

Foot & Ankle Research Review

Making Education Easy

Issue 6 – 2010

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Welcome to the latest edition of Foot and Ankle Research Review.

The recent debate about barefoot running has researchers continuously talking about whether it is beneficial or not. However, when we talk about footwear fashions, or using therapeutic footwear for everyday use, clinicians should be aware of factors that could contribute to adherence and the biomechanical effects that they have on patients. Footwear is a topic that certainly evokes passion and controversies. The current issue includes two articles relating to footwear, a study examining the social and emotional consequences of therapeutic footwear use in women from three European countries, and a study that undertook a comparative analysis of human gait while wearing thong-style flip-flops versus sneakers.

I have also included in this issue three articles relating to diabetes. The 21st century is witnessing a worldwide epidemic of diabetes. During their lifetime, approximately one in four people with diabetes will develop a foot ulcer, the precursor of amputation. It is sobering to consider that one diabetes-related amputation is performed every 30 seconds around the world. I strongly recommend that people read the article by Rogers et al.

I hope you find the selection for Foot & Ankle Research Review stimulating reading, and we welcome your feedback.

Kind regards,

Professor Keith Rome

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Comparative analysis of human gait while wearing thong-style flip-flops versus sneakers

Authors: Shroyer JF and Weimar WH

Summary: These researchers from the US had casually observed that individuals have a different gait while wearing thong-style flip-flops compared to when they are wearing shoes, and suggest that such an alteration in gait may cause the anecdotal lower limb and foot discomfort associated with wearing flip-flops. They undertook a study involving 56 college students aged 19-25 years (19 men and 37 women) to investigate gait kinetics and kinematics while wearing thong-style flip-flops and while wearing athletic-style sneakers (participants wore their own footwear). Individuals were randomly assigned to a footwear order (either flip-flops or sneakers first) and were instructed to wear the footwear the day before and on the day of testing. Testing involved videotaping participants as they walked at a self-selected speed across a force platform during three separate trials. Testing was then repeated while the individual wore the opposite footwear type according to the same procedure. Statistical analysis was undertaken using a 2 (gender) x 2 (footwear) repeated-measures analysis of variance. The study findings revealed that compared with sneakers, flip-flops resulted in a shorter stride length, a shorter stance time, a smaller braking impulse, and a larger ankle angle/plantarflexion at the beginning of the double support phase and during the swing phase. In addition, significant differences were found between men and women with regard to peak anterior force, peak vertical force, braking and propulsive impulse. Significant interaction effects of footwear and sex were found for attack angle at heel contact, peak anterior force and ankle angle during the swing phase.

Comment: Flip-flops, known as thongs or jandals here in New Zealand, are currently used in everyday activities. In the current study, the authors evaluated the forces and range of motion in a group of college students and found significant changes in gait compared to athletic footwear. The study was restricted to a young adult asymptomatic population. Although the results were interesting, other factors such as comfort, safety and its impact on people with chronic foot conditions such as gout or diabetes require further investigation. The number of high-risk patients in New Zealand who wear flip-flops is of concern and further work into this vulnerable group needs to be undertaken. However, the present study did demonstrate the different gait parameters and provides an insight into the causes of foot, ankle and lower leg discomfort associated with the use of flip-flops in young healthy adults.

Reference: *J Am Podiatr Med Assoc.* 2010;100(4):251-7

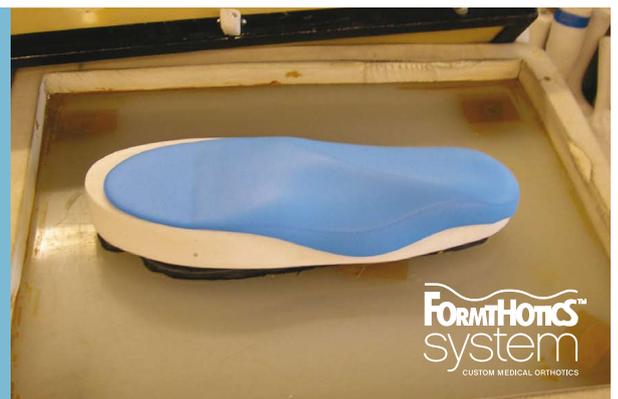
<http://www.japmaonline.org/cgi/content/abstract/100/4/251>

