Foot & Ankle RESEARCH REVIEW™

Making Education Easy

Issue 56 – 2023

In this issue:

Abbreviations used in this issue
BMD = bone mineral density
CI = confidence interval
CT = computed tomography
HRQoL = health-related quality of life
MRI = magnetic resonance imaging
OR = odds ratio

Welcome to Issue 56 of Foot and Ankle Research Review.

In this issue I highlight some recent publications surrounding the role of exercise and rehabilitation in people with diabetes-related foot ulcers. This is a particularly interesting area of research with the International Working Group on the Diabetic Foot recently ranking the need for research investigating the role of exercise in people with diabetes as one of their top ten research priorities. My favourite read for this issue was the study by Mørk et al., who explored experiences of individuals with persistent plantar fasciopathy. The article provides a great person-based perspective on dealing with this condition.

I hope you enjoy this issue.

Noho ora mai

Associate Professor Matthew Carroll
matthewcarroll@researchreview.co.nz

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

Exercise in adults admitted to hospital with diabetes-related foot ulcers: A pilot study of feasibility and safety

Authors: Aitken E et al.

Summary: This small pilot study assessed the feasibility of a tailored exercise programme (supervised exercise training, including aerobic and resistance exercise, followed by a home exercise programme; tailored to ulcer location to ensure podiatric recommendations for pressure offloading) in 20 adult diabetic patients with diabetes-related foot ulcers. Overall, the retention rate was 95%, the rate of adherence to inpatient and outpatient follow up was 75%, and the rate of adherence to home exercise was 50.0%.

Comment: The role of exercise in people with diabetes has been identified by the International Working Group on the Diabetic Foot as an important area for future research and was identified as one of the top 10 research priorities. In people with diabetes and foot ulceration, the role of exercise is a balance between providing sufficient offloading and the positive effects of exercise participation. This Australian-based study investigated the feasibility of exercise participation in patients admitted to hospital with diabetes-related foot ulceration. Results indicated high retention rates to the exercise programme but lower rates of adherence, particularly to home-based exercises (50% adherence). Participants were accepting of the exercise programme but felt the exercise sessions in the hospital setting were more useful and safer compared to home-based exercises. The research highlights that exercise is feasible but points to the numerous patient-based factors that need to be overcome to enable successful exercise participation.

Reference: J Foot Ankle Res. 2023;16(1):18
Abstract

Rehabilitation for people wearing offloading devices for diabetes-related foot ulcers: A systematic review and meta-analyses

Authors: Jones K et al.

Summary: This systematic review and meta-analysis assessed the use of rehabilitation interventions to promote physical activity in diabetic patients using offloading devices for diabetes-related foot ulcers (DFUs) based on eight studies including 441 patients. Patients using non-removable total contact casts had lower activity levels than patients wearing offloading devices (standardised mean difference [SMD] -0.45; 95% CI -0.87 to -0.04; p = 0.03). Healing of DFUs at 12 weeks and 20 weeks was more likely with total contact casts than removable devices.

Comment: This review evaluated the clinical effectiveness of rehabilitation interventions designed to promote or support physical activity in people using offloading devices for DFUs. The most significant finding of this review is the limited evidence to determine whether rehabilitation interventions are safe, or clinically cost-effective. Significantly, pooled data from the study also indicated the odds of DFU healing in people using a total contact cast were over 2-fold that with removable devices. This finding supports the use of total contact casts. The authors also postulate that decreased activity due to immobilisation may inevitably exacerbate cardiovascular risk. More work is required to understand the balance between rehabilitation and adequate wound offloading.

Reference: J Foot Ankle Res. 2023;16(1):16
Abstract

The struggle to stay physically active – A qualitative study exploring experiences of individuals with persistent plantar fasciopathy

Authors: Mørk M et al.

Summary: This small study assessed the experiences of patients with plantar fasciopathy using face-to-face, semi-structured interviews to explore the lived experiences of 15 people with longstanding plantar fasciopathy. Using Braun and Clark's reflexive thematic analysis based on an inductive approach led by a phenomenological theoretical framework, three core themes and 10 sub-themes were identified: 1) 'Struggling to stay active' (sub-themes: 'Struggling with pain and how to adjust it', ' Finding alternative activities', 'Longing for the experience of walking'); 2) 'Emotional challenges' (sub-themes: 'Feelings of frustration and self-blame', 'Worries of weight gain and related consequences'); 3) 'Relations to others' (sub-themes: 'Participation in family and social life', ' Visible in new ways', ' Striving to avoid sick leave', 'Bothering others').

