population being back pain, osteoarthritis, hypertension and depression. The results of this study demonstrate that people with multimorbidity have poorer foot health than people without, both before and after podiatric intervention. Multimorbidity was associated with worse outcomes for foot function at 3 months, and foot pain, foot function and footwear at 6 months. The authors pose a great question based upon the results, that is, whether enough foot health benefits can be achieved in people who suffer from multimorbidity via interventions designed to address presenting foot pain complaints in isolation. It appears that they do not, based upon the results of this study. This is a great study that highlights the need for health professionals to think beyond what they can offer as a professional.

**Reference:** *J Foot Ankle Res.* 2019;12:36

[Abstract](#)



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## The footwear experiences of people with gout: a qualitative study

**Authors:** Frecklington M et al.

**Summary:** This study used a qualitative descriptive methodological approach to explore the footwear experiences of 11 people with gout. A purposive sampling strategy with semi-structured interviews was used and thematic analysis undertaken. Four key meanings and patterns within the data were identified: (1) comfort as a priority, (2) knowing what to buy, (3) knowing what to wear, and (4) challenges of different environments. The study revealed that footwear comfort was of high importance; uncomfortable footwear negatively influenced participation in daily activities. Patients reported that balancing of comfort, appearance and cost resulted in fewer options and reduced confidence when shopping for shoes. Foot tophi and flares limited footwear use.

**Comment:** The issues surrounding footwear choice for people with gout are illustrated by this study. Interestingly, the study revealed some people with gout did not have any foot problems or difficulty with footwear and for some gout did not factor into the decision-making surrounding footwear. Cost of footwear was identified as an important factor and increased the complexity of finding footwear that was both comfortable and aesthetically pleasing. The authors also noted a link between the participant's footwear and their clothing outfit – footwear decisions for social occasions were often made to the detriment of comfort. The research further highlights the challenges of finding appropriate footwear for people with gout. Health practitioners must be at the forefront of footwear education and provide people with chronic foot conditions functional and affordable option.

**Reference:** *J Foot Ankle Res.* 2019;12:38

[Abstract](#)

## The iPhone Measure app level function as a measuring device for the weight bearing lunge test in adults: a reliability study

**Authors:** Banwell HA et al.

**Summary:** This study measured the reliability and validity of the iPhone level measure, within the Measurement App, for measuring the weight-bearing ankle lunge test in adults; these findings were compared to measurements taken with a digital inclinometer. Measurements were undertaken in 21 participants by 2 experienced raters measuring ankle dorsiflexion range of motion in the knee extended and knee flexed positions of the weight-bearing lunge test. Good intra-rater reliability using the iPhone and good inter-rater reliability using the digital inclinometer in the knee extended position were observed, while all other intra- and inter-rater reliability for both devices and both leg positions were excellent. Concurrent validity was found to be excellent between the two devices on a flat surface and a known angle surface, with good validity shown by a Bland Altman plot for all measures in all positions.

**Comment:** Clinicians involved in lower limb rehabilitation often measure ankle joint range of motion. This reliability trial demonstrated that the level measure on the iPhone measurement function can reliably quantify ankle joint dorsiflexion range of motion. Although found to be reliable, there were differences in measuring range of motion between a straight leg and flexed leg position, the flexed leg demonstrating higher reliability. Clinicians using this method and device should be consistent in their use of either the flexed or straight leg position. There also needs to be consideration of the relationship between a static measure of joint range of motion and dynamic function. That is, does a limited static range of motion affect dynamic function?

**Reference:** *J Foot Ankle Res.* 2019;12:37

[Abstract](#)

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## Evaluation of orthotic insoles for people with diabetes who are at-risk of first ulceration

**Authors:** Martinez-Santos A et al.

**Summary:** This study investigated the effects of pressure-relieving orthotic insoles for use with retail footwear in diabetics at risk of first forefoot ulceration. Sixty diabetic patients with evidence of neuropathy had orthotic insoles designed with metatarsal bar location and shape customised according to obtained plantar pressure data. Patients walked in 9 variants of the orthotic insole, comprising 3 variations in proximal/distal location of the customised metatarsal bar and 3 different metatarsal head offloading materials. Most frequently, reductions in pressure were evident when the anterior edge of the metatarsal bar was placed at 77% of the peak pressure values. In the flat insole, 1 or more metatarsal head areas with pressure above 200 KPa were evident in 61% of participants, with this value reducing to 58% when adopting generic orthotic design rules and 51% when using the best orthotic insole of those tested.

**Comment:** This study is well worth a read as it investigates a common clinical dilemma for those who use in-shoe redistributive padding, that is, where to place a material and what material to use. There are a few take-home messages from the study. First, the addition of cushioning material to areas where there are voids (cavities) decreased pressure. Second, metatarsal padding will likely increase pressure to the hallux, so be mindful of this secondary effect. Third, optimal clinical results could be achieved if metatarsal bars/pads are located according to regions of peak pressure, rather than anatomical structures. This is further evidence advocating the use of plantar pressure measurement as a routine assessment tool.

