

Foot & Ankle Research Review™

Making Education Easy

Issue 16 – 2013

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Abbreviations used in this issue

RA = rheumatoid arthritis

Welcome to the latest issue of Foot & Ankle Research Review.

In this edition, I have chosen four articles that have been published from New Zealand ranging from a laboratory-based study looking at the impact of weight on muscle changes in children (*Blakemore VJ et al: Mass affects lower extremity muscle activity patterns in children's gait*) to evaluating a podiatric rheumatology service (*Rome K et al: A new podiatry service for patients with arthritis*). It is nice to see the increasing number of publications relating to the foot and ankle that is pertinent to New Zealand.

I have also included four articles relating to the management of plantar fasciitis. The reasons I have chosen these articles is to highlight the difficulties clinicians have in deciding which modality or modalities to choose. There is no single universally accepted method for treating plantar fasciitis. The condition frequently responds to a wide range of conservative treatments that demonstrate variable levels of efficacy. Over the years, there has been extensive debate regarding the most effective form of treatment and in the latest edition of Foot & Ankle Research Review you will see the controversies still continue.

I hope you enjoy reading the latest edition and any feedback is most welcome.

Kind Regards,

Professor Keith Rome

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Mass affects lower extremity muscle activity patterns in children's gait

Authors: Blakemore VJ et al

Summary: This New Zealand study examined differences in lower extremity muscle activation patterns in children with different body mass during three walking speeds. Twenty children aged between 8 and 12 years were included in the study and classified as overweight, normal-weight or underweight. While the subjects walked on a treadmill at different speeds (slow, self-selected and fast), electromyography was undertaken on their vastus lateralis, semitendinosus, gastrocnemius and tibialis anterior muscles. Compared with overweight children, underweight children experienced greater duration of tibialis anterior and vastus lateralis activation during the swing phase, while overweight children exhibited a greater duration of gastrocnemius activation during stride than the underweight children. All three groups exhibited a greater duration of vastus lateralis activation while walking faster and, during this condition, normal-weight children exhibited greater duration of tibialis anterior activation. During faster walking, overweight children exhibited a lower duration of gastrocnemius activity during swing, but a greater duration of this muscle activation during stance.

Comment: In this New Zealand study, the overweight children continued to activate their gastrocnemius throughout stride, indicating that excess mass required greater muscle activation to propel the participant through locomotion. These findings support previous research, which has suggested that overweight children transition quickly from dorsiflexion to plantarflexion during swing so that the foot is in a flatter position prior to landing. The flatter position allows greater contact between the foot and ground, thus providing an increased base of support, increased stability and a greater dispersion of shock absorption. The authors suggested that overweight children purposefully change their gait strategy to accommodate additional mass. It is interesting to note that only sagittal plane motion was assessed and only in one limb, and that the authors assume that there are symmetrical differences. This is a limitation and should be considered in reviewing any article that evaluates only one limb. Finally, the article relates to healthy asymptomatic children and cannot be adapted to populations with neuromuscular conditions or to those who suffer with foot pain.

Reference: *Gait Posture* 2013;Feb 25 [Epub ahead of print]

[http://www.gaitposture.com/article/S0966-6362\(13\)00097-0/abstract](http://www.gaitposture.com/article/S0966-6362(13)00097-0/abstract)

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Foot Science
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A prospective, randomized, double-blinded study with crossover to determine the efficacy of radio-frequency nerve ablation for the treatment of heel pain

Authors: Landsman AS et al

Summary: This US multicentre, prospective, double-blinded, crossover study involved 17 individuals with plantar fasciitis, randomised to receive radio-frequency nerve ablation (n = 8) or sham (n = 9); subjects were offered crossover after 4 weeks if no symptom improvement was observed. First-step pain, average pain and peak pain in the heel region were evaluated using a visual analog pain scale. Statistically significant symptom improvement was seen in radio-frequency nerve ablation recipients and in those who had crossed over from sham to this treatment. No such symptom improvement was observed in the sham-treated group.