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Prevalence of hallux valgus in the general population: a systematic review and meta-analysis

Authors: Nix S et al

Summary: Hallux valgus (HV) is commonly seen in medical practice and is frequently accompanied by significant foot pain and functional disability. However, it is difficult to ascertain a precise estimate of the prevalence of HV. This systematic review was undertaken to determine the prevalence of HV in the overall population and to evaluate the influence of gender and age. These Australian researchers searched electronic databases to identify all available publications discussing HV prevalence up to June 2009. Seventy six studies, involving a total of 496,957 participants were included and grouped by study population for meta-analysis. Twenty eight of the studies were conducted in the US, twenty one in the UK, eight in Australia, four in Germany and fifteen in 'other' regions. The studies varied widely in terms of their methodology and study population. Pooled prevalence estimates for HV showed that the prevalence of the deformity increased with age, being 23% in adults aged 18-65 years (95% CI 16.3-29.6; 15 studies) and 35.7% in elderly people aged >65 years (95% CI 29.5-42; 37 studies). The prevalence of HV was also found to be higher in females (30%; 95% CI 22-38; 23 studies) than in males (13%; 95% CI 9-17; 22 studies). The researchers point out that there was a high degree of heterogeneity between all subgroups and that potential sources of bias were sampling method, study quality and method of HV diagnosis. They conclude that HV is prevalent; more so in females and with increasing age.

Comment: This article will be of interest to those who evaluate patients with HV. There is evidence from the literature indicating that it is more common in women and in the older population. This common foot problem is always a source of controversy and hot debate. As clinicians, we are often asked how do you prevent or manage the condition. Although the current review highlights the high prevalence in women and that it increases with age, it does not reflect the issues of dealing with the problem. However, the authors highlighted methodological issues, in particular the diagnosis of HV. From a clinical perspective diagnosing HV can be undertaken by clinical observation or using semi-quantitative photographs. However, the use of radiographs to objectively evaluate the degree of severity is the gold standard. Only a small number of studies define a diagnosis of HV using angular criteria measured clinically or on x-ray. An issue that was not addressed by the authors, that would be of interest to clinicians here in New Zealand, is ethnic differences and differences in long-term chronic foot conditions such as rheumatoid arthritis. Hence, the study is somewhat limited, but is worthy of review.

Reference: *J Foot Ankle Res.* 2010;3:21

<http://www.jfootankleres.com/content/3/1/21/abstract/>

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A case-series study to explore the efficacy of foot orthoses in treating first metatarsophalangeal joint pain

