

Foot & Ankle Research Review™

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Issue 25 – 2015

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Abbreviations used in this issue

BMI = body mass index
MTP = metatarsophalangeal
OR = odds ratio



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

In this issue I have included three articles relating to hallux valgus. The first article reviews the role of the abductor hallucis muscle in different age groups (Aiyer A et al: The effect of age on muscle characteristics of the abductor hallucis in people with hallux valgus: a cross-sectional observational study). The second article explores the use of the Internet for information about hallux valgus (Tartaglione JP et al: Evaluating the quality, accuracy, and readability of online resources pertaining to hallux valgus). The third article describes a toe-exercise programme (Kim MH et al: Effect of toe-spread-out exercise on hallux valgus angle and cross-sectional area of abductor hallucis muscle in subjects with hallux valgus).

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

Kind Regards,

Professor Keith Rome

keithrome@researchreview.co.nz

The effect of age on muscle characteristics of the abductor hallucis in people with hallux valgus: a cross-sectional observational study

Authors: Aiyer A et al.

Summary: This New Zealand study in 96 feet with hallux valgus aimed to measure differences in abductor hallucis muscle characteristics between three age groups (20–44 years, 45–64 years, 65+ years). Dorso-plantar thickness ($p = 0.003$) and cross-sectional area ($p = 0.008$) differed among the age groups; Bonferroni post-hoc adjustment for multiple testing ($p < 0.0167$) indicated differences between the 20–44 age group ($p = 0.003$) and the 65+ age group ($p = 0.006$). Differences between the three age groups included medio-lateral width ($p > 0.05$) and musculoskeletal ultrasound echo-intensity ($p > 0.05$). Spearman's rho correlation indicated an association between increasing age and a reduction in dorso-plantar thickness ($r = -0.27$; $p = 0.008$) and cross-sectional area ($r = -0.24$; $p = 0.019$), but with small effect sizes. People over the age of 65 years with hallux valgus exhibit a significant reduction in abductor hallucis muscle size consistent with age-related changes to skeletal muscle.

Comment: Despite the high prevalence of hallux valgus in the elderly, the effect of age on abductor hallucis muscle characteristics is not well understood. The findings from this study indicate that there is a significant reduction in dorso-plantar thickness and cross-sectional area of the abductor hallucis muscle between people with hallux valgus aged 20–44 years and people aged 65+ years old. A decline in muscle size with aging may be due to the loss of muscle fibres as well as a decline in muscle fibre size, as a result of reduced neuromuscular activation in older individuals. The current study is limited by its cross-sectional design meaning the true relationship between age and abductor hallucis size, and quality, could not be assessed. Furthermore, echo intensity assessment in musculoskeletal ultrasound is unable to differentiate between different non-contractile tissue. Further studies on the effectiveness of exercise, foot orthoses and other non-surgical management strategies in recruiting and strengthening the abductor hallucis muscle in adults with hallux valgus is required.

Reference: *J Foot Ankle Res.* 2015;8:19

[Abstract](#)

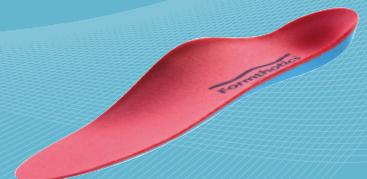
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Evaluating the quality, accuracy, and readability of online resources pertaining to hallux valgus

Authors: Tartaglione JP et al.

Summary: The purpose of this study was to evaluate the quality, accuracy, and readability of resources related to hallux valgus found by using the search terms "hallux valgus" and "bunion" in Google, Yahoo, and Bing searches. 62 websites were assessed and quality was higher with use of the search term "bunion" as compared to "hallux valgus" ($p = 0.045$). Resources created by physicians had higher quality ($p = 0.04$) and accuracy ($p < 0.001$) scores than those created by non-physicians and websites without commercial bias. However, the reading level (Flesch-Kincaid score) was higher for websites authored by physicians ($p = 0.035$). Websites requiring >8 th-grade reading level were more accurate than those written for ≤ 8 th-grade reading level. Overall, the quality of online information related to hallux valgus is poor and written at inappropriate reading levels.

