

Foot & Ankle Research Review™

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Issue 27 – 2016

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Abbreviations used in this issue

BMI = body mass index
ESWT = extracorporeal shock wave therapy
OR = odds ratio
RCT = randomised controlled trial

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

This issue highlights the array of conditions and clinical factors that must be considered on a daily basis by clinicians involved in rehabilitation of the lower limb. Such issues include: the importance of a team approach to the management of diabetic patients; what treatments are effective in the management of heel pain; the use of extracorporeal shock wave therapy and prolotherapy in tendinopathy rehabilitation; appropriate vascular assessment; strength assessment, the relevance of foot posture and the paediatric conditions of idiopathic toe walking and Sever's disease.

As the new reviewer for Foot and Ankle Research Review, I would like to take this opportunity to thank Professor Keith Rome for his significant contribution to this review over the previous years.

I hope you enjoy the selection of studies in this review and your assumptions are challenged. I look forward to your feedback.

Kind regards,

Dr Matthew Carroll

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Foot and ankle muscle strength in people with gout: A two-arm cross-sectional study

Authors: Stewart S et al.

Summary: This New Zealand study aimed to determine whether differences exist in foot and ankle muscle strength between people with gout (n = 20) and age- and sex-matched controls (n = 20), and whether foot and ankle muscle strength is correlated with foot pain and disability. Using a Biodex dynamometer, peak isokinetic concentric muscle torque was measured for ankle plantarflexion, dorsiflexion, eversion and inversion at two testing velocities (30°/s and 120°/s). The Manchester Foot Pain and Disability Index (MFPDI) was used to determine foot pain and disability. The study showed that individuals with gout had reduced muscle strength at both the 30°/s and 120°/s testing velocities for plantarflexion, inversion and eversion (p < 0.05) and a reduced plantarflexion-to-dorsiflexion strength ratio at both velocities (p < 0.05). Individuals with gout also exhibited a higher MFPDI score (p < 0.0001) and such scores were inversely correlated with plantarflexion and inversion muscle strength at the 30°/s testing velocity, and plantarflexion, eversion and inversion muscle strength at the 120°/s testing velocity (all p < 0.05).

Comment: Whilst reductions in muscle strength have been identified in other forms of inflammatory arthritis this is the first study to identify muscle strength reductions to the lower limb in people with gout. Having established muscle strength is decreased it will be interesting to see further research investigate how strengthening the lower limb muscles in gout affects physical function.

Clinical perspective: Classically in the clinical environment subjective methods are used to quantify muscle strength. Although this study used sophisticated equipment to assess muscle strength, there is benefit for the clinician to produce quantitative data when assessing strength in the lower limb. One such method readily available is hand-held dynamometry.

Reference: *Clin Biomech.* 2015;Nov 26 [Epub ahead of print]

[Abstract](#)

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Modern orthopedic inpatient care of the orthopedic patient with diabetic foot disease

Authors: Bateman AH et al.

Summary: A retrospective cohort review of complex patients requiring orthopaedic surgical treatment of Charcot feet or deformity, or infected ulceration at a single institution in the UK was undertaken in order to investigate the institution's emergency and elective pathways within the orthopaedic multidisciplinary inpatient care of patients with diabetic foot problems. Among a total of 30 admissions (19 emergency, 11 elective), the pathways were coordinated by a multidisciplinary team and comprised initial assessment and investigation and a series of key events (emergency and elective surgery plus intravenous antibiotics when indicated). Patients were rigorously monitored for infection and monitored closely for clinical and biochemical changes. Among the emergency admissions, a mean of 5.6 key events per admission occurred, including 4.2 antibiotic changes. Among the inpatient group, a mean of 4.8 key events per episode occurred including 3.7 antibiotic changes. A wide array of Gram-positive, Gram-negative, aerobic and anaerobic isolates were identified in both the podiatric and surgical tissue specimens and 15% of blood cultures showed bacteraemia. A total of three minor amputations were performed. The authors conclude that their successful modern care of the orthopaedic diabetic foot patient, involving close clinical, microbiological, and biochemical surveillance by the multidisciplinary team has enabled successful surgical intervention (debridement, pressure relief and stabilisation) with low rates of amputation.