Authors: Welsh BJ et al

Summary: This UK study investigated the clinical effects of foot orthoses (FOs) on mechanical joint pain at the first metatarsophalangeal (1st MTP) joint and explored kinematic changes at the 1st MTP and ankle/subtalar complex brought about by such intervention. The study involved 35 participants (mean age 42 years) who had mechanically induced 1st MTP joint pain of ≥ 4 weeks duration and a pain level of ≥ 40 mm on a 100 mm visual analogue pain scale. This level of pain was considered to be a level warranting intervention. Participants also had a Foot Pressure Index (FPI-6) score of $>4/12$ and exhibited a $\geq 40^\circ$ 1st MTP joint dorsiflexion measured by a non-weight bearing technique. Pre-fabricated FOs (X-line[®], Heathstep, Mossley, UK) were prescribed to all participants. High-density (400 kg/m³) ethyl-vinyl acetate wedged posting (tailored to each individuals requirements) was adhered to the medial underside of the orthoses in order to increase saggital and frontal plane pronatory control. A reduction in the FPI-6 score of ≥ 2 points indicated adequacy of pronatory control provided by the foot orthoses. The primary outcome, pain, was measured with a modification of the pain subscale of the Foot Function Index (FFI) with an endpoint of 24 weeks. The secondary outcomes, 1st MTP joint and ankle/subtalar complex motions, measured in 10 patients at 8 weeks, were assessed using electromagnetic motion tracking system. At 24 weeks, participants (complete data from 32 participants only) exhibited a significant reduction in median pain score from baseline (14.5 mm vs 48 mm). Gait analysis at 8 weeks (complete data from 9 participants) revealed that, in the sub-group investigated, there was no systematic change in 1st MTP joint dorsiflexion during the walking cycle (no orthoses median = 8° vs orthoses median = 7°) and no consistent effect of wearing FOs on maximum ankle/subtalar complex eversion (1° vs 1°). While this study demonstrated a significant decrease in 1st MTP joint pain associated with the use of FOs, this decrease was not found to be associated with 1st MTP joint dorsiflexion or with altered ankle/subtalar complex eversion.

Comment: The results from this study suggest that FOs do indeed reduce pain but do not alter biomechanical variables such as range of motion. FOs are considered a biomechanical treatment modality for prevention and/or rehabilitation of foot and ankle injuries to re-establish the normal biomechanics of the foot and ankle. However, there is limited knowledge about the specific functioning FOs provide. The same FOs are often proposed to solve different problems. FOs are often prescribed to improve lower extremity alignment, however, studies have shown that FOs have no effect on knee alignment and, while they may or may not alter subtalar joint alignment, the clinical benefit of such a possible change remains unclear. Individual responses in kinematics and kinetics due to systematic interventions are not consistent. Therefore, one should not expect systematic results in the functioning of such FOs, but rather a wide variety of effects produced by FOs. Additionally, the reaction of subjects to FO interventions is influenced by many factors including mechanical, neurophysiological, anatomical and maybe even psychological, which makes the prediction of a FO intervention outcome even more difficult. From a biomechanical point of view, FOs comfort may be related to fit, additional stabilising muscle work, fatigue and damping of soft tissue vibrations. Therefore, the observation that foot orthoses did not alter biomechanical variables in the current study should be carefully considered by clinicians before stating to patients that function can be altered with FOs.

Reference: *J Foot Ankle Res.* 2010;3:17

<http://www.jfootankleres.com/content/3/1/17>

Women's experiences of wearing therapeutic footwear in three European countries

Authors: Williams AE et al

Summary: This study investigated women's experiences associated with therapeutic footwear for rheumatoid arthritis (RA), and aimed to determine if such experience differed in three European countries (UK, Spain and The Netherlands). The study was undertaken to gain an insight into individual's feelings about the process of receiving such footwear, from the point of referral to its provision, and how these experiences relate to individual's subsequent choice to wear it or not. Potential differences in individuals cultural attitudes to such footwear and differences in current service delivery were explored. Ten women (mean age ≈ 57 years) with RA, who had been provided with therapeutic footwear for ≥ 6 months, were recruited from each country and underwent conversational style interviews with one of two interviewers. An interpretive phenomenological approach was adopted. Significant meanings and statements were organised into six themes: the referring professional's approach to the patient; feet being visibly different because of RA; the footwear being visible as different to others; the dispensing professional's approach to the patient; footwear influencing social participation; and the women's wishes for improved footwear services. All of the women revealed that footwear invokes emotions of shame, sadness and anger, and often it is the symbolic and final marker of the effects of RA on their changed lives and self-perception. These feelings result in major restriction of important activities, especially social activities. In Spain and The Netherlands, where a patient-focused approach was used, the footwear was accepted to a greater degree and there was less wastage resulting from the prescribed footwear not being worn. Women from the UK were more likely to passively accept being provided with the footwear and then not wear it. All women expressed the view that an area in which their experiences could be improved was their consultation with both the referring and dispensing practitioners.

