Foot & Ankle RESEARCH REVIEW™

Making Education Easy

Issue 49 – 2021

In this issue:

Abbreviations used in this issue
CI = confidence interval
EMG = electromyography
OR = odds ratio
RCT = randomised controlled trial

Welcome to Issue 49 of Foot and Ankle Research Review.

This issue highlights a recent evidence-based guideline for the management of plantar heel pain. For those with a keen interest in the paediatric flatfoot there is an informative review from Dr Angela Evans that introduces the concept of the 'boomerang' foot. There are also two interesting studies that focus on fungal nail infections.

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

Noho ora mai

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Management of plantar heel pain: A best practice guide informed by a systematic review, expert clinical reasoning and patient values

Authors: Morrissey D et al.

Summary: This study used a mixed methods process (systematic review of 51 trials [n = 4351], semi-structured expert interviews [n = 14], patient survey [n = 41]) to create a best practice guide for managing plantar heel pain. Systematic review findings and interview data provided good agreement about the use of taping (standardised mean difference [SMD] 0.47; 95% CI 0.05-0.88) and plantar fascia stretching (SMD 1.21; 95% CI 0.78-1.63) for short-term first step pain. Combining these interventions with education and footwear advice was the core self-management approach recommended. Experts also recommended stepped care management with focused shockwave therapy for first step pain in the short term (OR 1.89, 95% CI 1.18-3.04), medium term (SMD 1.31; 95% CI 0.61-2.01) and long term (SMD 1.67; 95% CI 0.88-2.45), with radial shockwave therapy for first step pain in the short (OR 1.66; 95% CI 1.00-2.76) and long (OR 1.78; 95% CI 1.07-2.96) term. There was good agreement to 'step care' using custom foot orthoses for general pain in the short (SMD 0.41; 95% CI 0.07-0.74) and medium (SMD 0.55; 95% CI 0.09-1.02) term.

Comment: This study had an interesting approach to developing a best practice guideline combining a systematic review, expert interviews, and a patient survey. The best practice guideline defines an approach to managing plantar heel pain and is presented in Figure 2 of the manuscript. The core approach being plantar fascia stretching, education and taping. Extracorporeal shockwave therapy (ESWT) is recommended in the best practice guideline when patients are failing to recover optimally using the core approach. If the core intervention or ESWT fails, foot orthoses, dry needling, corticosteroid or platelet-rich plasma injection therapies and resistance exercises should be considered. I feel this article is worth your time to read and it would be interesting to compare your treatment pathways with the ones presented by this research. Figures 1 and 2 in the manuscript present a graphical summary of the treatment approaches and may be a useful patient resource.

Reference: Brit J Sport Med. 2021;Mar 30 [Epub ahead of print]
Abstract

Lower leg muscle structure and function are altered in long-distance runners with medial tibial stress syndrome: A case control study

Authors: Mattock J et al.

Summary: This study examined whether 20 long-distance runners with medial tibial stress syndrome (MTSS) had differences from 20 matched asymptomatic runners in lower leg muscle structure and function. Limbs with medial tibial stress syndrome had a smaller cross-sectional area of flexor hallucis longus (FHL) and smaller soleus but larger lateral gastrocnemius than controls, but no difference in lean lower leg girth. There were relative deficits in strength of maximal voluntary isometric contraction of FHL, soleus, tibialis anterior and peroneal muscles, and less ankle plantar flexor endurance.

Comment: MTTS can be a tricky problem to manage, it is great to see some contemporary research in this condition adding to the limited evidence base to guide clinical decision making. This study demonstrated decreased cross-sectional area in the FHL and soleus muscles in people with MTSS. However, due to the cross-sectional nature of the study, the authors are unable to conclude if muscular changes are caused by, or result from, MTTS. The discussion provides good insight into the role of muscle strength in the pathological process. Study data provides evidence that strength and endurance exercises should be key components of a rehabilitation programme for MTSS.

Reference: J Foot Ankle Res. 2021;14:47
Abstract

Duration of total contact casting for resolution of acute Charcot foot: A retrospective cohort study

Authors: Griffiths DA and Kaminski MR

Summary: This Australian retrospective analysis assessed the duration of total contact casting (TCC) treatment for acute Charcot foot in 27 patients (mean age 57.9 years, 66.7% male, 88.9% diabetes, 96.3% peripheral neuropathy). Participants all had stage 1 Charcot foot with most located in the tarsometatarsal joints (44.4%) or midfoot (40.7%). Over 3-years follow-up, median TCC duration was 4.3 months, with an overall complication rate of 5% per cast, mostly skin rubbing/irritation (40.7%) and asymmetry pain (22.2%). Osteoarthritis (OR 6.00) was associated with TCC duration >4 months. After TCC, 48.1% of patients used footwear with custom foot orthoses, 25.9% used a life-long Charcot Restraint Orthotic Walker, and 22.2% received soft tissue or bone reconstructive surgery. Contralateral Charcot occurred in 3 participants.