Comment: This Norwegian qualitative study revealed pain during and after walking to be the most problematic component of living with plantar fasciitis. Pain became the central focus for the participants; they continually monitored pain and the pain became the decisive factor when choosing whether or not to participate in activities. The study also provides insight into the effect that limping had on participants; limping leading to embarrassment and discomfort and giving rise to the notion of social 'dys-appearance'. This was born from the limited ability to participate in social activities. Interestingly the authors also describe the experience of being disbelieved by others, in particular by their colleagues and employers. This is a nice article that provides a great person-based perspective on the pain associated with plantar fasciitis.

Reference: J Foot Ankle Res. 2023;16(1):20
Abstract

Independent commentary by Associate Professor Matthew Carroll

Matthew is an Associate Professor of Podiatry at Auckland University of Technology. His research focus is on chronic long-term conditions that affect the foot. He is a current Editorial Board member for the Journal of Foot & Ankle Research, Academic Editor for PLOS ONE, and past Associate Editor for BMC Musculoskeletal Disorders.

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Decline in health-related quality of life and foot and ankle patient reported outcomes measures in patients with haemophilia and ankle haemarthropathy

Authors: Wilkins RA et al.

Summary: This UK, cross-sectional, multicentre, questionnaire study examined the impact of ankle haemarthropathy in 243 patients with severe and moderate haemophilia A and B. The haemophilia-specific HRQoL questionnaire and Manchester-Oxford Foot Questionnaire mean total and index scores ranged from 35.3-35.8 and 50.5-45.8, respectively, indicating poor HRQoL. Moderate to severe ankle haemarthropathy was identified with mean Numerical Pain Rating Scale (NPRS) scores ranging from 5.0-5.5 and median ankle haemophilia joint health scores of 4.5-6.0. Poorer outcomes were associated with ankle NPRS scores over 6 months and inhibitor status.

Comment: This UK cross-sectional study revealed ankle pain to be the most impactful feature across all haemophilia disease characteristics. Despite the impact of disease creating high levels of pain, data indicated pain management was poor with less than half the cohort using regular pain medication (56% of patients did not use any pain medication). However previous research has identified coping with high levels of pain and management without pain relief is synonymous with chronic haemarthropathy. This is a well-constructed manuscript that is a must-read if you need a knowledge update on haemophilia and ankle haemarthropathy.

Reference: J Foot Ankle Res. 2023;16(1):12
Abstract

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Thick shells and medially wedged posts increase foot orthoses medial longitudinal arch stiffness: An experimental study

Authors: Pelaez AST et al.

Summary: This study examined foot orthoses medial arch stiffness to moderate biomechanical deficits and physical function in patients with musculoskeletal disorders by changing structural factors in two foot orthoses models 3D printed in polynylon-11 (without extrinsic additions [nFO] and with forefoot-rearfoot posts and a 6° medial wedge [6MW]) each in three thicknesses (2.6, 3.0, and 3.4 mm). The overall stiffness was 3.4-fold higher for 6MW versus nFO ($p < 0.001$) while 3.4 mm and 3.0 mm thickness orthoses were 1.3- and 1.1-fold stiffer than 2.6 mm and 3.4 mm thick orthoses were 1.1-fold stiffer than 3.0 mm orthoses. Overall, the force to lower the medial arch was up to 3.3-fold higher with 6MW versus nFO, and thicker orthoses required greater force ($p < 0.001$).

Comment: This study investigated the effect of shell thickness and the addition of 6MW had on the medial stiffness of the foot orthoses. The study is predicated on the theory that foot orthoses provide their kinetic effects through the production of reaction forces at the foot-foot orthoses interface. The medial longitudinal arch stiffness of the foot orthoses is a key parameter as data indicates greater stiffness is correlated with greater pronatory control of the foot and ankle during locomotion. Results showed that foot orthoses stiffness increased with the addition of medial wedging and shell thickness. The authors raise some very interesting clinical perspectives surrounding their findings, namely some patients may require stiffer foot orthoses than others to exhibit significant biomechanical changes and foot orthoses stiffness may have been insufficient for some participants in previous research. This may explain the variability of the biomechanical responses across participants and studies. This is some exciting research that may open up new avenues to explain the functionality of foot orthoses.