Comment: This study is based on a previous retrospective study in which the same authors showed a 92% success rate, as defined by a drop of approximately 5 points on a 10-point visual analogue pain scale, more than 1 month after treatment. Although radio frequency nerve ablation is a relatively new way to approach heel pain, the technology itself is not new and has been used to coagulate blood vessels, cut tissues and to treat Morton's neuroma. The study results are promising as the authors concluded it is an alternative method to extracorporeal shock wave therapy. However, with only a small number of patients being assessed, further investigations are required with larger numbers and over a longer period of time to evaluate any long-term adverse events.

Reference: *J Am Podiatr Med Assoc.* 2013;103(1):8-15

<http://www.japmaonline.org/content/103/1/8.abstract>

The effect of foot orthoses on balance, foot pain and disability in elderly women with osteoporosis: a randomized clinical trial

Authors: de Morais Barbosa C et al

Summary: This randomised controlled clinical trial, involving 94 elderly women (>60 years) with osteoporosis, evaluated the effect of insoles with medial arch support and metatarsal pad on balance, foot pain and disability. The women, who were all rheumatology outpatients, were randomly assigned to receive either foot orthoses or no such orthoses (control group). The Manchester Foot Pain and Disability Index (MFPDI), the Berg Balance Scale (BBS), the Timed Up and Go test (TUG) and a numeric pain scale (NPS) were evaluated at baseline and after 4 weeks. Analysis revealed that the two groups were similar at baseline, but only subjects wearing the foot orthoses showed significant (p < 0.001) improvements in disability (MFPDI), balance (both BBS and TUG) and foot pain (NPS).

Comment: This study from Brazil will be of interest to clinicians and researchers who deal with older adults. The results suggest that foot orthoses with medial arch supports and metatarsal pads were effective in improving balance, disability and pain for elderly women with osteoporosis. There is no standardised method for the prescription of insoles when the goal is the improvement of balance. The use of foot orthoses, even without pads or arch supports, can influence proprioception. An interesting comment made by the authors is that a greater concentration of mechanoreceptors has been observed in the metatarsophalangeal region. The additional use of a metatarsal pad in the current study may have provided better afferent information. I recommend you read this article, as this study and previous studies regarding the mechanisms of action of insoles that provide information about the central postural integrative mechanisms do seem to have an important effect on balance and the preventions of falls.

Reference: *Rheumatology (Oxford)* 2013;52(3):515-22

<http://rheumatology.oxfordjournals.org/content/52/3/515.abstract>

Botulinum toxin type A in chronic plantar fasciitis: clinical effects one year after injection

Authors: Díaz-Llopis IV et al

Summary: This observational follow-up study, involving 24 patients with chronic plantar fasciitis, investigated whether the efficacy of botulinum toxin type A injection in chronic plantar fasciitis was maintained for more than six months after treatment. At 12 months, compared with a six-month evaluation, there were significant improvements in two domains of the Foot Health Status Questionnaire: foot function (96.19 at 6 months vs 89.38 at 12 months; p = 0.047) and foot pain (91.11 at 6 months vs 80.00 at 12 months; p = 0.001). A small, non-significant deterioration in the shoe and foot health domains was evident between the two time points. An improvement in foot pain measured using the visual analogue scale was evident, although this did not reach significance (1.78 at 6 months vs 1.22 at 12 months; p = 0.142). The majority of patients reported good or very good satisfaction with the outcome of this treatment.

Comment: This Spanish study demonstrated the effectiveness of botulinum toxin type A injection at 12 months. The same authors have reported a similar study after 6-months. The study will be of interest to clinicians as the results have shown the stability of the clinical improvements in the condition up to one year. Understanding the aetiology of the problem and directing treatment accordingly is the key to successful treatment of plantar fasciitis. Close attention must be paid during the history and physical examination to ensure that other potential causes of heel pain are not missed. An organised, evidence-based, stepwise approach to treatment will help achieve good outcomes. Also essential is educating the patient about the expected time of recovery. This study and previous studies have indicated the strong evidence-based approach made by the authors on using botulinum toxin type A injection.