Comment: This British study highlights the importance of the multidisciplinary approach to management of the complex diabetic patient with foot deformity. A model for delivering multidisciplinary care to patients requiring inpatient management in both elective and emergency pathways is presented. This model involves intensive input from specialists in orthopaedic surgery, diabetic medicine, podiatry, and microbiology to coordinate care. The network allows close clinical, biochemical, and microbiological surveillance and facilitates the decision making for key events, which help direct treatment and successful passage through emergency and elective pathways.

Clinical perspective: The multidisciplinary team approach is emphasised by this study and is compelling for those clinicians who manage diabetic patients in isolation. However, many barriers to this approach exist in New Zealand and Australia, such as remoteness created by geography. I look forward to studies that examine this area with context to New Zealand and Australia.

Reference: *Int J Low Extrem Wounds* 2015;14(4):384-92

[Abstract](#)

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Muscle and joint factors associated with forefoot deformity in the diabetic neuropathic foot

Authors: Cheuy VA et al.

Summary: The effects of intrinsic foot muscle deterioration and limited ankle joint mobility on the severity of metatarsophalangeal joint (MTPJ) deformity, and the relationships between these factors and indicators of diabetic complications (advanced glycation end products and peripheral neuropathy) were investigated in this study involving 34 patients with diabetic neuropathy (average age 59 years). Computed tomography was used to measure MTPJ angle, while magnetic resonance imaging was employed to determine intrinsic foot muscle deterioration. Total forefoot lean muscle volume ($r = -0.52$; $p < .01$) and maximum ankle dorsiflexion ($r = -0.42$; $p < .05$) were found to be correlated with severity of MTPJ deformity; together they explained 35% of the variance of MTPJ angle. Neuropathy was correlated with forefoot muscle deterioration ($p = 0.53$; $p < .01$) and skin intrinsic fluorescence (which served as a proxy measure for advanced glycation end product accumulation) was correlated with severity of neuropathy ($r = 0.50$; $p < .01$), but not with maximum ankle dorsiflexion, nor with forefoot deterioration (when controlling for neuropathy).

Comment: Although this cross-sectional study of 34 participants only allows for correlations and not cause-and-effect relationships to be determined, advanced imaging techniques were used to investigate intrinsic foot structure. The results of this study support that the lean muscle tissue remaining in the foot is important to MTPJ alignment.

Clinical perspective: The study highlights the need for targeted early interventions specific to the ankle joint and foot musculature in diabetics with foot deformity. Particularly as this may slow deformity progression and potentially reduce the risk of ulceration.

Reference: *Foot Ankle Int.* 2015;Dec 14 [Epub ahead of print]

[Abstract](#)

The effectiveness of extracorporeal shock wave therapy in lower limb tendinopathy: A systematic review

Authors: Mani-Babu S et al.

Summary: The efficacy of extracorporeal shock wave therapy (ESWT) for lower limb tendinopathies was investigated in this systematic review and meta-analysis involving 13 studies investigating ESWT in greater trochanteric pain syndrome (GTPS), patellar tendinopathy (PT), or Achilles tendinopathy (AT). Meta-analysis revealed moderate evidence to suggest that ESWT is more effective than corticosteroid injections and home training in the short (<12 months) and long (>12 months) term for GTPS. There is limited evidence to suggest that ESWT is more effective than alternative nonoperative treatments (nonsteroidal anti-inflammatory drugs, physical therapy, and an exercise program) and equal to patellar tenotomy surgery in the long term for PT. For AT, there is moderate evidence indicating that ESWT is equal to eccentric loading for midportion AT and more effective than eccentric loading for insertional AT in the short term. Moderate evidence suggests that combining ESWT and eccentric loading in midportion AT may produce superior outcomes to eccentric loading alone.

