Foot & Ankle RESEARCH REVIEW™

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Issue 48 – 2021

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Welcome to Issue 48 of Foot and Ankle Research Review.

I have highlighted some recent diabetes publications that investigate the potential benefits of exercise to improve healing of diabetic foot ulcerations and the role of exercise in patients who have had minor amputations. I also review some recent dermatological publications that have investigated two tricky problems podiatrists encounter, intractable plantar keratomas and interdigital corns. For those who prescribe foot orthoses I encourage you to read the article by Deschamps et al., as it will challenge you to view the outcomes of orthotic therapy from a different perspective.

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

Noho ora mai

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The biopsychosocial-digital continuum of foot orthosis practice and research: The VALUATOR model

Authors: Deschamps K et al.

Summary: This study introduces the Value Based Foot Orthosis Practice (VALUATOR) conceptual model of foot orthosis practice that embraces a broad range of factors pertinent to orthosis practice, and incorporates behaviours and values of contemporary health service. Foot orthosis design and clinical value in the VALUATOR model considers a bio-psycho-social-digital continuum reflecting the reality of foot orthosis practice. It contextualises variable outcomes observed in research and practice in 6 key areas; value, person-centred approach, optimal bio-psycho-social stress, bio-psycho-social assessment, monitoring, and primary and secondary clinical strategies. It is targeted at students, lecturers, scientists and practitioners and includes terminology that supports a robust basis for educational and scientific discussion.

Comment: I would recommend all clinicians who prescribe foot orthoses should read this manuscript. The proposed model will challenge many foundational beliefs you have formed about foot orthoses. The model proposes that beliefs and practices surrounding foot orthoses must move beyond thinking that foot orthoses outcomes should only be assessed via a neuro-biomechanical effect. The authors present the VALUATOR model that represents a value-based healthcare approach. Within the model, foot orthosis design (the geometric and material properties of a foot orthosis) and clinical value is considered along a bio-psycho-social-digital continuum reflecting the nature of foot orthotic practice. The model helps to contextualise the variable outcomes that are observed in research and practice. On reflection after reading this article I have thought about the many varied outcomes I have achieved when prescribing foot orthoses and how my judgement of a successful outcome has been quite narrow.

Reference: J Foot Ankle Res. 2021;14(1):25

Abstract

The effectiveness of prolotherapy for recalcitrant medial tibial stress syndrome: A prospective consecutive case series

Authors: Padhiar N et al.

Summary: This small, UK, prospective consecutive case series in 18 patients evaluated ultrasound-guided injection of 15% dextrose for treatment of recalcitrant medial tibial stress syndrome (MTSS) in the reduction of pain and facilitation of a return to desired activity levels. Patients reported a reduction from baseline in median visual analogue scale (VAS) pain score at medium-term (mean 18 weeks) and long-term (mean 52 weeks) follow-up ($p < 0.01$); the median improvement was 4.5/10. At medium-term follow-up, patients rated their condition as 'much improved' and at medium-term and long-term follow-up the median return to sports score was 'returned to desired but not pre-injury level'.

Comment: Clinicians who routinely manage shin pain will appreciate the complexities of conservative MTSS management. Many treatment modalities are available including extracorporeal shockwave therapy, iontophoresis, ice massage, periosteal pecking, non-steroidal anti-inflammatory drug, stretching and foot orthoses, and modification of biomechanical factors. However, previous research has indicated a limited evidence base to support the use of the above modalities. The rationale behind prolotherapy is that injecting proliferants, such as hypertonic glucose solution, into damaged connective tissue, initiates inflammation, which leads to a healing cascade resulting in fibroplasia, deposition of new collagen and tissue hypertrophy. While this study found pain reductions with the use of prolotherapy, the reductions were more significant in the short term (1 month post injection). In the medium to longer term there was a trend for pain levels to recede. This indicates the use of prolotherapy may provide a short-term window to implement other modalities that will lead to long-term pain relief.

Reference: J Foot Ankle Res. 2021;14(1):32
Abstract

Effectiveness of saline water and lidocaine injection treatment of intractable plantar keratoma: A randomised feasibility study

Authors: Mercier M-P et al.

