

Foot & Ankle

RESEARCH REVIEW™

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Issue 54 – 2022

In this issue:

- Foot pain and inflammatory markers
- Diabetes podiatry services for Māori
- Friction at the sock-skin interface
- Idiopathic toe walking differences in lower limb joint ranges and strength
- Footwear stakeholders' opinions on young children's footwear
- Bacterial culture of proximal bone in diabetes-related foot infections
- Negative pressure wound therapy resource use in diabetic foot wounds
- Human amniotic membrane products for diabetic foot ulcers
- Total contact cast effects on lower limb kinematics and joint loading
- A scoping review of heel fat pad syndrome

Abbreviations used in this issue

BMI = body mass index
CI = confidence interval
CRP = C-reactive protein
IL = interleukin
OR = odds ratio
RCT = randomised controlled trial
RR = risk ratio
TNF = tumour necrosis factor

Welcome to Issue 54 of Foot and Ankle Research Review.

In this issue I highlight some recent publications surrounding wound healing, sock construction, idiopathic toe walking, and beliefs surrounding footwear choice for children. There is also a great commentary from Ihaka et al., that challenges the provision of diabetes podiatry services for Māori.

I hope you enjoy this issue.

Noho ora mai

Associate Professor Matthew Carroll

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Foot pain and inflammatory markers: A cross sectional study in older adults

Authors: Siefkas AC et al.

Summary: This analysis of data from the Framingham Foot Study including 909 participants (54% female, mean age 65 years), examined cross-sectional associations between the inflammatory markers CRP, IL-6, and TNF- α and foot disorders including foot pain (20%), hallux valgus (29%), hallux rigidus (3%), and toe deformities (27%). Unadjusted models suggested that in men, higher CRP (OR 1.5; 95% CI 1.1-2.0) and IL-6 (OR 1.8; 95% CI 1.2-2.6) were associated with foot pain, while in women, higher CRP was associated only with foot pain (OR 1.3; 95% CI 1.0-1.5). Forefoot pain in men was associated with higher CRP (OR 1.9; 95% CI 1.1-3.2) and IL-6 (OR 2.4; 95% CI 1.2-4.7). In women, higher CRP was associated with hindfoot pain (OR 1.8; 95% CI 1.2-2.6). After adjustment for age, BMI, physical activity, and smoking status, in men, CRP (OR 1.5; 95% CI 1.1-2.0) and IL-6 (OR 1.8; 95% CI 1.2-2.6) remained associated with foot pain, and IL-6 with forefoot pain (OR 2.9; 95% CI 1.4-6.1). There were no associations with structural foot disorders.

Comment: This study, using data from the Framingham Offspring Study population between 1998 and 2001, examined the relationship of inflammatory markers (CRP, TNF- α and IL-6) to foot pain and foot disorders. The study found that inflammatory markers were associated with foot pain in men. No inflammatory markers were associated with structural foot deformities. This may indicate that the link between inflammation and foot pain is not mediated by changes in foot morphology. This is a very interesting area of research because all three markers are elevated in obesity. Further research into associations between fat mass and foot pain is warranted. The further development of research in this area is also important, because when foot problems emerge due to mechanical load or structural foot disorders, footwear and orthoses may help. However, these interventions may not be as effective in cases where inflammation may be the primary cause of foot pain.

Reference: *J Foot Ankle Res.* 2022;15(1):57

[Abstract](#)

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Diabetes podiatry services for Māori in Aotearoa: A step in the right direction?

Authors: Ihaka B et al.

Summary: This commentary discussed the availability of diabetic podiatry services among Māori for reducing the incidence of diabetes-related lower limb amputations and suggests that diabetes podiatry services need to be reorientated and made culturally applicable to Māori to improve quality of life for an underserved community.