Comment: This review considered evidence for ESWT in the treatment of greater trochanteric pain syndrome, patellar tendinopathy and Achilles tendinopathy. The authors concluded that ESWT appears to be an effective intervention, with moderate-level evidence of efficacy, for all three tendinopathies investigated.

Clinical perspective: A worthwhile read both for clinicians who use ESWT and those considering the modality. The evidence base is definitely increasing, however, research specifically comparing the different elements of ESWT, energy levels, number of applications, and number of days between applications, is needed to identify the optimal protocol.

Reference: *Am J Sports Med.* 2015;43(3):752-61

[Abstract](#)

Independent commentary by Dr Matthew Carroll

Matthew 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. He is Head of Podiatry and Senior Lecturer at Auckland University of Technology, Director/Treasurer of the Australia New Zealand Podiatry Accreditation Council and a Board member of the Podiatrists Registration Board of New Zealand. He has a special interest in inflammatory arthritis and is active in research in rheumatoid arthritis, gout and lupus.



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Plantar heel pain and plantar fasciitis

Author: Landorf KB

Summary: This systematic review aimed to provide an update on the effects of conservative and non-conservative treatments for plantar heel pain. Included in the update were five systematic reviews and nine RCTs, identified via a search of Medline, Embase, The Cochrane Library and other important databases from January 2007 to November 2013. The efficacy of the following interventions was assessed: customised foot orthoses – likely to be beneficial; night splints – unknown effectiveness; stretching exercises – unknown effectiveness; taping – likely to be beneficial; corticosteroid injections (short-term effects) – likely to be beneficial; corticosteroid injections (longer-term effects) – likely to be ineffective or harmful; corticosteroid injection plus local anaesthetic injection (short-term effects) – unknown effectiveness; corticosteroid injection plus local anaesthetic injection (longer-term effects) – likely to be ineffective or harmful; ESWT – unknown effectiveness; surgery – unknown effectiveness.

Comment: This review provides the latest clinical evidence on both conservative and non-conservative treatments for plantar heel pain, and is an update on the 2008 publication. The trials included in the review were limited to high-quality RCTs with the GRADE system to assess for the quality of evidence, leading to quite strict criteria relating to the effects of conservative treatments for plantar heel pain.

Clinical perspective: The review highlights the limited evidence surrounding many commonly used treatment modalities for plantar heel pain. Whilst conservative treatments such as customised foot orthoses, prefabricated orthotics, taping and corticosteroid injections are likely to be of benefit, the effectiveness of heel pads, night splints, stretching, ESWT, local anaesthetic injection and surgery in the treatment of plantar heel pain remains unknown.

Reference: *BMJ Clin Evid.* 2015 Nov 25:pil 1111

[Abstract](#)



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Vascular assessment techniques of podiatrists in Australia and New Zealand: a web-based survey

Authors: Tehan PE and Chuter VH et al.

Summary: This study aimed to determine the clinical habits of podiatrists in Australia and New Zealand with regard to performing accurate vascular assessments of the lower extremity. Four hundred and forty-seven registered podiatrists practicing in these countries between 1 April and 31 July 2013 undertook a web-based, secure, anonymous questionnaire containing questions examining clinician's regular practices in vascular assessment, clinical indicators to perform and barriers in completing vascular assessment. The impact of years of experience and practice setting on clinical indicators to perform vascular assessment and types of assessment performed were also evaluated. The most frequently reported vascular assessments were palpation of pedal pulses (97%) and Doppler assessment (74%). The least frequent assessment was pressure measurement, with only 34% undertaking ankle-brachial indices and 19% completing toe-brachial indices. The most frequently reported barrier was lack of time (66%), followed by lack of equipment (28%). Podiatrists in public practice reported more varied and complete vascular assessment compared to those in private practice. New Zealand podiatrists reported lack of equipment as an issue to a greater extent than Australian podiatrists.

Comment: There are a number of diagnostic tests available for lower limb vascular assessment. This Australian study was the first to investigate clinical indications and barriers to undertaking lower limb vascular assessment.