Summary: This small randomised single-blind trial examined the feasibility, safety and effectiveness of innovative treatments in 40 patients with intractable plantar keratoma (IPK); block randomisation to 4 parallel groups compared conservative sharp debridement only or sharp debridement with needle insertion, physiological water injection or lidocaine injection. The feasibility results suggested recruitment challenges because, from the patient's perspective, the anticipated pain of needle insertion may not be worth the potential pain relief versus debridement alone. This was also the main cause of drop out. There was no main effect for any of the clinical outcomes of pain, Foot Function Index score or IPK size. However, there was an effect of time on Visual Analog Scale ($p < 0.001$), Foot Function Index score ($p < 0.001$) and IPK size ($p \leq 0.001$), but no group by time interaction.

Comment: It is great to see some dermatological research, particularly on IPKs, as research is very scarce. IPKs (often mistaken for a corn) are a member of the callosities family and are a common cause of foot pain that can have a significant detrimental impact on the mobility, quality of life, and independence of individuals. IPKs are a painful lesion which consist in a conical thickening of the epidermis' stratum corneum on the plantar aspect of the foot. Clinicians who routinely manage patients with IPKs will recognise how difficult it is to provide long-term relief. This study, which compared multiple treatment combinations, found no statistical differences between the differing treatment options, which is perhaps not surprising given the small number of study participants. However, there was a trend towards diminished pain sensitivity for a combination of treatment options over scalpel debridement alone. The study also raises some interesting thoughts related to the additional effects of lidocaine beyond simple anaesthesia, i.e., the negative effect on fibroblast proliferation (fibroblasts dictate the proliferation rate of dermal cells) and the modification of granulocytes cellular membrane, which may have additional roles in reducing pain associated with IPKs.

Reference: J Foot Ankle Res. 2021;14(1):30
Abstract

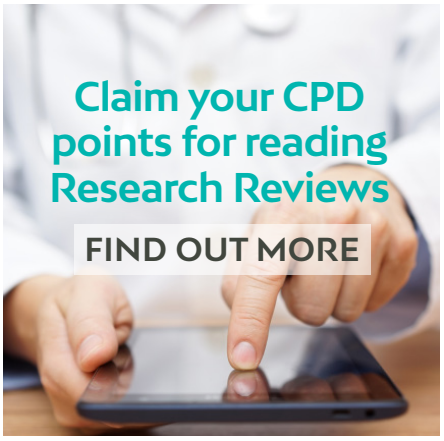
Efficacy and safety of condylectomy with minimally invasive surgery in the treatment of interdigital corns of the lesser toes compared to conservative treatment

Authors: Marti-Martinez LM et al.

Summary: This Spanish multicentre, prospective cohort study examined the use of condylectomy with minimally invasive surgery procedures versus conservative management to treat interdigital corns of the lesser toes. After 6 months, surgical patients experienced no pain on pressure, which differed from the conservative treatment group ($p < 0.001$). They also had improved clinical and functional status, reaching values similar to the standard population. Surgical treatment did not result in paresthesia, joint stiffness or instability, toe malalignment, or corn transfer to a contiguous site.

Comment: Interdigital corns are very painful, can affect mobility and effect the person's quality of life. It is great to see some research on treatment options for painful interdigital corns as conservative measures particularly through scalpel debridement, padding, and footwear modification are often ineffective in the long term. The surgical technique of condylectomy with minimally invasive surgery (using a burr on the involved bone surface) for the treatment of interdigital corns of the lesser toes has been performed by podiatric and orthopaedic surgeons for several decades. This study data indicated the efficacy of the surgical technique and showed that surgery eliminated interdigital corns and pain in this area in almost 100% of the cases. Whist the study demonstrated the procedure was effective and safe, it was not designed to demonstrate if the surgery was more effective than conservative management. I hope we see some research soon that investigates this question.

Reference: J Foot Ankle Res. 2021;14(1):20
Abstract



People with chronic ankle instability benefit from brace application in highly dynamic change of direction movements

Authors: Fuerst P et al.

