EFFECT OF FOOT ORTHOSES ON MULTI-SEGMENT FOOT KINEMATICS: A SYSTEMATIC REVIEW

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Introduction

The systematic review aims to identify and summarize the effects of foot orthoses on foot kinematics at the forefoot, midfoot, and rearfoot.

Methods

Methods: The literature search was conducted following the inclusion criteria: (1) running or walking as the experience tasks, (2) three-dimensional kinematics were only included because the transverse alignment of the foot affects movement in the frontal plane in the two-dimensional analysis and exclusion criteria: (1) considering the foot to be a rigid part of the body, (2) those participants with neurological conditions, systemic diseases, or degenerative conditions were excluded from the study. (3) unpublished or non-peer reviewed articles was excluded, (4) studies on sensor insoles and vibration insoles were excluded. Three orthoses categories were categorized for data synthesis: (1) non-posted moulded, which customed or contouring the participants foot; (2) non-moulded posted, which flat orthoses without contouring, but with adding posting; (3) posted moulded that had customed-contouring and additional posting[1]. The Down and Black Quality Index in an adapted version to assess the methodological quality of each study.

Results

A total of 22 studies were included. Meta-analyses were not conducted due to comparisons were absence the same across orthosis design, foot posture, and gait. The significant differences that had a large effect size are described below. Forefoot: moulded posted orthoses effect the peak forefoot eversion during walking (ES 1.14); posted orthoses decrease the dorsiflexion at heel contact at heel contact (ES 0.6) and effect the peak eversion during running (ES 0.58). Midfoot: In walking gait, moulded orthoses decrease the midfoot mean medial longitudinal arch (ES 0.43). Moulded orthoses and posted orthoses both increase the mean dorsiflexion (ES >0.4) and the mean abduction (ES >0.4). Rearfoot: In walking gait, moulded orthoses and posted orthoses both increase the mean rearfoot abduction (ES>0.04) and reduce the peak eversion (ES 0.63). Posted orthoses and moulded posted orthoses both increase the mean rearfoot plantarflexion (ES 0.47). In running gait, posted orthoses increase the rearfoot peak eversion (ES 0.4) and dorsiflexion at heel contact (ES 0.53).

Discussion

Molded posted orthoses are significantly effective in controlling forefoot eversion. Forefoot kinematics in the frontal plane did not show significant results. Posted orthoses are more effective on the midfoot and rearfoot kinematics in all three planes. There are several limitations in data analysis of this study: as measurement of midfoot kinematics in the transverse plane is difficult, there was not sufficient data to analyze. Multi-segment running kinematics data are limited by the small number of studies included.

Parameters	Test gait	Intervention	Comparator	MD (95% CI)	ES
Peak forefoot eversion	W	moulded posted(heel)	control	-3.4(-6.58 to -0.22)	**0.98**
		moulded posted(heel)	control	3.6(1.24 to 5.96)	**1.14**
Forefoot DF at HC	R	arch posted (heel 6mm)	arch posted (heel 2mm)	-3.6(-8.05 to 0.85)	**0.6**
Forefoot peak EV	R	arch posted (heel 6mm)	arch posted (heel 2mm)	-2.2(-5.02 to 0.62)	**0.58**
Mean MLA	W	Moulded (hard)	control	-3.6(-18.11, 10.91)	**0.43**
Midfoot mean DF		Posted(heel)	Control	↑ 5-55%, ↓ 65-80%	**P<0.001**
		Posted(forefoot)	Control	↑ 20-85%	**P<0.001**
		Moulded (rigid)	Moulded	MD 0.69 (2-48%), MD 0.77 (49-78%)	**P<0.001**
		Moulded posted (medial heel)	Moulded	MD 1.36 (0-80%)	**0.41**
Mean midfoot ABD		Posted(heel)	Control	↑100%	**P<0.001**
		Posted(forefoot)	Control	↑ 20-85%	**P<0.001**
		Moulded (rigid)	Moulded	MD 0.52	**ES>0.4**
		Moulded posted (heel)	Moulded	MD 0.49(0-44%)	**ES>0.4**
Mean abduction	R	Posted(heel)	Control	Increase	**P<0.001**
		Posted(forefoot)	Control	Increase	**P<0.001**
		Moulded (rigid)	Moulded	1.02(14-100% stance)	ES>0.4
Rearfoot peak EV	W	Moulded (powerstep)	Control	-2.29(-5.52, 0.94)	**0.48**
		Carbon twist spring insole	Control	-0.96(-2.74 to 0.82)	**0.63**
		Posted (medial heel)	Control	-5.42(-7.24 to -3.6)	**1.42**
Mean rearfoot PF	W	Moulded posted (medial heel)	Moulded	2.43	**0.85**
		Moulded posted(heel)	Moulded	1.15	**0.47**
		Moulded (rigid)	Moulded	-0.83 (8-100% stance)	
Rearfoot DF at HC	R	Arch posted (heel 6mm)	Control	5.1(0.32 to 9.88)	**0.8**
		Arch posted (heel 10mm)	Control	7.3(1.47 to 13.13)	**0.94**
Peak rearfoot eversion	R	Arch posted (heel 10mm)	Control	1.8(-1.55 to 5.15)	**0.4**
		Arch posted (heel 6mm)	Archposted (heel 2mm)	0.5(-2.8 to 3.8)	0.11
		Arch posted (heel 10mm)	Archposted (heel 2mm)	1.7(-1.29 to 4.69)	**0.42**

Table 1: The mean difference and effect size of the significant parameters.
MD:mean difference, W:walking, R:running, EV:eversion, DF at HC: dorsiflexion at heel contact, MLA: medial longitudinal angle, ABD: abduction, PF: plantarflexion.

References

1. Mills, Kathryn, et al, BJ Sportsmed, 44:1035-1046, 2010.

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