Clinical perspective: This study suggests that amongst New Zealand and Australian podiatrists there is a reliance on subjective vascular assessment testing methods such as pedal pulses palpation and Doppler examination, and a lack of use of objective measurement such as the ankle brachial and toe brachial index. The reliance on subjective testing methods will result in missed or late diagnosis of peripheral arterial disease and/or inaccurate diagnosis of disease severity. With these factors in mind the study advocates for the routine use of objective vascular testing in populations deemed at risk of peripheral arterial disease.

Reference: *J Foot Ankle Res.* 2015;8:17

[Abstract](#)

Effectiveness and safety of prolotherapy injections for management of lower limb tendinopathy and fasciopathy: a systematic review

Authors: Sanderson LM and Bryant A

Summary: The clinical efficacy and safety of prolotherapy injections for treatment of lower limb tendinopathy and fasciopathy was assessed in this review of data from eight suitable studies investigating prolotherapy injections for Achilles tendinopathy, plantar fasciopathy or Osgood-Schlatter disease. The methodological quality of the eight included studies was generally poor. The findings of the analysis provided limited support for the hypothesis that prolotherapy is effective in both reducing pain and improving function for lower limb tendinopathy and fasciopathy; no study reported a mean negative or non-significant outcome following prolotherapy injection. The findings suggest that prolotherapy injections provide equal or superior short-, intermediate- and long-term results to alternative treatment modalities (eccentric loading exercises for Achilles tendinopathy, platelet-rich plasma for plantar fasciopathy and usual care or lignocaine injections for Osgood-Schlatter disease). There were no adverse events to prolotherapy reported in any study in this review.

Comment: In recent times prolotherapy has become an increasingly popular regenerative injection technique for treatment of a wide range of musculoskeletal pathologies. The review presented data surrounding prolotherapy intervention for Achilles tendinopathy, plantar fasciopathy and Osgood-Schlatter disease. Data was only able to be pooled and analysed for the three studies with multiple interventions, and while a statistically significant overall difference between prolotherapy and other interventions was found for short- and long-term data, the small sample size and testing of various pathologies reduces the weight of these findings.

Clinical perspective: The authors indicate their review suggests that prolotherapy injections may be superior or at least comparable to eccentric loading exercises for Achilles tendinopathy, platelet-rich plasma for plantar fasciopathy, and usual care or lignocaine injections for Osgood-Schlatter disease. Currently, these findings need a cautionary approach as this is definitely a treatment modality that requires more comprehensive studies to determine the true effectiveness of the therapy.

Reference: *J Foot Ankle Res.* 2015;8:57

[Abstract](#)

Are clinical measures of foot posture and mobility associated with foot kinematics when walking?

Authors: Buldt AK et al.

Summary: This study investigated the associations of clinical measures of static foot posture and mobility with foot kinematics during barefoot walking in 97 healthy adults (mean age 24.4 years; 46 males). The 6-item Foot Posture Index (FPI), Arch Index (AI), Normalised Navicular Height (NNHt) and Normalised Dorsal Arch Height (DAH) were used to measure foot posture, while foot mobility was evaluated using the Foot Mobility Magnitude (FMM) measure. A five-segment foot model was then used to measure tri-planar motion of the rearfoot, midfoot, lateral forefoot, medial forefoot and hallux, with peak and range of motion variables during load acceptance and midstance/propulsion phases of gait extracted for all relative segment to segment motion calculations. The degree of variance in peak and range of motion kinematic variables that was independently explained by foot posture measures was: NNHt 6-20 %, FPI 5-22 %, AI 7-13 %, DAH 6-8 %, and FMM 8 %; the FPI was retained as a significant predictor across the most number of kinematic variables, but the amount of variance explained by the FPI for individual kinematic variables did not exceed other measures. Overall there was a stronger association between static foot posture measures and kinematic variables than foot mobility measures and they explained more variation in peak variables compared to range of motion variables.

Comment: In this Australian study using multiple assessments of static foot posture and three-dimensional gait analysis, foot posture was compared to dynamic foot motion. Data indicated that when carried out on a wide range of foot postures, the use of clinical measures of foot posture or foot mobility explain only a small amount of variation in dynamic kinematic behaviour of the foot during barefoot walking.