Summary: This small study in only 15 participants with and 15 without chronic ankle instability examined the effects of a soft and a semi-rigid ankle brace on the execution of highly dynamic 180° turning movements in reaction to light signals. Maximum ankle inversion angles and velocities were lower in those wearing the semi-rigid brace versus those without a brace and with a soft brace ($p \leq 0.006$). The effect sizes were greater in participants with chronic ankle instability versus healthy controls. Peroneal activation levels decreased when wearing the semi-rigid brace in the 100 ms before and after ground contact.

Comment: Ankle braces have been reported to reduce ankle injuries by 50-70%. The proposed mechanisms of action being that bracing provides additional mechanical stiffness and improves neuromuscular function to the ankle joint. In this study, significant reductions in participants ankle inversion angles and velocities were seen in those who wore rigid braces compared to those who wore soft bracing and control participants. The authors propose this demonstrates that the mechanical stiffness of the bracing is the primary reason behind the effect of rigid bracing. The results also highlight that soft bracing seems to have little effect on joint kinematics or kinetics.

Reference: J Foot Ankle Res. 2021;14(1):13
Abstract

Availability and service provision of multidisciplinary diabetes foot units in Australia: A cross-sectional survey

Authors: Vo UG et al.

Summary: An online survey distributed to all 195 Australian members of the Australian and New Zealand Society for Vascular Surgery investigated the characteristics of services treating patients with diabetes-related foot disease. The response rate to the survey was 26.7%. More than half of respondent's institutions had a multidisciplinary diabetes foot unit, most in tertiary hospitals. The common components of these units were podiatrists, vascular surgeons, infectious disease physicians and endocrinologists. Vascular surgery was identified by most (63.5%) respondents as the primary admitting specialty for diabetes-related foot disease patients requiring hospitalisation and this was consistent even in centres with multidisciplinary diabetes foot unit (MDFU) clinics. Only one-third of multidisciplinary diabetes foot units had independent admitting rights.

Comment: This Australian study demonstrated the heterogeneity in Australian multidisciplinary care models for diabetes-related foot disease. This may be driven by there being no universally accepted guideline to define the ideal composition of a multidisciplinary team for the management of diabetes-related foot disease. The National Institute for Health and Care Excellence guidelines (England, 2015) recommended that a MDFU should consist of specialists in the following areas: diabetology, podiatry, diabetes specialist nursing, vascular surgery, microbiology, orthopaedic surgery, biomechanics and orthoses and interventional radiology. Study data indicated only 60% of respondents reported availability of MDFU in their institutions and that the key members participating in MDFU were podiatrists (95%), vascular surgeons (90%), infectious disease physicians (89%) and endocrinologists (83%). Approximately half of the respondents' units included a diabetes nurse specialist (44%), or a wound management nurse specialist (55%). Notably, less than 20% of MDFUs in this survey reported having a regular orthopaedic surgeon's input.

Reference: J Foot Ankle Res. 2021;14(1):27
Abstract

Does exercise improve healing of diabetic foot ulcers? A systematic review

Authors: Tran MM & Haley MN

Summary: This systematic review of 3 randomised controlled trials (n = 139) examined whether 12 weeks of non-weight bearing exercise improved healing of diabetic foot ulcers. Two of the studies found greater reduction in percentage wound size with exercise versus control, with one of these studies achieving statistically significant findings ($p < 0.05$). The third study demonstrated reductions in total wound size ($p < 0.05$), but the results were analysed within, but not between, treatment groups.

Comment: This was an interesting question posed by this review as offloading strategies and activity reduction are often advised in the management of diabetic foot ulcerations. Research investigating the mechanism of exercise effecting healing of diabetic foot ulcers is limited. This idea is driven by data suggesting that exercise induces an increase in blood flow, leading to an increase in nitric oxide synthesis and reducing oxidative stress in persons with type 2 diabetes. Hyperglycaemia inhibits nitric oxide synthesis, affecting insulin resistance and reducing the vasodilator response in blood vessels. The combination of vasodilation and an increase in tissue blood flow may potentially facilitate ulcer healing. The review results were inconclusive to support the use of exercise therapy in people with diabetic foot ulcerations. However, it is noted by the authors that there appear to be no negative consequences of non-weight bearing exercises for people with diabetic foot ulcerations.