Comment: This is a very thought-provoking commentary on the provision of podiatry services to Māori with diabetes. The commentary highlights the increasing burden of disease borne by indigenous peoples. Significantly, Māori with diabetes are at a 65% greater risk of amputation compared to non-Māori with diabetes. The commentary also provides a great overview of podiatry management of diabetes for Māori. The commentary's conclusion being that despite the support for diabetes podiatry in preventing lower limb amputations, the effectiveness of these services for Māori are largely unknown and call for wānanga (open discussions) to allow for opportunities for engagement and collective decision-making surrounding service provision to occur, an approach which is a better reflection of a Te Tiriti o Waitangi partnership.

Reference: *J Foot Ankle Res.* 2022;15(1):59

[Abstract](#)

Tribology of the sock-skin interface – the influence of different fabric parameters on sock friction

Authors: DeBois IJ et al.

Summary: This study examined the influence of knit structure, fibre composition, fibre linear density, and yarn type on the frictional profile at the sock-skin interface using a polypropylene probe and a synthetic skin material (Lorica soft®). In dry conditions, knit structure (single jersey vs terry) was the most prominent fabric parameter affecting frictional force at the sock-skin interface, while fibre linear density, and yarn type (filament vs spun) also affected the frictional force. Fibre composition (polyester vs cotton) had no effect on the frictional force at the sock-skin interface.

Comment: Sitting at the interface between footwear and skin, the sock is an important consideration, particularly for its role in blister formation and prevention. Blisters are caused by abrasion caused by frictional forces. Factors associated with blistering include; the effect of moisture or skin hydration on the frictional force, a person's skin characteristics, and the number of impact cycles over which the frictional force occurs. However, it is still unclear what role different textile parameters play in blister formation. This study provides some evidence for the role that knit structure, yarn count and yarn type may play in blister formation. The discussion also provides you with useful, albeit technical, insight into the properties of socks. A good read if you want to expand your sock knowledge.

Reference: *J Foot Ankle Res.* 2022;15(1):61

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Children with idiopathic toe walking display differences in lower limb joint ranges and strength compared to peers: A case control study

Authors: Caserta A et al.

Summary: This study examined differences in lower limb muscle active range of motion and strength in 26 children with idiopathic toe walking (ITW) versus children with typical gait. Reduced weight bearing ankle range of motion (measured with a bent knee) was associated with ITW ($p = 0.009$) along with being older ($p < 0.001$) and weighing less ($p < 0.001$). Reduced ankle plantar flexion range was only associated with ITW ($p = 0.015$). All lower limb strength measures, except for hip external rotation, showed that those with greater strength did not toe walk ($p < 0.002$), were older ($p < 0.001$) and weighed more ($p < 0.014$).

Comment: ITW has an estimated prevalence in 5% of healthy children and is commonly associated with ankle equinus. The management of ITW is supported by limited evidence; however, manual therapies such as stretching or motor control interventions such as home exercise programmes are often recommended. The study found children with ITW were not as strong, but it is not clear if the strength deficit results from the condition or the cause of the initial gait adaptation. The joint range of motion findings were very interesting. Data indicating that there was not only less ankle joint dorsiflexion but also less plantar flexion motion. Interestingly, hip joint range of motion was not different to normative data suggesting that children with ITW may not develop proximal joint tightness above the ankle from their altered gait pattern. Although the study's power is limited by the number of participants, the research offers a promising direction for future interventions.

Reference: *J Foot Ankle Res.* 2022;15(1):70

[Abstract](#)

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Parents, health professionals and footwear stakeholders' beliefs on the importance of different features of young children's footwear: A qualitative study

Authors: Williams CM et al.

Summary: This qualitative study, nested within an international modified Delphi survey, assessed how 121 different stakeholders (health professionals [n = 90], parents [n = 26], footwear industry representatives [n = 5]) described the importance of flexibility and other footwear features for young children. Inductive thematic analysis identified overarching themes of developmental impacts of footwear, therapeutic impact and the role of footwear in function.