Reference: *Clin Rehabil.* 2013 Feb 14 [Epub ahead of print]

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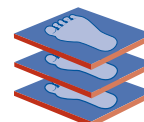
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A new podiatry service for patients with arthritis

Authors: Rome K et al

Summary: This retrospective New Zealand study involving 245 patients at Counties Manukau DHB with rheumatic disease-associated foot problems was undertaken in order to identify the impact of a new podiatric rheumatology service on reducing foot pain, impairment and disability, and to report on patient satisfaction with the service. The Foot Function Index (a self-reporting patient outcome measure) was utilised to measure foot pain, impairment and disability, and 148 patients received a postal patient satisfaction questionnaire. A variety of intervention measures were used, with 28% of patients given footwear advice and 24% of patients being prescribed foot orthoses. A significant ($p < 0.001$) reduction in foot pain from initial visit to second visit (18% reduction) was evident, as was a significant ($p = 0.04$) decrease in foot disability. However, no significant differences were seen in foot impairment. The patient survey revealed that 80% of patients felt the service helped with their foot problems and 84% of patients were satisfied with the new service.

Comment: This study demonstrated the significant impact of podiatrists in reducing foot pain and musculoskeletal disability relating to rheumatic diseases. The role of the podiatrist in the rheumatology team is becoming recognised as a vital component in the integrated care given to patients by the multidisciplinary team. The results found significant reductions in pain and impairment over 18 months suggesting improved clinical results with podiatric intervention for patients with rheumatic diseases. The results from the patient satisfaction survey showed that patients were highly satisfied with the care provided by the rheumatology specialist podiatrist. The quality of care from the patients' perspective is increasingly considered an important component of comprehensive chronic disease management. A limitation of the study is that in the patients' satisfaction survey, over 78% of respondents were European. Future directions should evaluate patients from different ethnic backgrounds.

Reference: *N Z Med J.* 2013;126(1370)70-7

<http://journal.nzma.org.nz/journal/126-1370/5552/>

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Ultrasonic evaluation of the abductor hallucis muscle in hallux valgus: a cross-sectional observational study

Authors: Stewart S et al

Summary: This ultrasound study involving 102 feet with hallux valgus deformity (mean age 60.3 years) investigated characteristics of the abductor hallucis muscle in relation to the severity of the deformity. Varying severities of hallux valgus were stratified into four groups representing the four grades of the Manchester Scale (grade 0: no deformity; grade 1: mild deformity; grade 2: moderate deformity and grade 3: severe deformity). Measurements of medio-lateral (ML) width, dorso-plantar (DP) thickness and cross-sectional area (CSA) revealed significant differences in ML width between feet with no hallux valgus (grade 0) and feet with grade 2 hallux valgus ($p = 0.010$), in DP thickness between feet with no hallux valgus (grade 0) and feet with hallux valgus grade 2 ($p = 0.001$) and 3 ($p < 0.001$), and in CSA between feet with no hallux valgus (grade 0) and feet with grade 2 ($p < 0.001$) and grade 3 ($p < 0.001$) hallux valgus. There were no significant differences in these three muscle characteristics between grades 1, 2 and 3 hallux valgus.

Comment: This New Zealand-based study demonstrates the muscle characteristics of the abductor hallucis muscle in different stages of hallux valgus. The abductor hallucis muscle plays an important role through isometric contraction in maintaining first metatarsophalangeal joint stability and preventing abnormal transverse plane motion. Significant differences were reported in thickness, width and cross-sectional area of the abductor hallucis muscle between feet with and without hallux valgus. The authors proposed that these results may be attributed to the muscle's changing anatomical position in feet with hallux valgus, as the muscle size characteristics of the abductor hallucis muscle did not vary significantly between the mild, moderate and severe stages of the deformity. It may be that morphological changes to the muscle occur early in the development of the deformity and do not change significantly thereafter. The findings may have impact on any intervention strategies, which aim to improve the strength and function of the muscle and be implemented in the mild stage of the deformity.