Comment: This is an interesting paper on an important and often ignored aspect in footwear provision for women with RA. The authors present findings from three different European countries from in-depth interviews of 30 female participants who all had RA. The most striking aspect of the results is in how the women perceive and understand the potential benefits of therapeutic footwear, yet state that therapeutic footwear does restrict their activities, making them less likely to accept such footwear. An additional original aspect to this study is the discussion of passivity amongst the UK participants, compared to those from Spain or The Netherlands in the referral process for therapeutic footwear. Although this is a European study, some of the commentary is frequently discussed by New Zealand women. The issue of prescribing therapeutic footwear is an on-going issue that merits further research and discussion with all health care professionals.

Reference: *J Foot Ankle Res.* 2010;3:23

<http://www.jfootankleres.com/content/3/1/23>

Toe and flow: essential components and structure of the amputation prevention team

Authors: Rogers LC et al

Summary: Due to the complexities of the diabetic foot, it would be rare to find a single practitioner capable of managing all aspects of foot care in a patient with diabetes. For this reason, a team of dedicated specialists is required to prevent lower-limb amputation in such patients. This review from the US outlined the critical skill sets required to assemble a team to care for the patient with diabetic foot complications. The rapid response acute foot team guidelines suggest that the diabetic podiatric physician and the vascular surgeon (toe and flow concept) make up the 'irreducible minimum' diabetic foot care team. Study findings show that the involvement of podiatric physicians in the foot care team substantially reduce amputation rates. Outlined in the review are three separate programmatic models of care that could be implemented in the developed and developing worlds to further improve diabetic foot care; basic, intermediate and centre-of-excellence. The goal of the basic care model is to provide a community with basic curative and preventative diabetic foot care; clinicians would include a general practitioner, a podiatric physician and a diabetic nurse. The intermediate model (hospital-based) would aim to provide basic curative and preventative care for all types of patients and may be able to deliver more advanced diagnosis and assessment; clinicians would include a diabetologist, a vascular surgeon, a podiatric physician and a diabetic nurse. The goal of the centre-of-excellence model (hospital-based) would be to provide specialised curative and preventative care for complex cases and to teach and disseminate information widely; clinicians would include a diabetologist, a vascular surgeon, a podiatric physician, an orthopaedist, an orthotist, an educator, a plaster technician, a rehabilitation specialist, a diabetic nurse and a psychiatrist. The review points out that reductions in major amputation rates and foot complications have previously been seen with multidisciplinary cooperation.

Comment: Working with other health care professionals in high risk groups such as diabetes is essential. This US article describes an excellent example of the podiatrist and vascular surgeon working together. This is not novel but does illustrate the need to strive to a common goal using key experts in their own field of work. A number of highly-experienced podiatrists do work in interdisciplinary teams around New Zealand and their work enhances the quality of life of the diabetic patient. The podiatrist's role is to identify, diagnose and treat disorders, diseases and deformities of the feet and legs and implement appropriate and timely care. This may be provided directly by a podiatrist or in association with other healthcare team members as required by the individual's foot problems. The goal of the podiatry element of diabetes care is to reduce foot-related pain, maintain/improve foot function and therefore mobility, while protecting skin and other tissues from damage. I highly recommend reading this article and it is hoped that this paper will lead to further collaborations between different health care professionals.

Reference: *J Am Podiatr Med Assoc.* 2010;100(5):342-8

<http://www.japmaonline.org/cgi/content/abstract/100/5/342>

Safety and effectiveness of flexor tenotomies to heal toe ulcers in persons with diabetes

Authors: Kearny TP et al

Summary: This US study, involving 48 patients with diabetes-related neuropathy, evaluated the safety and effectiveness of percutaneous tenotomy of the flexor digitorum longus as a technique to heal neuropathic ulcers on the tip of the toe. A total of 58 tenotomy procedures were performed. Healing of the ulcer was then assessed, along with any adverse events including recurrence, healing failure, infection and amputation. In total, 98.3% of the ulcers healed (mean ulcer healing time 40 ± 52 days). Recurrence occurred at the same site in 12.1% of the operated toes (mean time to recurrence was 13.9 ± 15.2 months). Five percent of patients developed post-operative soft tissue infection. Two patients required amputation of the toe (both had pre-existing osteomyelitis). The authors concluded that flexor tenotomy can enhance individuals healing potential and is a simple and safe procedure.