Reference: J Foot Ankle Res. 2023;16(1):11
Abstract

Is the diagnostic validity of conventional radiography for Lisfranc injury acceptable?

Authors: Chen C et al.

Summary: This retrospective study (2017-19) examined the use of conventional radiography for diagnosis of Lisfranc injury in 307 patients with, and 100 patients without, Lisfranc injury. Inter- and intra-observer reliabilities between senior and junior surgeons independently assessing anonymised conventional radiographs on two occasions 3 months apart were moderate to very good. The mean true positive rate was 81.8%, the mean true negative rate was 90.0%, the mean false positive rate was 10.0%, and the mean false negative rate was 18.2%. The positive predictive value was 96.1%, negative predictive value 62.4%, classification accuracy 83.8%, and balanced error rate 14.1%. The most likely injuries to be identified were three-column injuries (mean rate 92.1%), and intermediate-lateral-column injuries (mean rate 81.5%), whereas medial-column injuries were more difficult to identify (mean rate 60.7%). Non-displaced injuries had a mean diagnostic rate of 76.7% versus 95.5% for displaced injuries. There was a difference in the recognition rate of non-displaced injuries ($p = 0.005$) between the two surgeons.

Comment: Conventional radiography remains the most commonly used imaging method to diagnose Lisfranc injury. However, a significant number of Lisfranc injuries, especially those with subtle initial presentations, tend to be overlooked or missed with conventional radiography. Data showed a mean recognition rate of non-displaced Lisfranc injuries using conventional radiography of 76.7%, which was lower than that of the displaced injury group (95.5%). Column involvement was associated with severity and long-term functional outcomes with three-column injuries having the highest recognition rate (92.1%), followed by intermediate-lateral-column injuries (81.5%). The study highlights the possible delays in diagnosis of Lisfranc injuries particularly injury involving only one or two columns and emphasises the need to consider referral for additional imaging such as CT scanning to ensure diagnosis is not delayed.

Reference: J Foot Ankle Res. 2023;16(1):9
Abstract

Rate of tarsal and metatarsal bone mineral density change in adults with diabetes mellitus and peripheral neuropathy: A longitudinal study

Authors: Youmans NJ et al.

Summary: This longitudinal cohort study assessed rate of change in bone mineral density (BMD) over 3-4 years in individual bones in the foot in 60 participants with diabetes mellitus and peripheral neuropathy. Mean and calcaneal BMD decreased from baseline at 6 months, 18 months, and 3-4 years ($p < 0.05$). Individual tarsal and metatarsal bones had a range of rates of change from -0.3 to -0.9% per year, but did not differ from calcaneal BMD change. The only correlate with BMD and rate of BMD change was age.

Comment: This American study investigated BMD change in people with diabetes and peripheral neuropathy over a 4-year period. The study was based on the rationale that foot fracture risk and deformity are associated diabetes-related complications and have been linked to the loss of tarsal and metatarsal BMD. People with type 2 diabetes have also shown a higher relative risk of fracture (37% higher) than that in control populations without type 2 diabetes, suggesting the involvement of peripheral neuropathy in fracture predisposition. Data indicated no differences between rates of BMD change in individual tarsals and metatarsals, with the talus showing the greatest rate of BMD change. Also of note was that greater peripheral neuropathy severity, sex, physical activity, and statin use were not associated with rate of BMD change.

Reference: J Foot Ankle Res. 2023;16(1):6
Abstract

Radiological features accompanying peroneus brevis split rupture revealed on magnetic resonance imaging – A cohort study

Authors: Huuskonen M et al.

Summary: This retrospective study examined the association of peroneus brevis split rupture with MRI abnormalities including joint effusion, bone marrow oedema, and abnormalities in the malleolar groove, superior peroneal retinaculum (SPR), anterior talofibular ligament (ATFL), calcaneofibular ligament (CFL), and prominent peroneal tuberculum in 80 patients with peroneus brevis split tears and 115 controls. After Bonferroni-Holm correction for multiple comparisons, the only abnormality more common in the split tear group was bone marrow oedema in the posterior lateral malleolus ($p < 0.05$). SPR total rupture occurred only in patients with peroneus brevis split rupture. There were no differences in incidence of ATFL, CFL or other SPR lesions.

