The influence of an off the shelf lateral wedge orthotic on knee loading during running

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Introduction

Knee injuries are prevalent in sport and associated with degenerative changes to the joint (Silverwood *et al.*, 2015). High external knee adduction moments (EKAM), knee adduction angular impulses (KAAI) and knee flexion moments (KFM) have been associated with increased cartilage deterioration (Chehab *et al.*, 2014).

Lateral wedge insoles (LWI) have demonstrated reductions in biomechanical loading (EKAM, KAAI) associated with osteoarthritis progression during walking in individuals with osteoarthritis (OA; Jones *et al.*, 2014). Younger individuals who sustain a knee injury during sport are likely to return to physical activity following treatment (Kim *et al.*, 2013). With increased risk of developing knee OA, identifying preventative measures to delay the progression of OA during dynamic tasks such as running is required.

Previously, customised LWI have demonstrated reduced knee loading when compared to medial wedge insoles during running (Lewinson *et al.*, 2013) but no difference compared with neutral insoles. Yet, participants reported discomfort with increased wedge thickness. An off-the-shelf LWI with medial arch support has shown improved comfort, most likely to ankle joint changes, whilst maintaining similar reductions in knee loading to LWI (Jones *et al.*, 2014). This device offers the advantage of being available to all without requiring access to specialist podiatric or orthotic skill-sets. However, no data exists in more dynamic activities.

Purpose of the study

The aim of this study was to examine the effect of arch supported LWI on knee loading during running.

Methods

Nine healthy individuals (age 25.1 ± 2.2 years, mass 68.2 ± 11.6 kg, height 1.7 ± 0.1 m), 5 males and 4 females, who ran at least 15 km per week for at least three months prior to data collection volunteered for this study. Two footwear conditions; a standard trainer (Decathlon Kalenji Running Shoes) and the standard trainer plus the arch supported LWI (SalfordInsole™, UK) were assessed. Familiarisation to the conditions were given. For each condition, participants completed 5 successful 25 m running trials at 3.5 ± 0.2 m/s on a running track.

The CAST technique (Cappozzo *et al.*, 1995) was employed to collect lower limb kinematic (10 Qualisys ProReflex; 240 Hz, Qualisys AB, Sweden) and kinetic (3 force plates; 3600 Hz, AMTI, USA) data. A window was made in the heel counter to accommodate an additional wand marker on the lateral calcaneus defining calcaneus motion independent of the condition. Foot strike patterns for individuals were classified using the strike index and kinematic approach (Altman and Davis, 2012). Comparisons between conditions were assessed using dependent t-tests.

Results

Frontal and sagittal lower limb motion and moments were similar between conditions (Table 1). COP excursion demonstrated similar results between the two conditions. Foot strike patterns differed between the participants; 5 participants rearfoot, 3 midfoot and 1 forefoot.

Table 1: Kinematic and kinetic variables between the two conditions

	Trainer	Insole
EKAM (Nm/kg)	0.52 ± 0.23	0.54 ± 0.22
KAAI (Nm/kg*s)	0.06 ± 0.03	0.06 ± 0.03
KFM (Nm/kg)	2.65 ± 0.54	2.86 ± 0.60
Peak knee flexion (deg)	41.68 ± 5.13	43.05 ± 4.82
Ankle moment (Nm/kg)	0.79 ± 0.18	0.79 ± 0.22
Maximum eversion (deg)	-7.68 ± 4.01	-9.21 ± 4.56
COP excursion (mm)	54.51 ± 17.52	55.07 ± 16.79

Discussion and conclusion

The current study assessed the use of an arch supported LWI on knee loading during running. The study showed that running with this device demonstrated no changes in lower body biomechanics.

Unlike the current study, Lewinson *et al.* (2013) reported lower knee loading with increased LWI thickness when compared with a neutral condition, although not significant. The variation in lower limb motion between individuals in the current is likely due to the varied footstrike patterns reported.

Our findings suggest that arch supported LWI do not reduce frontal plane knee loading in healthy individuals with varied foot strike patterns. Further evidence is needed to identify interventions on those predisposed to degenerative changes following a knee injury and effect of such interventions on pain during dynamic tasks.

References

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