**Reference:** *J Foot Ankle Res.* 2019;12:35

[Abstract](#)



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## Outcome of trans-metatarsal amputations in patients with diabetes mellitus

**Authors:** Humphrey JA et al.

**Summary:** The outcomes of 41 consecutive diabetic patients (37 men, 4 women) who had undergone trans-metatarsal amputation between January 2008 and December 2017, and who were managed within a diabetic foot care service, were investigated in this retrospective case series. A total of 36 (88%) patients were followed up (mean 2.3 years). Reoperation was required in 4 (11%) patients, including 3 (8%) major amputations; all of these patients had peripheral vascular disease. The 4-year survival rate was 69%. Among the surviving patients not requiring a revision to a major amputation, 96% (21/22) were fully mobile while wearing bespoke orthoses.

**Comment:** This retrospective study reviewed hospital records of consecutive patients with diabetes mellitus who had undergone a trans-metatarsal amputation over a 10-year period. Following trans-metatarsal amputation in this cohort of patients, re-amputation rates were lower (8%) than seen in previously reported research. Although cost analysis was not the goal of the study, data highlights the number of surgical procedures patients received prior to trans-metatarsal amputation, notably, 30 patients (73%, 30/41) had undergone 33 operations on the ipsilateral foot prior to their trans-metatarsal amputation. The results also present the spectrum of pre-operative trans-metatarsal amputation microorganisms grown. I am particularly interested in the changes to foot position related to structural and soft tissue changes post trans-metatarsal amputation. There is scope for research to look at the long-term changes in foot pressures and structural change post trans-metatarsal amputation.

**Reference:** *Foot (Edinb.)* 2019;40:22-6

[Abstract](#)

## Tibialis anterior tendinosis: Clinical characterization and surgical treatment

**Authors:** Cignetti C et al.

**Summary:** These authors investigated surgical treatment and clinical outcomes in 9 patients (6 female, 3 male) with severe tibialis anterior tendinosis. Two patients with no tear, 1 with partial tear and 6 with complete tear underwent operative treatment involving debridement and direct repair without augmentation, direct repair with fibre tape augmentation, tibialis posterior tendon transfer, or tibialis anterior tendon (TAT) augmentation with a tendon autograft (extensor digitorum longus [EDL] tendon, plantaris tendon, or both; n = 4). During the procedure, all patients underwent a gastrocnemius recession and intraoperative examination revealed that approx. 15-20° of dorsiflexion was achieved. During a mean postoperative follow-up of 21.3 months, dorsiflexion strength improved to 5/5 in 7 patients from a baseline of 0/5. Overall, patients expressed a high level of satisfaction with treatment.

**Comment:** Tibialis anterior tendinosis is a relatively rare clinical entity. Patients may report burning medial midfoot pain and swelling. Physical exam is often positive for a palpable mass on the dorsal aspect of the ankle with decreased strength, reduced ankle dorsiflexion, a drop foot with associated high-step gait, and recruitment of extensor hallucis longus (EHL) and EDL with ambulation. If untreated, long-term sequelae can include clawing of the toes due to EHL and EDL overcompensation, gastrocnemius, and Achilles tendon contracture. When considering conservative versus surgical management, age and expectations surrounding activity level maintenance are important. Surgical repair provides very good outcomes, and leads to fewer sequelae, such as persistent drop foot and flatfooted gait, with a strong likelihood of return to baseline activity status.

**Reference:** *Foot (Edinb.)* 2019;39:79-84

[Abstract](#)

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### Independent commentary by Associate Professor Matthew Carroll

Matthew is Associate Professor of Podiatry and Head of Postgraduate Programmes within the School of Clinical Sciences at the Auckland University of Technology. He graduated in podiatry at the CIT in Wellington. He undertook his postgraduate work at Otago University, Dunedin, New Zealand, Curtin University, Western Australia and Auckland University of Technology, Auckland, New Zealand. His research areas include investigating musculoskeletal function in the lower limb in inflammatory arthritis. He is active in the supervision of higher degree students. He is Associate Editor for BMC Musculoskeletal Disorders and is an Editorial Board Member for the Journal of Foot & Ankle Research.



## Everyday footwear: An overview of what we know and what we should know on ill-fitting footwear and associated pain and pathology

**Authors:** Branthwaite H and Chockalingam N

**Summary:** This overview investigated what is known and what should be known about ill-fitting footwear and its association with pain and pathology. The review authors explained that footwear advice on healthy footwear should be individualised, as there is no definition of an ill-fitting shoe. The review highlighted that the evidence on ill-fitting footwear is limited and based on indirect association, assumptions and mythology, and that the mechanisms of ill-fitting footwear need to be further explored.

**Comment:** This review provides insight into the concepts of ill-fitting footwear, high heels and the mythology surrounding footwear. The mythology section is particularly thought provoking and reignites the debate about the necessity for a stiff heel counter (mainly the lack of empirical evidence surrounding the functional usefulness of a stiff heel counter). There is also little guidance on what are the most effective fastening systems, and apart from stopping heel slippage, are they functional? The optimal fit, but particularly what is the correct length a shoe should be fitted to, is also controversial. The current suggestion is that this should be between 1-1.5 cm beyond the longest point of the foot, however, there is no standard approach to the correct assessment of this characteristic.