Reference: J Foot Ankle Res. 2021;14(1):19
Abstract

Re-amputation in patients with diabetes-related minor amputations who underwent physical therapy during their hospitalization

Authors: Imaoka S et al.

Summary: This retrospective cohort study (2015-18) examined modifiable risk factors for re-amputation (ipsilateral lower extremity) in 129 patients with minor amputations for diabetes-related foot lesions who received physical therapy during hospitalisation. Over an average 6.2 months follow-up, 42 (32.5%) patients underwent re-amputation. Factors associated with re-amputation were a requirement for haemodialysis, ankle dorsiflexion angle, and Functional Independence Measure ambulation score.

Comment: An interesting study that adds further evidence to the importance of maintenance and development of ankle joint dorsiflexion in patients with limited flexion as part of a post ulceration rehabilitation plan. The authors provide evidence that advocates for regular screening for pre- and post-operative range of motion limitations. The study data also highlights the need to continually monitor foot pressures in people with diabetes. Early identification and management of high pressures may prevent an initial amputation, which is a strong predictor of re-amputation.

Reference: J Foot Ankle Res. 2021;14(1):14
Abstract

Factors impacting the evidence-based assessment, diagnosis and management of acute Charcot neuroarthropathy: A systematic review

Authors: Diacogiorgis D et al.

Summary: In a systematic review, these authors examine the factors that impact on the delivery of evidence-based care in assessment, diagnosis and management of people with acute Charcot neuroarthropathy (CN) based on 32 articles and 4 consensus/guidelines. Practices that depart from evidence-based assessment, diagnosis and management of acute CN had themes that were centred on the patient, health professional and health organisation/environmental. Delays in diagnosis were influenced by the patient's knowledge of when to seek help, practitioner recognition and referral for immediate care, confusion in imaging, and offloading and appropriate geographical and local health service resources to manage the condition.

Comment: This review presents a number of interesting findings that may explain factors that impact the care of CN. The most significant factors impacting practice being a delay in timely assessment, diagnosis and management. This delay may be related to the patient's lack of awareness of the condition, lack of health professional knowledge of CN, lack of proximity to services and access, and health service protocol on the management of CN. The review highlighted that health organisations often do not have the expertise and capacity to assess, diagnose and manage acute CN in a timely and efficient manner. Access to specialist care in dispersed geographical rural and remote communities was also identified as a barrier to care. This review highlights a complication of diabetes that appears to be poorly understood by both patients and healthcare professionals.

Reference: J Foot Ankle Res. 2021;14(1):26
Abstract

Differences in toe flexor strength and foot morphology between wheelchair dependent and ambulant older people in long-term care: A cross-sectional study

Authors: Yokozuka M & Sato S

Summary: This study examined differences in toe flexor strength and foot morphology in 84 people aged ≥70 years without motor paralysis requiring long-term care as a result of changes in the way they mobilise with (wheelchair group, n = 30) or without a wheelchair (walking group, n = 54). Multiple logistic analysis with wheelchair dependence as the dichotomous outcome variable identified no between-group difference in foot morphology. Factors related to differences in ways of ambulating were history of fracture, heart disease and toe flexor strength. Toe flexor strength was lower than the hand grip strength in the wheelchair group.

Comment: This study investigated if toe flexor strength is decreased in people who are wheelchair dependent. The proposition being that people in a wheelchair have a reduced opportunity to perform activities in the standing position, consequently, muscle strength will be decreased due to disuse atrophy. Quantifying toe flexor strength is also important as it is associated with increased falls risk and decreased walking speed. The study found significant decreases in toe flexor strength in wheelchair dependent participants, but no differences in foot morphology between the two study groups. The method by which this study assessed foot morphology may explain this result, as foot morphology was assessed by a simplistic measuring of foot contour. Clinically this study reinforces that toe flexor strength should be a routine outcome recorded as part of an older adults monitoring programme.

Reference: J Foot Ankle Res. 2021;14(1):17
Abstract

Independent commentary by Associate Professor Matthew Carroll

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