Comment: In this study, the opinions of health professionals, parents and representatives of the footwear industry were collected on the importance of footwear characteristics in young children. The research is based on the premise that footwear recommendations for children should be age specific. Four themes emerged from the data; (1) The sole and heel flexibility plays a role in development, (2) Sole and heel flexibility of footwear has a therapeutic effect, (3) Heel counter flexibility has an alignment effect, (4) Footwear features and flexibility impact all important aspects in a child's life. The results offer interesting insights, particularly into perceptions of footwear flexibility and the role of sole firmness, as you will read that there was a degree of inconsistency among respondents. This article is very interesting and worth reading.

Reference: *J Foot Ankle Res.* 2022;15(1):73
[Abstract](#)

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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.

Routine bacterial culture of proximal bone specimens during minor amputation in patients with diabetes-related foot infections has little clinical utility in predicting re-operation or ulcer healing

Authors: Voon K et al.

Summary: This Australian retrospective study assessed the concordance of microbiological results from proximal bone cultures versus superficial wound swabs after trans-phalangeal and trans-metatarsal amputation (n = 144) for management of infections of diabetes-related foot ulcers (DFUs). Moderately high degree concordance was observed between microbiological samples, 35% of patients having discordant microbiology, but concordant versus discordant results were not associated with adverse outcomes (67.2% vs 68.6% achieved complete healing, p = 0.89). Revascularisation during admission (adjusted OR [aOR] 0.37; 95% 0.13-0.96; p = 0.04) and amputation of the 5th ray (aOR 0.45; 95% CI 0.21-0.94; p = 0.03) were risk factors for non-healing.

Comment: Due to concerns about the reliability and accuracy of superficial wound cultures for identifying pathogenic organisms, current guidelines do not encourage routine superficial wound swab collection when treating infected DFUs. Data from this study indicated moderate to high swab-to-specimen agreement. The authors posit that this calls into question the usefulness of routine intraoperative bone sampling. Interestingly, the results also showed no difference in healing outcomes, the need for further surgery, or progression to major amputation and death in the small proportion of patients, even when there were conflicting microbiological specimen results. The presence of positive microbiological results also had no correlation with poorer results in the study population. The results must be considered in light of a relatively small sample size, but the study raises questions about the importance of the superficial swab prior to amputation.

Reference: *J Foot Ankle Res.* 2022;15(1):64
[Abstract](#)

NPWT resource use compared with standard moist wound care in diabetic foot wounds: DiaFu randomized clinical trial results

Authors: Seidel D et al.

Summary: The multicentre DiaFu clinical study examined resource utilisation of negative pressure wound therapy (NPWT) versus standard moist wound care (SMWC) for diabetic foot wounds after amputation, surgical debridement or wound cleansing. Treatment duration was 16 days shorter with NPWT (mean 82.8 vs 98.8 days; p = 0.001) with 14.9 days shorter outpatient treatment (mean 68.3 vs 83.2 days), fewer dressing changes per patient (mean 35.1 vs 42.9; p = 0.067) and less time spent per dressing change (mean 19.7 vs 16.5 minutes; p < 0.0001).

Comment: This German RCT compared the use of SMWC to NPWT in patients with diabetes-related foot ulceration. There were some very interesting results among the participants who received NPWT. That is, the duration of outpatient treatment was significantly shorter, the total treatment duration within 16 weeks was significantly shorter, significantly more subjects with NPWT achieved 95% granulation within 16 weeks, and 50% of subjects with NPWT had a closed wound within 16 weeks. The median time to wound closure was also significantly shorter in the NPWT arm. Of note, there was no significant difference between the treatment arms in the percentage of study participants with an amputation at 16 weeks. Overall, the study advocates the use of NPWT to achieve more frequent and faster wound healing.

Reference: *J Foot Ankle Res.* 2022;15(1):72
[Abstract](#)



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Human amniotic membrane products for patients with diabetic foot ulcers. Do they help? A systematic review and meta-analysis

Authors: Mohammed YA et al.

