Foot & Ankle RESEARCH REVIEW™

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Issue 62 – 2024

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Welcome to Issue 62 of Foot and Ankle Research Review.

In this issue I have highlighted a mixture of recent publications ranging from adherence to prescription footwear to hallux valgus in dancesport athletes. For those with a passion for dermatology, I also highlight a recent review that investigated dermoscopic features of psoriatic nails.

I hope you enjoy the issue.

Noho ora mai

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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.

Exploring the relationship between the supination resistance test and the effects of foot orthoses on the foot and ankle biomechanics during walking

Authors: Payen E et al.

Summary: This cross-sectional descriptive study involving 23 participants with flat feet aimed to determine the effects of two commonly prescribed types of foot orthoses (thin-flexible and medially wedged) on lower limb biomechanics during gait, and whether there is an association between these effects and the results of the supination resistance test. Midfoot, ankle, knee and hip angle/moments were calculated for each participant while walking under the following three conditions: shod; thin-flexible foot orthoses; and medially wedged foot orthoses. Thin-flexible and medially wedged foot orthoses were found to reduce midfoot dorsiflexion angles and ankle inversion moments. Compared with thin-flexible foot orthoses and shoes, medially wedged foot orthoses decreased midfoot and ankle abduction angles and midfoot plantarflexion moments. Correlations were moderate to good between the supination resistance test and medially wedged foot orthoses for the frontal and transverse ankle angles and moments. The authors concluded that medially wedged foot orthoses are more effective in modifying lower limb biomechanics during walking than thin-flexible foot orthoses.

Comment: This study investigated the effects of two types of foot orthoses on gait biomechanics correlated to the supination resistance test. Medially wedged foot orthoses (forefoot-rearfoot posts and a 5° medial wedge fabricated with a 3.2 mm polypropylene shell) were more effective at altering foot and ankle motion than traditional foot orthoses (thin-flexible foot orthoses without any extrinsic additions and fabricated with a 2.5 mm polypropylene shell). Medially wedged foot orthoses significantly reduced midfoot dorsiflexion, suggesting greater pronation control. The authors note that this is likely due to the increased stiffness and wedging of medially wedged foot orthoses. Interestingly, participants with greater supination resistance showed more pronounced responses to medially wedged foot orthoses. Theoretically, this supports the use of the test in the clinical environment. It would be good to see the validity of the supination resistance test explored further in future research.

Reference: Gait Posture 2024;113:6-12

Abstract

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Hallux valgus in preprofessional adolescent dancesport athletes: Prevalence and associated training factors

Authors: Liu Z et al.

Summary: These authors used a cross-sectional questionnaire investigating demographic characteristics, training information and height and weight, to determine risk factors associated with hallux valgus angle among preprofessional adolescent dancesport athletes. The questionnaire was completed by 275 athletes (73 males and 202 females) aged between 11 and 18 years. Unpaired t-test findings did not reveal any significant differences in start age, athletic career, and weekly training time in those with and without hallux valgus. There was a higher prevalence of hallux valgus in female than male elite adolescent dancesport athletes according to the Chi-square test. Female sex was found to be a strong predictor of a higher prevalence of hallux valgus according to multiple logistic analysis; odds ratio (OR) 3.954 (95% CI 2.193-7.131), $p < 0.001$. Longer weekly training time was also found to be a risk factor for hallux valgus; OR 1.033 (95% CI 1.001-1.067), $p = 0.041$.

Comment: Results showed that female dancers and those with longer weekly training were more susceptible to developing hallux valgus. Dancesport, particularly styles involving high heels, appears to contribute to a higher prevalence of hallux valgus compared to other activities, including ballet. This is likely due to the repetitive stress and pressure placed on the feet during intense training and competitions. The study confirmed that female athletes are more predisposed to hallux valgus, possibly due to inherent anatomical differences in foot structure, such as a smaller and rounder metatarsal head and weaker foot muscles. Interestingly, while training intensity was linked to hallux valgus, the age at which dancers began training was not a significant factor. This might be because most participants started after age 10, a stage where the progression of hallux valgus is less likely to increase significantly.

Reference: J Foot Ankle Res. 2024;17(3):e12043
Abstract

Adherence to wearing prescribed footwear in people at risk of diabetes-related foot ulcers

Authors: Jarl G et al.