Comment: Estimations based on cadaveric dissections put the incidence of peroneus brevis tendon split tears between 11% and 37% while split tears in the peroneus longus tendon are less common. This Swedish study investigated the relationship of the peroneus brevis split rupture and lateral ligament injury. The authors provide a very detailed discussion that provides a great explanation of the study results. Takeaway points from the study include (1) Peroneus brevis split rupture is multifactorial and can be difficult to diagnose, so accompanying features are valuable, Ankle MRI is an appropriate imaging modality for the assessment of peroneus brevis tendon pathology. (2) Peroneus split tears most commonly do not cause acute symptoms. (3) Most split ruptures of the peroneus brevis are chronic, while ligament injuries are more associated with trauma. (4) Split rupture of the peroneus brevis may result from the instability that results from ligament damage.

Reference: J Foot Ankle Res. 2023;16(1):10
Abstract

Does Kinesio taping of tibialis posterior or peroneus longus have an immediate effect on improving foot posture, dynamic balance, and biomechanical variables in young women with flexible flatfoot?

Authors: Tahmasbi A et al.

Summary: This study examined whether kinesio taping on the tibialis posterior or the peroneus longus provided greater benefit for enhancement of foot posture, dynamic balance, and biomechanical parameters in 30 young women with flexible flatfeet. Navicular Drop Test and Foot Posture Index decreased in both groups ($p < 0.05$) but did not differ between groups. Tibialis posterior taping increased maximum total force of the stance phase during running ($p < 0.05$) along with some temporal parameters. Peroneus longus taping improved Y-balance test in all directions, and increased the width of the gait line during walking. Postural stability parameters did not change in a within-group comparison, with the exception of mean centre of pressure displacement with peroneus longus taping ($p = 0.04$).

Comment: This study examined the immediate effects of applying kinesio tape to either the tibialis posterior or peroneus longus muscle. Data indicated no differences in foot posture irrespective of tape placement. The participants with the kinesio tape applied to the peroneus longus demonstrated improvement in one measure of dynamic balance. Walking parameters were also assessed with improvements following taping application. Although the authors conclude that kinesio taping applied to the peroneus longus can alter temporal parameters in walking and running, the mean differences were so small that I doubt they would be clinically meaningful. Consequently, I would interpret the result of this research with caution.

Reference: Foot (Edinb) 2023;56:102032
Abstract

Is the duration of diabetic foot ulcers an independent risk factor for developing diabetic foot osteomyelitis?

Authors: Jaroenarpornwatana A et al.

Summary: This retrospective (2015-20) cohort study in 855 patients in a diabetic foot clinic assessed whether prolonged diabetic foot ulcers were associated with diabetic foot osteomyelitis. Over 6 years, 78 patients developed diabetic foot ulcers (annual incidence 1.5%) and 24 developed diabetic foot osteomyelitis (annual incidence 5%; incidence rate 0.1 per person-year). Risk factors for diabetic foot osteomyelitis were bone-deep ulcers (adjusted risk ratio [aRR] 2.50; $p = 0.04$) and inflamed wounds (aRR 6.20; $p = 0.02$). Duration of diabetic foot ulcers was not associated with osteomyelitis (aRR 1.00).

Comment: The average annual incidence of developing diabetes foot osteomyelitis is approximately 5-6%. This study investigated the relationship between the duration of diabetes foot ulceration and the risk of diabetes foot osteomyelitis. Data indicated amongst patients who had a diabetic foot ulceration, a total of 24 developed osteomyelitis. The main finding of the research was that ulcer duration was not found to be a risk factor for development of diabetes foot osteomyelitis. A bone-deep ulcer was identified as a risk factor for diabetes foot osteomyelitis. The authors reinforcing the usefulness of the probe-to-bone test as the most useful clinical examination for diagnosing osteomyelitis. The research also showed the highest relative risk of developing diabetes foot osteomyelitis was a foot ulcer with signs of inflammation with signs of soft tissue inflammation appearing to predict the occurrence of diabetes foot osteomyelitis.

Reference: Foot (Edinb) 2023;56:102000
Abstract

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