Comment: Clinicians will enjoy reading this article about how patients and health care professionals utilise the Internet for information. It is important for health care professionals to become familiar with patient education materials, so that appropriate recommendations can be made regarding valuable resources. The authors report on the poor quality of information. Health information is more and more available on the Internet, with the continuous growth of medical information websites. While many of them are intended for health professionals, more and more websites directly address the population with a view to providing information about health problems, self-care and prevention. However, this new technology also hides several shortcomings, such as: (i) uneven quality of medical information available on the Internet; (ii) difficulties in finding, understanding and using this information; (iii) lack of access for the unconnected population; and (iv) the potential for harm and risks of over-consumption. To be able to overcome these dangers, it is important that health care professionals be involved in the design, dissemination and evaluation of web-based health and medical information.

Reference: *Foot Ankle Spec. 2015; Jun 29 [Epub ahead of print]*

[Abstract](#)

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Foot deformities, function in the lower extremities, and plantar pressure in patients with diabetes at high risk to develop foot ulcers

Authors: Tang UH et al.

Summary: This cross-sectional study describes the prevalence of risk factors in patients with diabetes without foot ulcers and explores possible connections between these risk factors and high plantar pressure in 27 patients with type 1 and 47 patients with type 2 diabetes. Neuropathy was present in 28 (38%) patients while 39 (53%) patients had callosities in the heel region; a low forefoot arch was observed in 57 (77%) patients. Gait-related parameters, including ability to walk on the forefoot or heel, were normal in all patients and 80% percent of patients had normal function at the hip and ankle joints. All patients were stratified to risk group 3 for risk of developing foot ulcers according to the Swedish National Diabetes Register. Both hallux valgus and hallux rigidus were associated with an increase in the plantar peak pressure in the medial forefoot. A higher BMI was associated with an increase in the plantar peak pressure at metatarsal heads 4 and 5, while pes planus was associated with a decrease in plantar peak pressure at metatarsal head 1. Neuropathy was not associated with plantar peak pressure.

Comment: Foot deformities, neuropathy, and high peak pressure on the foot have been identified as potential risk factors for the onset of diabetic foot ulcers. The most important finding is the high prevalence of foot deformities and callosities in the group that was studied. These findings are of importance, as foot deformities have been shown to increase plantar pressure and thus probably increase the risk of developing plantar foot ulcers. Although the patients included in this study are representative for the general population of patients in Sweden with diabetes according to age, sex, and duration and proportion of type 1 diabetes, there is a risk for bias depending on the fact that they initially were identified to have raised risk to develop foot ulcers. An optimal study design would have been to include control groups of patients with diabetes without loss of protective sensation and without deformities and also a group consisting of participants representing the general population. A further limitation of the current study is the lack of a globally standardised protocol that could be used for foot assessments in patients with diabetes. However, this study demonstrates that patients with diabetes without foot ulcers have several potential risk factors for the onset of diabetic foot ulcers and are in need of preventive strategies.

Reference: *Diabet Foot Ankle 2015;6:27593*

[Abstract](#)

Effect by custom-made foot orthoses with added support under the first metatarso-phalangeal joint in hallux limitus patients: Improving on first metatarso-phalangeal joint extension

Authors: Gordillo-Fernández LM et al.

Summary: The objective of this randomised, double-blinded, clinical trial was to test whether custom-made foot orthoses with a support element under the first metatarsophalangeal joint (1MTP) could increase the range of mobility of the joint in 20 patients with hallux limitus. In the experimental group ($n = 10$), an improvement of 4.5° in the relaxed position and 22.2° in the maximum extension of the hallux was observed (both $p < 0.001$) after 6 months. Custom-made foot orthoses with added support under the 1MTP were proved to be an effective treatment to restore functionality of the joint in hallux limitus patients. Limited hallux movement in the propulsive gait phase negatively affects the lower extremity biomechanics, causing changes in the rest of the joints.

Comment: The principal objective of this Spanish clinical trial was to improve the extension capacity of the hallux in hallux limitus patients by using custom-made foot orthoses. The results of this study suggest that the use of custom-made foot orthoses to control the pathomechanics of the foot with added support under the 1MTP significantly improves the maximum extension of the hallux over 6-months in a group of healthy participants. An issue with the current study and similar studies is the use of healthy participants. People were excluded if they were suffering degenerative osteoarthritis disease or neuromuscular imbalance, any type of foot trauma or surgery, or experiencing pain or functional disability in any region of the foot, which could affect the normal mobility of the 1MTP. However, it would be difficult to translate the current findings into clinical practice since people with hallux limitus will often seek treatment for 1MTP pain and impairment, and a clinician may consider using a custom-made foot orthoses.