Comment: Common forefoot deformities that are known to increase pressures and are associated with skin breakdown include hammertoe, claw-toe and first metatarsophalangeal joint deformities (hallux limitus/rigidus). The technique of percutaneous flexor tenotomy is an option for the treatment of neuropathic toe ulcerations secondary to contracture deformity. Although the methodological quality of the study is poor, it does support the ability of a percutaneous flexor tenotomy of the hallux and lesser toes to heal neuropathic toe ulceration secondary to toe contracture in people with diabetes. Although surgery is an option, it is the fundamentals of care that one must prioritize. The basic, fundamental aspects of care include infection control, debridement and offloading. It is also important to ensure adequate limb perfusion and determine if there is an ischemic component to the wound. Proper offloading is an essential component in the overall care of patients with diabetes. In summary, this study will be of interest to surgeons, but working with other health care professionals to obtain maximum care (including non-surgical interventions) should be considered in high-risk groups such as diabetics.

Reference: *Diabetes Res Clin Pract.* 2010;89(3):224-6

<http://tinyurl.com/24zyp7>

Outcome after using two different approaches for excision of Morton's neuroma

Authors: Faraj AA et al

Summary: This retrospective UK study compared the outcomes of two approaches (plantar and dorsal) for the surgical removal of interdigital (Morton's) neuroma of the foot. Records of 36 patients (42 feet) who had undergone the surgical removal of a Morton's neuroma by a single surgeon were identified. A plantar approach was used for the removal of 20 of the neuromas while a dorsal approach was undertaken for 22. The mean follow-up time was 18 months. The mean time to full weight bearing was significantly ($p < 0.05$) longer in the plantar group than in the dorsal group (3 weeks vs 2 weeks). Overall, time return to work, time to return to driving, and time to return to recreational activities were longer in the plantar group. Those patients who underwent the plantar approach exhibited a significantly ($p < 0.05$) higher rate of postoperative wound infection, haematoma and scar problems. The study therefore indicates that the dorsal approach may be a better choice for Morton's neurectomy.

Comment: The current retrospective study highlights the current debate on surgical interventions for Morton's neuroma. There is no general agreement on the optimal approach: plantar or dorsal for this pathology. The dorsal approach allows for the option of transverse ligament release strategy. While others have expressed concerns with metatarsal splaying with a dorsal approach, this was not a problem in the current series of patients.

Reference: *Chin Med J.* 2010;123(16):2195-8

<http://www.cmj.org/Periodical/AbstractList.asp?titleid=1W2010823395889301708>



*Independent commentary by
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Pain management after elective hallux valgus surgery: a prospective randomized double-blind study comparing etoricoxib and tramadol