Reference: *BMC Musculoskeletal Disord.* 2013;14:45

<http://www.biomedcentral.com/1471-2474/14/45>

The New Zealand Joint Registry: report of 11-year data for ankle arthroplasty

Authors: Tomlinson M and Harrison M

Summary: This study reported on ankle arthroplasty data from the New Zealand Joint Registry, participation in which is mandatory for all New Zealand orthopaedic surgeons undertaking arthroplasty surgery. Over the 11-year period from January 2000 to December 2010, 728 primary ankle arthroplasties were performed (average age of patients 65.2 years). In 528 cases osteoarthritis was the indication for surgery and 138 had post-traumatic arthritis. Other diagnoses included RA, avascular necrosis and other inflammatory arthropathies. Fifty revision ankle procedures were undertaken with a mean time to revision of 1196 days. A questionnaire (modelled on the Oxford 12 questionnaire) sent to patients at 6 months and 5 years post surgery revealed a mean primary ankle score of 33.38 from 574 questionnaire respondents at 6 months (a score of 0 being the worst possible score while 48 the best); 56% of patients had a score of good or excellent. Out of 83 respondents at 5 years who had not undergone a revision, 64% achieved a good or excellent score. Among 26 revision respondents, 46% achieved an excellent or good score.

Comment: Large-scale collection and analysis of arthroplasty data are crucial for monitoring, developing and improving outcomes of joint replacement surgery. This New Zealand study capturing the first 11 years of ankle arthroplasty illustrates the good scores reported by the patient-reported outcome measure. A registry allows trends to often be identified early and implants with higher revision rates can be identified. In addition, individual surgeons can be given data that compare their performance with the collective data, providing invaluable feedback. This study illustrates the use of outcome measures to gauge the results of surgery. Patient outcome measures are important to use and should be implemented by all health care professionals.

Reference: *Foot Ankle Clin.* 2012;17(4):719-23

<http://www.sciencedirect.com/science/article/pii/S1083751512000642>

Foot and Ankle Research Review



Independent commentary by Professor Keith Rome,
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Research Review publications are intended for New Zealand health professionals.

Effectiveness of adjustable dorsiflexion night splint in combination with accommodative foot orthosis on plantar fasciitis

Authors: Lee WC et al

Summary: The effectiveness of a soft and self-adjustable dorsiflexion night splint in combination with an accommodative foot orthosis for patients with plantar fasciitis was investigated in this study. Twenty-eight such patients were assigned to one of two groups - foot orthosis only or foot orthosis plus dorsiflexion night splints (combination). Pain and functions of feet just before, 2 weeks after, and 8 weeks after the treatments were evaluated using a Foot Function Index (FFI) questionnaire. At 2 and 8 weeks, patients in the combined group exhibited significantly ($p < 0.001$) reduced pain scores. Patients who had received orthoses alone, did not exhibit significant differences in pain, disability, activity limitation and total FFI scores for the three time periods.

Comment: In this study from Hong Kong, the application of foot orthoses with adjustable dorsiflexion night splints was found to be more effective than the application of foot orthoses alone in relieving foot pain in patients with plantar fasciitis. Night splinting has been reported in the literature over the past 20 years. Similar to previous studies the results look encouraging. However, when conservative managements such as orthotic treatments, stretching exercises, shockwave therapies and steroid injection are available to the clinicians, it is difficult to estimate which modality or modalities are appropriate for patients with chronic plantar fasciitis. A limitation of the current study was the authors being unable to ensure the same type of shoes were worn over the 8 weeks. However, the results are interesting and I recommend you review the article, as the findings may be beneficial to individual patients with this long-term chronic foot condition.