Reference: *Prosthet Orthot Int. 2015; Jun 10 [Epub ahead of print]*

[Abstract](#)



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Effect of toe-spread-out exercise on hallux valgus angle and cross-sectional area of abductor hallucis muscle in subjects with hallux valgus

Authors: Kim MH et al.

Summary: This study involving 24 patients with mild-to-moderate hallux valgus determined whether toe-spread-out exercise affects the hallux valgus angle, the cross-sectional area of the abductor hallucis muscle, and the hallux valgus angle during active abduction (measured by radiography and ultrasonography). Individuals were randomly assigned to one of two groups and for 8 weeks either wore an orthosis or wore the orthosis and undertook toe-spread-out exercises. Compared with baseline measurements, no differences were observed in the three parameters in the orthosis group, but significant differences were seen in the orthosis plus toe-spread-out exercise group after 8 weeks, and significant differences were evident in the three measures between the two groups, with toe-spread-out exercise increasing the cross-sectional area of the abductor hallucis muscle and reducing the hallux valgus angle and hallux valgus angle during active abduction.

Comment: Generally, available treatments for hallux valgus are divided into operative and non-operative treatments. Non-surgical management includes the use of foot orthoses, exercise programs, advice on footwear and foot health education. Previous studies have highlighted the importance of strengthening the abductor hallucis muscle in hallux valgus patients, but few studies have determined which specific exercises should be performed. The findings from this Korean study found after the 8-week intervention, the hallux valgus angle, and the hallux valgus angle during active abduction, were significantly reduced, and the cross-sectional area of the abductor hallucis muscle was significantly increased in the foot orthoses plus toe-spread-out exercise group, but there were no significant differences in the foot orthoses group. The present study had several limitations. First, the results cannot be generalised because the subjects were relatively young (mean age 23 years), and had only mild-to-moderate hallux valgus. Additional research examining the effects of toe-spread-out exercise on different age groups, and in severe hallux valgus cases, is required. Second, we didn't evaluate the strength of the abductor hallucis muscle during the 8 weeks. Future studies should assess the strength of abductor hallucis muscle after toe-spread-out exercise lasting for 8 weeks.

Reference: *J Phys Ther Sci.* 2015;27(4):1019-22

[Abstract](#)

Independent commentary by Professor Keith Rome.

Keith was awarded a Diploma in Chiropody and Membership to the Society of Chiropodists and Podiatrists in 1979 and worked in the health service and private practice. He has worked in full-time academia within podiatry and physiotherapy since 1988. He was awarded a Bachelor of Science in Podiatry from the University of Westminster in 1989 and in 1990 a postgraduate diploma in Biomechanics from the University of Strathclyde.



In 1994, he was awarded a Master of Science Degree in Research Methodology for Physical Therapists from Kings College London and in 2000 was awarded a PhD from the University of Teesside, UK. He was promoted to a Reader in Musculoskeletal Rehabilitation in 2002, and in 2005 was appointed as Professor of Podiatric Rehabilitation at University of Teesside. In 2007 he was appointed a Professor in Podiatry at AUT University, New Zealand.

Keith is currently leading podiatric research at AUT University and his current research interests relate to chronic gout, rheumatoid arthritis and the effects of foot orthoses/footwear on postural stability in long-term chronic conditions.

Prospective comparison of running injuries between shod and barefoot runners

Authors: Altman AR and Davis IS

Summary: This prospective study examined injury patterns in barefoot and shod runners. A total of 201 adult runners (107 barefoot and 94 shod) were surveyed over the course of a year on information regarding injuries and mileage, and musculoskeletal and plantar surface injuries were assessed. While fewer overall diagnosed musculoskeletal injuries per runner were noted in the barefoot group, the injury rates were not statistically different due to significantly less mileage run in the barefoot group. Barefoot runners exhibited a significantly greater number of injuries to the plantar surface of the foot, reported less plantar fasciitis, reported a lower number of knee and hip injuries, but a higher number of calf injuries, than shod runners.