**Reference:** *Foot (Edinb.)* 2019;39:11-4

[Abstract](#)



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## Vertical ground reaction forces during gait in children with and without calcaneal apophysitis

**Authors:** McSweeney S et al.

**Summary:** Vertical ground reaction force, peak plantar pressure (forefoot, midfoot, heel) and temporospatial gait parameters (cadence, step length, stride, stance and swing phase durations) were assessed during barefoot walking and running in 14 children with, and 14 without, calcaneal apophysitis in order to determine differences in vertical loading. Testing was undertaken using a treadmill at matched and self-selected speeds. While there were no significant differences between groups in vertical ground reaction force peaks or regional peak plantar pressures, during running, cadence was significantly ( $p < 0.05$ ) higher ( $\approx 5\%$ ) and step length shorter ( $\approx 5\%$ ) in children with calcaneal apophysitis than those without, when normalised to stature. Also during running, the maximum pressure beneath the rearfoot was significantly correlated with self-reported pain in those with calcaneal apophysitis.

**Comment:** Children in this study had increased cadence, which may be a central mechanism to reduce loads and pain beneath the heel during running. A potential link was also made between pain and peak rearfoot pressure during running, suggesting a potential antalgic gait response at the higher gait speeds. These findings are interesting and reinforce that when assessing children with this condition the true effect of their function must be assessed during not only walking but also running.

**Reference:** *Gait Posture* 2019;71:126-30

[Abstract](#)



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## Clinical risk factors for Achilles tendinopathy: a systematic review

**Authors:** van der Vlist AC et al.

**Summary:** In their systematic review, these authors evaluated the association between potential clinical risk factors and Achilles tendinopathy. Ten relevant cohort studies were identified from Embase, MEDLINE Ovid, Web of Science, Cochrane Library and Google Scholar to February 2018; all of the studies exhibited a high risk of bias. Twenty-six putative risk factors were found to not be associated with Achilles tendinopathy, including being overweight, static foot posture and physical activity level. The following 9 clinical risk factors were possibly associated with an increased risk of Achilles tendinopathy, although the evidence was limited: (1) prior lower limb tendinopathy or fracture, (2) use of ofloxacin (quinolone) antibiotics, (3) an increased time between heart transplantation and initiation of quinolone treatment for infectious disease, (4) moderate alcohol use, (5) training during cold weather, (6) decreased isokinetic plantar flexor strength, (7) abnormal gait pattern with decreased forward progression of propulsion, (8) more lateral foot roll-over at the forefoot flat phase and (9) creatinine clearance  $<60$  mL/min in heart transplant recipients.

**Comment:** This comprehensive review provides some useful considerations for those who manage Achilles tendinopathy. Of note, the review found limited evidence to associate Achilles tendinopathy with footwear, leg dominance, rearfoot inversion or eversion, a pronated foot posture or restrictions to non-weight-bearing ankle dorsiflexion. Clinically, the review identified three recommendations surrounding treatment and management of Achilles tendinopathy; (1) to reduce the use of alcohol to less than 7 units per week for men and less than 4 units for women, (2) to avoid the use of ofloxacin if alternatives are available and (3) to improve plantar flexor strength by performing strengthening exercises of the calf muscles. However, the effectiveness of these interventions in the clinical setting is unknown.

**Reference:** *Br J Sports Med.* 2019;Feb 4 [Epub ahead of print]

[Abstract](#)

## The relationship between static and dynamic foot posture and running biomechanics: A systematic review and meta-analysis

**Authors:** Hollander K et al.

**Summary:** This systematic review and meta-analysis investigated the evidence about the relationship between foot posture and running biomechanics. Studies specifically investigating the relationship between medial longitudinal arch characteristics and running biomechanics identified from Pubmed, Web of Science, Cochrane and SportDiscus databases were included in the analysis. A total of 25 studies were included in the qualitative review and 7 in the quantitative analysis. The majority of the studies exhibited a moderate risk of bias. The evidence for a relationship between foot posture and subtalar joint kinematics and leg stiffness was found to be moderate; small pooled effects:  $-0.59$  (95%CI  $-1.14$  to  $-0.003$ ) and  $0.59$  (95%CI  $0.18$  to  $0.99$ ), respectively. There was limited or very limited evidence for a relationship with forefoot kinematics, tibial acceleration/shock, tibial/leg rotation, plantar fascia tension, plantar pressure distribution, and ankle kinetics as well as an interaction of foot type and footwear regarding tibial rotation.

**Comment:** Research is challenging the long-standing foundations of lower limb podiatric biomechanics, particularly the relationship between static clinical measures and dynamic function. A major difficulty of research that investigates this question is the inconsistency in how foot type is classified. As shown by this review, the inconsistency in foot type classification makes it very difficult to pool data and compare the findings between studies. Consequently, as occurred in this review, only a few studies could be compared. The study did find some evidence for a relationship between the medial longitudinal arch and foot kinematics, but this must be considered in light of the few studies that were actually able to be compared. A link between static measures and dynamic function remains controversial.

**Reference:** *Gait Posture* 2019;72:109-22

[Abstract](#)

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