Comment: This Australian study provides a good insight into the issues of managing an acute Charcot foot. Data showed that the median duration of TCC treatment was 4.3 months, which is comparable to US and European research data. The authors do acknowledge that variation in median treatment times between studies is multifactorial and can be affected by differing participant characteristics, Charcot characteristics (e.g., pattern and stage), techniques and protocols for monitoring Charcot progression, definition of Charcot resolution, and experience in applying the TCCs. Of note, Charcot misdiagnosis occurred in more than half of the participants, most misdiagnosed as cellulitis. This highlights the need for close monitoring for signs of Charcot foot in those with ulceration or reported traumatic injury to the foot.

Reference: J Foot Ankle Res. 2021;14:44
Abstract

Podiatrists' views and experiences of using real time clinical gait analysis in the assessment and treatment of posterior tibial tendon dysfunction

Authors: Harradine P et al.

Summary: This qualitative study used semi-structured interviews to examine the views and experiences of 29 musculoskeletal podiatrists using real-time clinical gait analysis (RTCGA) when assessing or treating patients with posterior tibial tendon dysfunction. Five themes were identified: 1) methods of RTCGA; 2) working with RTCGA; 3) uses of RTCGA; 4) what could improve RTCGA; and 5) how to acquire real-time clinical gait analysis skills. Clinical observations included patient-perceived experiences such as pain and orthotic comfort. Normative kinematic reference values were not perceived as important to the management goal. Rearfoot to leg angle, medial bulge, forefoot abduction and arch integrity were the most common barefoot RTCGA observations. There was a high degree of variation in gait observations between participants, and documentation methods also varied. RTCGA was most often learnt through experience.

Comment: RTCGA is defined as assessment of gait conducted live without the use of any recording, play back or computerised equipment, or more simply, gait observation. This UK study found that RTCGA to assess gait change in people with posterior tibial tendon dysfunction was common in clinical practice. RTCGA was used as both a measure of outcomes and to guide clinical decision making. Whilst gait analysis through computerised systems is thought to be more reliable and accurate, the availability of systems and limited clinical space often limits the use of computerised gait analysis. Study participants indicated the most common observations used to assess gait during RTCGA were assessment of medial foot bulge and leg-to-foot angle.

Reference: J Foot Ankle Res. 2021;14:42
Abstract

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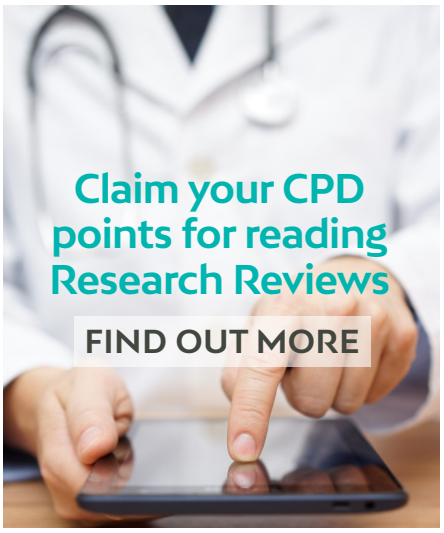

Lower limb biomechanics in individuals with chronic ankle instability during gait: A case-control study

Authors: Moisan G et al.

Summary: This case-control study examined kinematic, kinetic and EMG differences between 28 patients with chronic ankle instability (CAI) and 26 healthy controls during walking. Compared to controls, patients with CAI had greater ankle inversion angles (14-48% of the stance phase; $p=0.008$), ankle eversion moments (40-78%; $p<0.001$), knee abduction moments (3-6%) and peroneus longus muscle activity (0-15% [$p=0.003$] and 60-76% [$p=0.003$]). There were no differences in ankle sagittal and transverse angles and moments, knee angles, knee sagittal and transverse moments, or gluteus medius, vastus lateralis, gastrocnemius lateralis and tibialis anterior muscle activity.