Comment: Barefoot running has received very little attention until recently. Advocates of barefoot running suggest that it is more natural and may be a way to minimise injury risk. In contrast, opponents believe shoes are needed to adequately cushion and support the foot. While the aetiology of running injuries is clearly multifactorial, modern day footwear may have played an important role. The addition of a cushioned heel dramatically changes the landing pattern during running. Opponents suggest barefoot running will be associated with increased injury incidence due to the lack of support and cushioning modern running shoes provide. The purpose of this American prospective study was to examine the differences in injuries between habitually barefoot and habitually modern day shod runners. Musculoskeletal injuries per runner (including diagnosed and self-reported) were 30% lower in the barefoot compared to the shod group. There were several limitations to this study mostly related to the differences in participant characteristics between the two groups. First, the barefoot participants were older on average by 4 years. However, while significant, the clinical relevance of this age difference as related to injury is unknown. There were more males in the barefoot group resulting in their being taller and heavier. While sex is not a risk factor for overall injuries, it does play a role in some specific diagnoses. Therefore, studies designed to assess specific injuries should be balanced by sex. Finally, a larger cohort would have allowed for the examination of statistical differences in individual injuries.

Reference: *Br J Sports Med.* 2015;Jun 30 [Epub ahead of print]

[Abstract](#)

Footwear experiences of people with chronic musculoskeletal diseases

Authors: Hendry GJ et al.

Summary: In order to investigate the main issues surrounding the footwear experiences of individuals with chronic musculoskeletal diseases in New Zealand, a qualitative manifest content analysis of open-ended survey responses concerning such experiences was conducted from a national footwear survey. Qualitative data content analysis of responses from 85 individuals revealed the following four categories encompassing a total of nine subcategories related to the footwear experiences of respondents: 1) difficulties in finding appropriate footwear; 2) dissatisfaction with therapeutic footwear provision and foot care access; 3) high costs of footwear, foot care and self-care; and 4) satisfaction with therapeutic footwear and foot care.

Comment: Individuals with chronic musculoskeletal diseases frequently report foot pain and deformities, but only limited research has been conducted to explore the key issues concerning footwear difficulties in this population. The results from this New Zealand study provide new qualitative data on the footwear experiences of people with chronic musculoskeletal diseases. This data largely corroborates previous findings with regards to the footwear experiences of people with rheumatoid arthritis, but also provides new and novel data concerning the experiences of those with other less frequently researched conditions in the context of footwear issues, particularly osteoarthritis, lupus, gout and systemic scleroderma. The main limitation to this study was that the open-ended nature of the question posed to respondents at the end of the primary electronic survey meant that interesting statements that were provided by respondents could not be followed up with further questioning for clarity and/or further in-depth exploration. Nevertheless, the high proportion of respondents with osteoarthritis (58%) suggests that footwear experiences in this patient group may have been previously underestimated given that there is a scarcity of published osteoarthritis footwear research available in the current literature relative to rheumatoid arthritis.

Reference: *Arthritis Care Res.* 2015;67(8):1164-72

[Abstract](#)

Perceived barriers to the management of foot health in patients with rheumatic conditions

Authors: Lansdowne N et al.

Summary: Using a web-based survey, these researchers evaluated New Zealand podiatrist's perceived barriers in the management of rheumatic conditions. Fifty-six podiatrists undertook the self-administered survey, comprising thirteen questions. The findings revealed poor integration of podiatrists into multidisciplinary teams caring for patients with arthritic conditions, with dedicated clinical sessions seldom offered (16%); only a few podiatrists (16%) reported being part of an established multidisciplinary team. Furthermore, poor uptake of clinical guidelines was reported (27%) with limited use of patient reported outcome measures (39%). However, the majority of podiatrists were interested in professional development for the podiatric management of such conditions (95%) and 100% agreed that there should be nationally developed clinical guidelines for foot care relating to arthritis.

Comment: The findings of the study demonstrated that the majority of podiatrists were not involved in a multidisciplinary team managing people with rheumatic conditions. As a result, timely access to podiatric care may be hindered or the opportunity for foot care, for individuals with rheumatic conditions, may be missed. This is of significance as previous research has demonstrated that offering a podiatric service to individuals with rheumatic conditions can result in significant improvements in foot pain and disability. The study has limitations. The number of participants represents only 18% of the New Zealand podiatry workforce and therefore limits the generalisability of the results to the wider podiatry profession in New Zealand and worldwide. While this research examines the podiatrist perspective and current involvement within a multidisciplinary team, future research is warranted to examine trends in the management of people with rheumatic conditions within an integrated care setting. An examination of the perspectives of other health professionals with regard to podiatrists in this setting would also be of value and may provide some direction toward achieving greater integration of podiatrists in multidisciplinary teams and integrated care settings in New Zealand.