Summary: This systematic review and meta-analysis compared the use of dehydrated human amnion and chorion allograft (DHACA) plus standard of care (SOC) versus SOC alone for diabetic foot ulcers based on 11 RCTs. Pooled effect estimates suggested DHACA was superior to SOC for complete wound healing at 6 (RR 3.78; 95% CI 2.51-5.70; $p < 0.00001$) and 12 weeks (RR 2.00; 95% CI 1.67-2.39; $p < 0.00001$) and favoured DHACA for mean difference time to heal at 12 weeks (-12.07; 95% CI -19.23 to -4.91; $p = 0.001$). Mean difference for wound size reduction was also better with DHACA (1.18; 95% CI 0.10 to 2.26; $p = 0.03$).

Comment: Biochemical properties of the amniotic membrane help modulate inflammation and enhance soft-tissue healing. DHACAs are skin substitutes that can be placed in wound beds to accelerate wound healing and decrease pain without the need for meticulous wound care. Eleven studies were included in this review. Pooled data indicated some significant differences when using DHACA plus SOC (pressure relief, debridement, infection management, and revascularisation) compared to the use of SOC alone. SOC with the addition of DHACA showed reductions in wound healing, improvements in wound size reduction, and reduced healing times.

Reference: *J Foot Ankle Res.* 2022;15(1):71

[Abstract](#)

Assessment of the effect of a total contact cast on lower limb kinematics and joint loading

Authors: Theodorakos I et al.

Summary: This study in 12 participants examined the effect of total contact casts (TCCs) on lower extremity joint loading assessed using musculoskeletal modelling. Reduced ankle, knee and hip range of motion occurred during TCC with decreased hip abduction and flexion moments during initial contact. Anterior knee force was decreased during mid and terminal stance and the second peak of compressive knee force was reduced during TCC. As expected, TCC reduced ankle loading.

Comment: The effect of TCC on plantar pressure alteration has been assessed through plantar pressure assessment. This research sought to quantify how TCC affects the kinematics and kinetics of the lower extremity during gait through 3-D gait analysis and musculoskeletal modelling. Importantly, the study demonstrated that in addition to reduced ankle loading, peak loads on the knee and hip joint were not increased. Consideration must be given to the fact that the participants in the study population were healthy. Research must now investigate the influence of TCC on the distal joint in populations where TCCs are adopted routinely.

Reference: *Gait Posture* 2022;98:203-209

[Abstract](#)



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What do we actually know about a common cause of plantar heel pain? A scoping review of heel fat pad syndrome

Authors: Chang AH et al.

Summary: This scoping review assessed the prevalence, aetiology and diagnostic criteria, and conservative management of heel fat pad syndrome (HFPS) based on seven studies. The analysis suggested that HFPS may be the second leading cause of plantar heel pain. Differentiating pain characteristics and behaviours may diagnose HFPS versus plantar fasciitis/fasciopathy or unspecified heel pain, while thinning heel fat pad assessed by ultrasonography may provide corroboration. RCTs assessing the efficacy of viscoelastic heel cups or arch taping were not found.

Comment: This review assessed the role of HFPS in contribution to plantar heel pain. I found this review interesting, as although HFPS is a distinct pathology and commonly implicated aetiological factor in plantar heel pain, evidence surrounding the condition is limited. The review highlights some interesting points, such as the contradictory role of ultrasonography in the diagnosis of HFPS, the wide anatomical variation in heel fat pad thickness making benchmarking thickness as a diagnostic criterion difficult, and the wide variation in non-surgical interventions used to manage HFPS. Overall, the review will provide you with a good overview of the condition, but as I suspected the review just highlights that there is no real strong evidence to guide its management.

Reference: *J Foot Ankle Res.* 2022;15(1):60

[Abstract](#)



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