Comment: CAI is characterised by a reoccurrence of a lateral ankle sprain at least 12 months after the first sprain, frequent episodes of the ankle giving way, persistent symptoms such as pain, swelling, limited motion, weakness, and diminished ankle function. Study data found greater inversion angles during the stance phase of gait in participants with CAI compared to controls. The study also showed that peroneal muscle activity was greater in participants with CAI, this increase in muscle activity thought to be a compensatory mechanism to limit ankle inversion. Study data was also suggestive of a relationship between participants with CAI and compensatory mechanisms in the knee. The authors postulating that changes to knee function occur to attenuate load and strain to the lateral ankle. The authors advocate that rehabilitation programmes should address the faulty ankle movements and restore sensorimotor function.

Reference: J Foot Ankle Res. 2021;14:36
Abstract

Efficacy of lasers for the management of dermatophyte toenail onychomycosis

Authors: Gupta AK et al.

Summary: This systematic literature review assessed the efficacy of laser monotherapy for dermatophyte onychomycosis of the great toenail. Few RCTs examined laser monotherapy for dermatophyte toenail onychomycosis and many measured cure rates using only microscopy or culture, but not both. Combined clinical cure rates were 13.0-16.7% for short-pulsed laser and 25.9% with long-pulsed laser. No studies reported the complete cure rate, but one study reported a treatment success (mycological cure and ≤10% clinical involvement) rate in nails of 16.7%.

Comment: This review is well worth a read for those who use or are considering the use of laser as a therapeutic option to manage fungal nail infections (onychomycosis). The review provides a nice contrast between how the success of oral and topical agents are measured in comparison to medical devices (laser therapies) in the treatment of onychomycosis. The review will provide you with a good understanding of mycological cure versus clinical cure versus complete cure. The discussion provides a nice overview of the theoretical effect of laser at the cellular level. My summary of the evidence from this review is that the efficacy of laser therapies is lower than oral therapies (this is not surprising), but laser is a very safe treatment modality with no potential toxic side effects. Evidence indicates laser may improve the aesthetics of the nail, but is less likely to lead to complete mycological cure.

Reference: J Am Podiatr Med Assoc. 2021;Jul 6 [Epub ahead of print]
Abstract

Fungal lung: The risk of fungal exposure to nail care professionals

Authors: Gupta AK and Quinlan EM

Summary: Dust generated through use of nail drills to reduce nail thickness and smooth foot callouses can be inhaled and deposited in the respiratory tract, potentially causing health problems from fungi. Healthy individuals can tolerate inhaled fungi, but older, immunocompromised, and allergy-prone individuals may trigger the inflammatory pathways, leading to mucus overproduction, bronchoconstriction, and sometimes lung tissue damage. Use of surgical masks, water spray suppression systems on nail drills, air filtration systems, and considering drilling technique, can reduce nail dust exposure.

Comment: Following on from the study on onychomycosis, and after I attended a conference lecture on fungal debris in the air, I thought this was a good review to highlight. For those who work in foot care where there is nail and skin dust, please wear a mask, use a dust suppression nail drill, and consider an air filtration system. Past research has indicated that podiatrists in the UK exhibited four times the national average of asthma, indicative of their increased exposure to nail and skin dust. Nail dust from podiatry clinics has been shown to contain dermatophytes, *Aspergillus* and *Scopulariopsis*. The review ends with some good pointers on how to reduce lung exposure to nail dust including mask wearing, water suppression and nail machine drilling techniques. This is a very informative review and worth ten minutes of your time to read.

Reference: J Am Podiatr Med Assoc. 2021;Jun 11 [Epub ahead of print]
Abstract

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Paediatric flatfeet - a 2020 guide for clinicians to identify the 'Boomerangs'

Author: Evans AM

Summary: This review of paediatric flatfeet provides an 8-step strategy to improve outcomes. Normative paediatric foot posture data and confirmation that flatfeet lessen with age, encourage a structured and considered approach. Furthermore, three 'boomerang' flatfeet factors that separate symptomatic from asymptomatic flatfeet and applicable cut-off levels are presented. Recognising the risk of overdiagnosis and unnecessary treatment, a clear '20:20' vision for paediatric flatfoot is developed.

Comment: A great review article from Dr Angela Evans one of the leaders of paediatric foot knowledge. This is a must read for all who manage paediatric foot conditions. The review presents the concept of the 'boomerang' flatfoot. This is a tool designed to provide clinicians with a triaging process to aid clinical decision making. The boomerang concept identifies three factors (valgus heel, talo-navicular bulge, ankle dorsiflexion range) that delineate symptomatic from asymptomatic flatfeet in children. The review also advocates for knowledge of the foot posture index (FPI) and the normative age-associated FPI values, the use of the 3QQ (three quick questions) and validated gait assessment tools such as the p-GALS (paediatric Gait Arms Legs and Spine). The review ends with a challenging question 'is it better to do something rather than nothing'. As you will ascertain from reading this review, Dr Evans feel the paediatric flatfoot is often unnecessarily treated. This is a great clinically-based review that will ensure your evidence base is up to date.