Author: Brattwall M et al

Summary: This Swedish randomised, double-blind study compared etoricoxib (a selective cyclo-oxygenase-2 [COX-2] inhibitor) with sustained-release tramadol for postoperative pain management in female patients who had undergone hallux valgus (HV) surgery. Women were randomised to receive either oral etoricoxib 120 mg once daily for 4 days followed by 90 mg once daily for 3 days (n = 50) or sustained release tramadol 100 mg twice daily for 7 days (n = 50). Patients received their first dose of the agents immediately after surgery. Patients reported pain using the visual analogue scale (VAS) and answered questions regarding adverse events. They also documented the use of rescue medication (oral paracetamol 1 g as first-line and oral oxycodone 5 mg as second-line rescue analgesia) during the first 7 postoperative days. Wound healing was assessed via a CT scan at 12 weeks and via clinical observation at 16 weeks. Evaluation, undertaken in 98 patients, revealed that overall pain was well managed. However, during the first 7 postoperative days, the mean maximum VAS score was significantly (p < 0.05) lower for etoricoxib recipients compared with the tramadol recipients (12.5 vs 17.3). Patients receiving etoricoxib also exhibited significantly (p < 0.05) better pain relief than tramadol recipients on days 2 and 3, the most painful postoperative days. Satisfaction with pain medication and patient's grading of pain relief was significantly (p < 0.05) higher in the etoricoxib group than in the tramadol group (47/49 vs 39/49 and 92 vs 85, respectively). During the 7-day follow-up period, 20 patients in the etoricoxib group and 13 in the tramadol group did not require rescue medication. The incidence of adverse events (predominantly nausea, dizziness and sleepiness) was higher among tramadol recipients. Furthermore, at 12 and 16 weeks, satisfactory healing was seen in both groups.

Comment: Non-steroidal anti-inflammatory drugs are frequently used in day-case surgery as part of multimodal pain management. In this Swedish study, the authors found a structured 7-day analgesic protocol with etoricoxib following elective HV surgery to be more effective than sustained-release tramadol for pain relief during the first 7 post-operative days. The authors say that their most important observation was the lack of difference in healing between the two groups.

Reference: *Anesth Analg.* 2010;111(2):544-9

<http://www.anesthesia-analgesia.org/content/111/2/544.abstract>



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The clinical and cost effectiveness of bee honey dressing in the treatment of diabetic foot ulcers

Authors: Moghazy AM et al

Summary: This study investigated the efficacy of honey as a topical treatment for diabetic foot ulcers. A total of 30 patients with diabetic foot ulcers presenting to a Surgical Department in Egypt were recruited. Participants had a ≥3 month history of cessation of healing or worsening of their wound. The treatment regimen that had been followed for the previous period was continued during the study. A baseline measurement of wound surface area and a bacterial culture were undertaken. A 5-day combination course of ciprofloxacin and mitronidazole was initiated if signs of invading infection were apparent at baseline or became apparent during the study period. Pure raw untreated honey-impregnated gauze was applied following wound debridement. The frequency of wound re-dressing depended on the amount of exudate (the dressing was reapplied if it became soaked). Subjects were discharged once single daily dressing was achieved and followed up at weekly intervals. Honey dressings were applied to wounds for 3 months or until healing, grafting or treatment failure. At weekly follow-up, changes in grade and stage of wounds were recorded using the University of Texas Diabetic Wound Classification system and surface area measurements. Ulcer size significantly (p < 0.01) decreased in 28 patients (the remaining two required amputation). Complete healing was achieved in 43.3% of patients, while healthy granulation and a decrease in ulcer size was evident in another 43.3% of patients. The grade and stage of ulcers improved significantly (< 0.01) over the entire study period.

Comment: Diabetic foot infections remain a serious problem despite advances in antimicrobial therapy. Such infection often persists despite treatment with topical and systemic antibacterials. Furthermore, such agents have led to the emergence, and subsequent rapid overgrowth, of resistant bacterial strains. Drug-induced adverse events and organ specific toxicity have also been seen with antimicrobial agents. The medicinal properties of honey have been recognised since ancient times and studies have revealed that it may be effective against antibiotic-resistant strains of bacteria. These diabetic patients had persistent ulcers, but the majority saw great improvement with the application of honey dressings. The findings of this study indicate that commercial clover honey is a clinical and cost-effective dressing for diabetic wounds. However, the authors did note that when severe vascular insufficiency was present, the honey had no effect. Although the study showed promising outcomes, the use of honey requires further investigation, preferably in randomised controlled trials. The authors concluded that patient beliefs and culture should be taken into account before prescribing this treatment modality.

Reference: *Diabetes Res Clin Pract.* 2010;89(3):276-81

<http://tinyurl.com/29bj6e4>

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