Reference: *J Rehabil Res Dev.* 2012;49(10):1557-64

<http://www.rehab.research.va.gov/jour/2012/4910/lee4910.html>

Full-length silicone insoles versus ultrasound-guided corticosteroid injection in the management of plantar fasciitis: A randomized clinical trial

Authors: Yuçel U et al

Summary: This Turkish study randomly assigned 42 patients with chronic unilateral plantar fasciitis to either a full-length silicone insole or an ultrasound-guided corticosteroid injection for the management of this condition. After 1 month, a significant improvement from baseline was evident in ultrasonographic thickness of the plantar fascia, Visual Analogue Scale, Heel Tenderness Index and Foot and Ankle Outcome Score in both groups. Plantar fascia thickness and Foot and Ankle Outcome Score for sport and recreation function were significantly ($p < 0.05$) better in the injection group than in the insole group. However, the study authors recommend the use of silicone insoles as a first line of treatment for individuals with plantar fasciitis.

Comment: This study illustrates the differences between foot orthoses and corticosteroid injection techniques available to clinicians to treat plantar fasciitis. Unfortunately for the clinician is the unanswered question: which foot orthoses or insole to use? Numerous designs have been advocated ranging from customised foot orthoses to simple cushioned insoles. In the current study, we find the authors recommend silicone insoles as a first line of treatment for persons with plantar fasciitis. However, the evidence is very conflicting on which type of orthoses to prescribe. I recommend you read Landorf and colleagues article on the effectiveness of foot orthoses to treat plantar fasciitis; *Arch Intern Med* 2006: 1305-10 (Available from: <http://archinte.jamanetwork.com/article.aspx?articleid=410537>). The authors report that "foot orthoses produce small short-term benefits in function and may also produce small reductions in pain for people with plantar fasciitis, but they do not have long-term beneficial effects compared with a sham device". A similar conclusion can be made from the current study. We do not know the long-term effects of foot orthoses.

Reference: *Prosthet Orthot Int.* 2013;Mar 7 [Epub ahead of print]

<http://poi.sagepub.com/content/early/2013/02/25/0309364613478328.abstract>

Effect of thong style flip-flops on children's barefoot walking and jogging kinematics

Authors: Chard A et al

Summary: This Australian study involving 13 healthy children (mean age 10.3 years) compared the effect of thong style flip-flop footwear (jandals) on their barefoot three dimensional foot kinematics during walking and jogging. The children undertook five walking trials and five jogging trials in a straight line while barefoot, or while wearing simple, non-contoured jandals. Video data were recorded using a 14-camera motion analysis system and kinematic data was analysed using a 3-segment foot model describing ankle, midfoot and hallux kinematics during contact, midstance and propulsive stance phases. Significant ($p < 0.05$) differences between jandal wearing and barefoot trials during walking included an increase in ankle dorsiflexion of 10.9° during the contact phase of walking, while midfoot plantarflexion was increased by 6.7° during propulsion; hallux dorsiflexion was reduced during walking 10% prior to heel strike, at heel strike and 10% post toe-off by 6.5° , 4.9° and 10.7° , respectively. During running, ankle dorsiflexion was increased by 8.1° during contact, midfoot plantarflexion increased 5.0° during midstance and by 5.4° during propulsion, and midfoot inversion was increased during contact by 3.8° .

Comment: This is an interesting study and will be of interest to clinicians who deal with children wearing flip-flops (jandals in New Zealand). Due to their flexible and unrestrictive nature, flip-flops may be preferable to other children's footwear types, all of which have been shown to alter natural foot function. The results found minimal effect on walking and jogging at self-selected speed. The problem with this type of shoe is that the foot needs to adapt to maintain contact between the jandal and the foot. In particular, the authors reported increased contact phase ankle dorsiflexion during walking and jogging with reduced hallux dorsiflexion during walking, suggesting a need to retain the jandals during weight-bearing. These adaptations may result in muscle overuse syndromes for rearfoot dorsiflexors and midfoot plantarflexors with prolonged jandal wear. In summary, the authors reported that foot motion whilst wearing jandals might be more replicable of barefoot motion than originally thought. This article is worthy of further reading, but be aware that only 13 children, aged between 8-13 years old were recruited. The reader should also be aware that all children were reported to have 'normal-arched' feet and the results may not be applicable to those with low- or high-arched feet.

Reference: *J Foot Ankle Res.* 2013;6(1):8

<http://www.jfootankleres.com/content/6/1/8>



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