Summary: This study investigated predictors of footwear adherence and variations in adherence and activity in 60 individuals at high risk of diabetes-related foot ulceration. The overall mean prescribed footwear adherence rate was 63% and was similar across activities (61% to 63%). Adherence to prescribed footwear was lower at home (59%) than away from home (74%), while activity was the opposite (2.2 vs 1.2 hours per day, respectively). While no single variable predicted overall adherence to prescribed footwear, higher Hba1c level predicted lower adherence at home ($\beta = -0.34$, $p = 0.045$, $R^2 = 11.6\%$), and more daily steps predicted lower adherence away from home ($\beta = -0.30$, $p = 0.033$, $R^2 = 9.3\%$). Differences in adherence were observed between time of day, with adherence and activity highest in the mornings (71% and 1.1 hours) and afternoons (71% and 1.5 hours), and lower in the evenings (40% and 0.8 hours) and at nights (9% and 0.1 hours). While activity was higher on weekdays (3.4 vs 3.0 hours), adherence to prescribed footwear was similar on weekdays and weekend days (63% vs 60%).

Comment: This study investigated adherence to custom-made footwear in people with diabetes at high risk of ulceration. The average footwear adherence was 63%, with lower rates at home (59%) than when away from home (74%). This is of concern due to the relationship between low footwear adherence and increased risk of diabetes-related foot ulcers. Higher HbA1c levels were linked to lower adherence at home, while a greater number of daily steps predicted lower adherence to prescribed footwear away from home. The authors relate this finding to the concept of "strategic non-adherence," where people balance their quality of life with the costs and benefits of adherence. The research highlights a need to improve footwear adherence, particularly at home. Strategies such as promoting indoor footwear could be beneficial. Importantly, adherence should not be viewed as a one-size-fits-all concept. Instead, healthcare professionals and researchers must consider the influence of context and individual preferences to effectively promote the use of prescription footwear.

Reference: J Foot Ankle Res. 2024;17(3):e70002
Abstract

Plantar pressure in relation to hindfoot varus in people with unilateral upper motor neuron syndrome

Authors: Bloks BE et al.

Summary: This retrospective study assessed plantar pressure characteristics of 49 people with chronic unilateral upper motor neuron syndrome (UMNS), and 586 healthy controls in relation to hindfoot varus and proposed a plantar pressure-based outcome measure for evaluation of surgical interventions. UMNS patients had lower plantar pressure area ratios than healthy controls, along with increased plantar pressure underneath the lateral foot in those with persistent hindfoot varus. Centre of pressure trajectories were more lateral than in healthy controls for the first 26% of the stance phase in those with a dynamic hindfoot varus and for the first 82% of the stance phase in those with a persistent hindfoot varus. The authors propose to primarily use the medio-lateral centre of pressure trajectory as the appropriate outcome measure for evaluation of surgical interventions to improve hindfoot varus.

Comment: People with UMNS showed reduced foot contact area and altered pressure distribution compared to people without UMNS. Those with rearfoot varus experienced increased pressure on the outer edge of their feet. Interestingly, the timing of pressure changes also differed. In dynamic rearfoot varus (where the deformity comes and goes during walking), pressure shifted to the lateral foot only at the commencement of the stance phase. However, in persistent varus, this lateralisation lasted throughout the entire stance phase. These findings highlight the importance of examining both spatial and temporal aspects of plantar pressure when assessing foot function in people with UMNS. Analysing how pressure changes over time, particularly through the centre of pressure trajectory, can provide valuable insights into dynamic foot deformities. The study suggests that these pressure measurements could be used to evaluate the effectiveness of surgical interventions for rearfoot varus. However, further research is required to confirm the sensitivity of these measures to changes after surgery and their correlation with clinical outcomes.

Reference: J Foot Ankle Res. 2024;17(3):e12041
Abstract

INDEPENDENT COMMENTARY BY
Professor Matthew Carroll

Matthew is a Professor of Podiatry within the School of Clinical Sciences at Auckland University of Technology (AUT). His research focus is on chronic long-term conditions that affect the lower limb and foot. He is a current Associate Editor for the Journal of Foot & Ankle Research. **FOR FULL BIO CLICK HERE.**

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Determining confidence and anxiety of Australian community podiatrists in managing foot ulceration: A cross-sectional study

Authors: Anning N et al.

Summary: This Australian online cross-sectional survey examined current practice, confidence and anxiety levels among 122 community-based podiatrists with respect to management of patients with diabetes-related foot ulcer (DFU), barriers to service provision and interest in future educational opportunities. Confidence in DFU management was high in manual skills including foot stabilisation (85.7%), scalpel control (83.0%), scalpel debridement (82.7%), aseptic technique (81.0%), maintaining healthy tissue (77.3%), appropriate tissue removal (75.6%), ulceration depth (73.7%) and management of messy wounds (69.1%). Lower levels of reported confidence were seen for curette debridement (41.0%). Performance anxiety was low with low modified competitive State Anxiety Inventory-2 (CSAI-2) scores for somatic (6/24) and cognitive anxiety (3/8).