Reference: *J Foot Ankle Res.* 2015;8:14

[Abstract](#)

Biomechanical evaluation of custom foot orthoses for hallux valgus deformity

Authors: Doty JF et al.

Summary: This study compared hallux valgus deformity pressure parameters seen in standard footwear (no orthosis) versus the pressure observed in the same footwear with the addition of three different length orthoses, by measuring forefoot pressure at the hallux valgus deformity using pressure sensors placed on the plantar, medial, and dorsal surface of the first metatarsal head. Each participant underwent walking trials with and without the orthoses and it was found that plantar pressures were decreased in the full length and 3/4 length orthoses, while dorsal pressures were increased with the full- and sulcus-length orthoses. A trend toward increased medial pressures was seen with the full- and sulcus-length orthoses, while the 3/4-length orthoses showed a trend toward decreased medial pressures.

Comment: The findings from this American study suggest that a custom foot orthoses might not significantly reduce first MTP joint medial pressures, which have been implicated in the development, progression, and discomfort of hallux valgus deformity. Previous studies suggest that an orthotic device might be uncomfortable, because it occupies space within the shoe. The data from this study support this notion, because the sulcus-length and full-length orthoses led to increased dorsal pressures at the bunion. These increased pressures could likely increase the irritation and pain generated from the dorsal-medial cutaneous nerve found overlying the medial eminence. The study had limitations. A statistically significant reduction in the medial pressures with the 3/4-length orthoses might have been detected with an increase in power. Also, orthoses could affect the more proximal joints and the intra-articular load of the MTP joint, which might have clinical implications. Although a single type of shoe might have made the changes in pressure more detectable, we chose to allow various types of closed toe shoes. Our patients are unlikely to buy a certain type of shoe for their orthoses but rather would switch the orthoses in and out of their typical daily footwear.

Reference: *J Foot Ankle Surg.* 2015;Jun 6 [Epub ahead of print]

[Abstract](#)



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Effect of minimalist footwear on running efficiency: A randomized crossover trial

Authors: Gillinov SM et al.

Summary: This randomised crossover trial involving 15 experienced runners examined the effect of minimalist footwear on running efficiency. Participants each completed three 90-second running trials on a treadmill, with each trial undertaken in a different type of footwear; barefoot (socked), minimalist running shoes with minimal heel cushioning, or traditional running shoes with a heavily cushioned heel. Foot strike, ground contact time, knee angle, and stride cadence during each trial was assessed using high-speed photography. Analysis revealed that traditional shoes were significantly ($p = 0.03$) associated with more rearfoot strikes (87%) than minimalist shoes (67%) and socked feet (40%). Traditional shoes were also significantly ($p = 0.005$) associated with longer ground contact time (265.9 ± 10.9 ms) compared with minimalist shoes (253.4 ± 11.2 ms) and socked feet (250.6 ± 16.2 ms). No difference in knee angle or stride cadence was observed between the groups and no differences were observed in running efficiency between running socked and running with minimalist running shoes.

Comment: Minimalist footwear is increasingly popular among runners, however, claims that minimalist footwear enhances running biomechanics and efficiency are controversial. Minimalist and barefoot conditions have been shown to improve running efficiency when compared with traditional running shoes. They are distinguished by a less cushioned heel and reduced heel-forefoot offset, greater sole flexibility, and lack of arch support and motion control. The findings from this American study found that compared with traditional shoes, minimalist shoes and barefoot (socked) running facilitated a midfoot or forefoot strike in a group of experienced high school runners. Minimalist shoes and socked running also resulted in a shorter ground contact time than traditional running shoes. The findings suggest that minimalist shoes and barefoot running are associated with improved running biomechanics when compared with traditional shoes by certain measures. In term of limitations, for the "barefoot condition," runners wore light socks to protect their feet, which could have an impact on biomechanics. Because all testing was performed on a treadmill, these results may not be generalisable to outdoor or track running. Finally, the study assessed only the immediate impact of footwear; it is possible that a short-term trial (days to weeks) or a longer-term trial (months) of different types of running footwear might have greater influence on running biomechanics.

Reference: *Sports Health* 2015;7(3):256-60

[Abstract](#)

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