Clinical perspective: Assessment of static foot posture remains the mainstay of many lower limb musculoskeletal examinations. The study findings bring into question the relevance of static assessments of foot posture as foot and lower limb injuries occur frequently during dynamic activities such as running. The relationship between static foot posture and dynamic foot function is controversial with biomechanical literature remaining inconclusive.

Reference: *J Foot Ankle Res.* 2015;8:63

[Abstract](#)

A comparison of the birth characteristics of idiopathic toe walking and toe walking gait due to medical reasons

Authors: Baber S et al.

Summary: This retrospective chart review of parent-reported birth histories of 95 children (mean age 5.8 years; 60 males) who presented to a dedicated toe-walking clinic between 2010 and 2014 compared the birth history or postnatal complications of idiopathic toe walking (ITW) and toe walking known to be associated with a medical condition. Compared with the normative Australian population, children with an ITW gait were found to have greater rates of prematurity (OR 2.4; 95% CI 1.43-4.03), lower birth weights (OR 6.6; 95% CI 3.48-12.5) and greater rates of admission to a special care nursery or neonatal intensive care unit (OR 1.98; 95% CI 1.23-3.18). Children with a medical reason for toe walking (n = 28, 68% males) had greater rates of instrumented births than the ITW cohort (OR 1.56; 95% CI 0.64-3.77) and greater rates of prematurity (OR 2.4; 95% CI 0.94-6.09) than the normative population. ITW gait was associated with greater rates of complications during and after delivery.

Comment: Toe walking is defined as the absence or inability to obtain heel strike during the stance phase of the gait cycle and is a common variation of normal gait development in children younger than 3 years of age. In this retrospective Australian study birth characteristics of children with ITW gait were investigated. This study indicates ITW gait is associated with a greater rate of pre and postnatal complications than those without an ITW gait. The authors postulate that this places infants at greater risk of mild neurologic insult that manifests as toe walking.

Clinical perspective: This study highlights the importance of taking birth histories in the clinical setting and encourages clinicians to implement this into their daily practice.

Reference: *J Pediatr.* 2016;Jan 16 [Epub ahead of print]

[Abstract](#)

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Factors associated with pain severity in children with calcaneal apophysitis (Sever disease)

Authors: James AM et al.

Summary: The association between the pain experienced as a result of calcaneal apophysitis and anthropometric data and lower limb measurements was investigated in this cross-sectional study, nested within a wider randomised, comparative efficacy trial. A total of 124 children (aged 8-14 years; 72 male) with a clinical diagnosis of calcaneal apophysitis were recruited. Compared with the normative population, study participants had a higher mean BMI ($p < 0.001$), increased weight ($p < 0.001$), and were taller ($p < 0.001$). They also exhibited differences in foot posture and ankle joint range of motion. Older participants ($p = 0.046$) and those who had experienced pain for longer ($p = 0.043$) reported higher pain severity according to the findings of multivariable regression analyses.

Comment: A common pathological entity encountered by the musculoskeletal clinician in children aged 8-14 years. The study identified that children with calcaneal apophysitis were more likely to have a greater BMI, increased weight, greater waist circumference, and increased height than the general population data. Of significance to the clinician, the study found that children experiencing pain with calcaneal apophysitis also had increased range of motion at the ankle. This finding is in contrast to previous research where restricted ankle range of motion due to muscle tightness has been postulated as an aetiological factor. However, considerations regarding how ankle range of motion is measured must be taken into account when comparing studies of this nature. Caution should also be applied when interpreting the data surrounding BMI as it was not clear if children with calcaneal apophysitis had high BMI prior to or just following the development of the condition.

Clinical perspective: This study provides more evidence on a pathology that in the past has been treated using anecdotal evidence. It will be interesting to see research develop around the effectiveness of increasing calf muscle flexibility in relation to this condition.

Reference: *Pediatr.* 2015;167(2):455-9

[Abstract](#)

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