Comment: The research explored the role of community podiatrists in managing DFU in Australia, aiming to understand their capacity to participate in shared care models with hospital services. The study found that community podiatrists manage a range of DFUs, often acting as first responders. While they generally possess high confidence in DFU management, their assessment practices are not always aligned with clinical guidelines, potentially due to resource constraints. The main barriers to optimal care were financial limitations for patients and the complexity of cases requiring specialist input. Interestingly, lack of confidence was not a significant barrier. Podiatrists strongly desired further training, particularly through online courses and clinical placements within hospital settings. This highlights a need for accessible educational opportunities focused on guideline-based assessment, triage, and establishing clear referral pathways. To enhance DFU care, the study recommends increased educational support for community podiatrists, clinical immersion opportunities in specialised hospital facilities, and integrating curette use into podiatry curricula.

Reference: J Foot Ankle Res. 2024;17(3):e12037
Abstract

Navigating the integration of knowledge and research evidence in clinical practice for children's foot health: A multi-professional survey

Authors: Hodgson L et al.

Summary: This UK descriptive, cross-sectional online survey examined professional habits of knowledge and research evidence acquisition in children's foot health based on responses from 247 health professionals (160 physiotherapists, 50 podiatrists, 25 orthotists, 12 nurses and health visitors). Three themes were identified: factors influencing knowledge and clinical practice; the role of Professional Bodies; Health Professionals' views on managing information for parents and caregivers.

Comment: This study investigated how health professionals in the UK specialising in children's foot and ankle care stay informed and apply knowledge to their practice. The research highlights the importance and challenges of translating research into practice, building on previous work identifying barriers to evidence-based care in this field. Health professionals value peer-to-peer learning and critical reflection, relying on professional networks more than journals due to difficulties with research appraisal. However, inconsistencies exist in how professional bodies promote evidence-based practice and the resources they provide. The study emphasises the need for knowledge translation to empower parents and caregivers with accurate information about children's foot health. Common topics discussed with parents include lower limb development and footwear, but gaps exist, particularly regarding footwear types. This is concerning, given the prevalence of poor-quality online information. Ultimately, the study advocates for improved knowledge transfer pathways to ensure evidence informs practice. Health professionals must be equipped to identify and debunk misinformation, engaging in open conversations with parents about the information they encounter.

Reference: J Foot Ankle Res. 2024;17(3):e12034
Abstract

Biomechanical effectiveness of controlled ankle motion boots: A systematic review and narrative synthesis

Authors: Stolycia ML et al.

Summary: This systematic review aimed to summarise the biomechanical effects of a controlled ankle motion (CAM) boot as an orthotic for restricting ankle range of motion (RoM) and offloading the foot based on 13 studies including 197 participants (113 male, 84 female). CAM boots restrict ankle RoM; however, neighbouring joints can show kinetic and kinematic compensatory alterations. Forefoot plantar pressure is effectively redistributed to the hindfoot by CAM boots. Hip and knee joint compensatory mechanisms could explain secondary site (ipsilateral knee, contralateral hip) pain, which is often reported by patients.

Comment: The review found that CAM boots effectively unload plantar pressure from the forefoot, with the degree of offloading significantly correlated with the degree of ankle plantarflexion within the boot. While tall and short boots reduce forefoot pressures, short boots offer less ankle restriction. The authors postulate that a short boot may decrease the chances of secondary pain and allow a more natural gait, potentially reducing secondary pain and muscle atrophy. It must be noted that this review excluded pathological cohorts; therefore, the application of the findings to the clinical population is limited.

Reference: J Foot Ankle Res. 2024;17(3):e12044
Abstract

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Comparison of accuracy and speed between plaster casting, high-cost and low-cost 3D scanners to capture foot, ankle and lower leg morphology of children requiring ankle-foot orthoses

Authors: Farhan M et al.

Summary: This study assessed the accuracy and speed of two high-performing 3D scanners (Artec Eva [Eva] and Structure Sensor II [SSII] 1-person [1p] and 2-person [2p] protocols) versus plaster casting in 10 paediatric patients (mean age 10.0 years) requiring an ankle-foot orthosis (AFO) for a movement disorder. Overall, Eva and SSII were accurate for foot, ankle, and lower leg key clinical landmarks (Eva-1 4.4%; Eva-2p 3.2%; SSII-1p 0.6%; SSII-2p 0.7%), while the SSII had lower biases for 1p (0.5 mm) and 2p (0.4 mm) protocols versus Eva (1p bias 2.3 mm; 2p bias 1.8 mm). The SSII 2p protocol was the fastest method (26.4 s).