Reference: J Am Podiatr Med Assoc. 2021;May 05 [Epub ahead of print]
Abstract

Structural and functional foot and ankle characteristics associated with falls in older people

Authors: Pol F et al.

Summary: This Iranian study examined the effect of foot problems as modifiable potential risk factors for falls in 187 older people (mean age 70.5 years) of whom 74 (39.9 %) participants had a fall in the previous year. Factors associated with falls, after accounting for physiological risks, were reduced first metatarsophalangeal (MTP) joint extension (OR 0.82; 95% CI 0.73-0.91), lower plantar flexor muscle strength (OR 0.29; 95% CI 0.15-0.55), greater medial forefoot pressure-time integral (OR 2.65; 95% CI 1.10-6.38), greater forefoot center of pressure velocity (OR 1.27; 95% CI 1.07-1.49) and greater foot pain (OR 1.09; 95% CI 1.02-1.16).

Comment: Foot and ankle characteristics are recognised as important and potentially modifiable risk factors in the prevention of falls. Study data demonstrated that foot and ankle characteristics are independently associated with falls. Interestingly fallers were found to have higher pressures on the medial column of the foot compared to non-fallers, with the odds of falling increasing 2.65-fold for each unit increase of medial midfoot pressure. The authors postulating that the use of foot orthoses to redistribute load more laterally may potentially improve balance and reduce falls, is definitely an interesting area for future research to investigate. A novel finding of this research was the association between MTP joint range of motion (ROM) and falling – the reduction in ROM in the first MTP joint impairs the normal propulsive function of the foot. Study data also demonstrated differences in lower limb muscle strength between fallers and non-fallers. Clinically this reinforces the need for clinicians to address restrictions in first MTP joint motion and foot and ankle muscle strength in patients who are at risk of or who have had falls.

Reference: Gait Posture. 2021;88:78-83
Abstract

Effects of barefoot vs. shod walking during indoor and outdoor conditions in younger and older adults

Authors: Hollander K et al.

Summary: This study examined how gait stability and variability parameters were affected by footwear versus barefoot walking in 32 younger (mean age 30 years) and 42 older (mean age 71 years) participants in indoor versus outdoor conditions. Minimal toe clearance variability was higher in shoes versus barefoot conditions ($p = 0.048$) and in outdoor versus indoor conditions ($p < 0.001$), while local dynamic stability differed between age groups ($p < 0.001$). Gait velocity and minimal toe clearance were higher in shoes and in the outdoor setting (both $p < 0.001$), while stride length and time were higher in shoes (both $p < 0.001$) and stride length was longer and stride time shorter in outdoor versus indoor settings (both $p < 0.001$). Stride length ($p < 0.021$) and stride time ($p < 0.001$) were shorter in older adults.

Comment: This study is a good reminder about how human gait is highly variable both between barefoot and shod and indoor and outdoor surfaces. Study data found minimal toe clearance variability increased in footwear and outdoor surfaces. Higher variability in minimal toe clearance has been associated with an increased falls risk. The authors suggest barefoot walking might be a strategy to reduce the risk of falling, although I am not sure of the practicality of this recommendation. In line with previous research, participants walked faster in shod conditions as well as indoors. Walking speed has been discussed to be very relevant with functional decline over the life span, affecting the quality of life and fear of falling. In the presence of perturbations (e.g., outdoor walking) or when not familiar with barefoot walking, a reduced gait speed might be a sign of a more cautious gait pattern. Clinically this research emphasises that if a walking-based rehabilitation programme is implemented, the conditions of the programme should be varied to include barefoot- and shod-, and outside- and indoor-based walking activities. I feel the research also emphasises the importance of obtaining simple measures of gait speed from your patients, this can be used as a simple outcome measure to monitor functional change.

Reference: Gait Posture. 2021;Apr 15 [Epub ahead of print]
Abstract

Independent commentary by Associate Professor Matthew Carroll

Matthew is Associate Professor of Podiatry at the Auckland University of Technology. He graduated in podiatry at the CIT in Wellington. Matthew undertook his postgraduate study and research at Otago University, Dunedin, New Zealand, Curtin University, Western Australia and Auckland University of Technology, Auckland, New Zealand. His research areas include investigating lower limb function in chronic diseases. He is Associate Editor for BMC Musculoskeletal Disorders and is an Editorial Board Member for the Journal of Foot & Ankle Research.