Comment: The research investigated high-cost Eva and low-cost SSII 3D scanners for creating AFOs in children with movement disorders. Using 1p and 2p scanning protocols, the scanners produced measurements comparable to traditional plaster casting. The SSII, especially with the 2p protocol, showed slightly better accuracy, potentially due to its use of infrared light, which is less susceptible to distortion. While the 2p protocol minimised motion artefacts, the 1p protocol offered efficiency and was successful for most participants. Considering cost and efficiency, the SSII 1p protocol emerged as a preferred approach, with the 2p protocol reserved for more complex cases. This study highlights the potential for 3D scanning to improve AFO fabrication workflows, offering faster and more cost-effective solutions that are particularly beneficial for resource-constrained healthcare settings. However, clinicians should be mindful of potential measurement discrepancies, especially for rearfoot width, mid-calf length, and arch height, and consider software corrections cautiously.

Reference: J Foot Ankle Res. 2024;17(3):e70006
Abstract

The association between peripheral neuropathy and daily-life gait quality characteristics in people with diabetes

Authors: Hulshof CM et al.

Summary: This exploratory analysis combined data from two cross-sectional studies to examine gait quality in daily life in 98 diabetic participants (mean age 68 years, 32 female), of whom 68 patients had peripheral neuropathy. Peripheral neuropathy was associated with lower walking speed (0.81 vs 0.88 m/s; β -0.114; 95 % CI -0.202 to -0.026), lower stride frequency (0.81 vs 0.85 strides/s; β -0.030; 95 % CI -0.057 to -0.003), lower gait intensity in the vertical direction (1.38 vs 1.63 m/s^2; β -0.074; 95 % CI -0.143 to -0.006), and less gait symmetry ratio in the vertical direction (1.82 vs 2.27; β -0.322; 95 % CI -0.474 to -0.170).

Comment: This study examined the impact of peripheral neuropathy on gait quality in people with diabetes during daily life gait. Four of the 25 assessed gait characteristics were worse in people with diabetes and peripheral neuropathy: walking speed, stride frequency, gait intensity, and gait symmetry. These metrics indicated poorer gait quality compared to those without neuropathy. Peripheral neuropathy was associated with slower walking, less trunk movement, and decreased gait symmetry. The study suggests that neuropathy-related impairments in proprioception, muscle strength, and activation contribute to poorer gait and increased fall risk. Despite large participant variability, significant associations with neuropathy remained. The authors advocate for future research focusing on gait training programmes tailored to people with peripheral neuropathy related to diabetes. Such programmes could improve gait quality and reduce fall risk in this population.

Reference: Gait Posture 2024;114:152-159
Abstract

Dermoscopic features of nail psoriasis: A systematic review

Authors: Rachadi H and Chiheb S

Summary: This systematic review assessed dermoscopic features of nail psoriasis based on 11 studies including 723 patients (60% male). The most common onychoscopic feature was pitting, suggesting nail matrix involvement, with other features including leukonychia, thickening of the nail plate, transverse and longitudinal ridges, and lunula abnormalities. The most common onychoscopic feature suggesting nail bed involvement was onycholysis, along with splinter haemorrhages, subungual hyperkeratosis, oil drop sign, agminated capillary dots, erythematous border, dilated capillaries, and pustules. Vascular abnormalities occurred in 52% of patients.

Comment: This review analysed dermoscopy findings in nail psoriasis, confirming nail pitting as the most characteristic sign. Pitting, onycholysis (nail separation), and splinter haemorrhages were consistently observed across all studies. Increased angiogenesis (blood vessel formation) is a key feature of psoriasis. Dermoscopy revealed most patients' capillary changes, often dilated or dotted, affecting various nail unit components. Vascular abnormalities at the nail's proximal edge were less frequently reported, possibly due to variations in dermoscopic examination techniques. The oil drop sign, subungual hyperkeratosis (thickening under the nail), and leukonychia (white discolouration) were also prevalent. Less specific signs included nail thickening, ridges, and lunula changes. The pseudo-fibre sign, characterised by red and black filaments, was observed, but its association with psoriasis remains debated. This review highlights the value of dermoscopy in characterising nail psoriasis, revealing a range of vascular and structural changes. However, it also emphasises the need for standardised examination techniques to ensure consistent and accurate reporting of dermoscopic findings.

Reference: Int J Dermatol. 2024;63(8):1013-1019
Abstract

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