A systematic review of the effects of shoes and other ankle or foot appliances on balance in older people and people with peripheral nervous system disorders

Hijmans J M, Geertzen J H, Dijkstra P U, Postema K

CRD summary
This review concluded that there is insufficient evidence from good-quality studies to determine the effects of shoes and other ankle or foot appliances on balance in older people and individuals with peripheral nervous system disorders. Given the small number of what appeared to be poor-quality studies and the limited analysis presented, it is not possible to comment on the reliability of the authors' conclusions. Caution is advised.

Authors' objectives
To review the effects of shoes and other ankle or foot appliances (AFA) on balance in older people and individuals with peripheral nervous system disorders (PNSD).

Searching
MEDLINE, EMBASE and RECAL Information Services were searched from 1989 to the end of 2004; the search terms were reported. The references of selected papers were also screened for additional studies. No language restrictions were applied.

Study selection
Study designs of evaluations included in the review
Randomised controlled trials, case series and observational, cross-sectional, case-control and cohort studies were eligible for inclusion in the review.

Specific interventions included in the review
Studies of any type of shoe or AFA were eligible for inclusion. Most of the interventions included in the review involved shoes with soles of varying thickness and hardness. Other interventions included a senior sport shoe with heel elevation; new orthopaedic footwear combined with an individual training programme; the application of flexible tubing to the plantar surface boundaries of the feet; and vibrating gel-based insoles.

Participants included in the review
Studies had to include either older adults (60 years and older) or individuals with a PNSD (not specifically defined). Only one of the included studies assessed individuals with a PNSD; this study included patients aged 12 to 44 years with hereditary motor and sensory neuropathy. The remaining studies included patients with a mean age ranging from 69 to 73 years (where reported); three of these studies also included groups of younger individuals. Three studies included only older men and one study included only older women.

Outcomes assessed in the review
Eligible studies had to include a measure of balance or falls. The included studies assessed: velocity and displacements of the centre of pressure under varying conditions; stepping reactions; whole body postural sway; balance failure (number of falls from a beam per 100 metres); rear foot angle; and perceived maximal supination. The majority of the included studies examined immediate effects, but the follow-up in two studies ranged from 5 weeks to 4 months.

How were decisions on the relevance of primary studies made?
One reviewer read and assessed titles and abstracts. Two reviewers then independently assessed the full papers and any disagreements were resolved through discussion or intervention by a third reviewer.

Assessment of study quality
The authors stated that they assessed validity, but their assessment appears to be more of an assessment of eligibility.
rather than an assessment of methodological quality. However, they did assess inclusion and exclusion criteria; whether the study used a prospective design; whether the study was an observational study; results published for T0 and T1; description of the intervention; and whether descriptive statistics relating to age and gender were reported.

**Data extraction**
The authors did not state how the data were extracted for the review, or how many reviewers performed the data extraction. The data appear to have been extracted as reported in the original study reports.

**Methods of synthesis**
How were the studies combined?
Differences in the interventions and outcome measures prevented the studies from being combined statistically, so a narrative synthesis was used.

How were differences between studies investigated?
Some differences between the studies were discussed in the text and were evident from the data tables.

**Results of the review**
Seven studies (113 older or PNSD patients) were included: five randomised crossover trials (89 older people), one controlled crossover trial (14 older people) and one case series (10 patients with PNSD). The sample sizes ranged from 10 to 26.

Study quality/evidence level.

Only two studies followed up the effects of the interventions over time. The sample size of all of the studies was small (range: 10 to 26).

Effects in people with PNSD.

One case series (n=10) evaluating the use of new orthopaedic footwear before and after the introduction of a 2- to 4-month individualised training programme reported a marked loss of sway control, which was improved after the introduction of the training programme. (No statistical measure of effect reported.)

Effects in the elderly.

Three randomised crossover trials (51 elderly adults) reported immediate impairments in balance control and foot position awareness after the fitting of shoes with soles of different thickness and hardness. A randomised crossover trial (26 older women) reported no differences in static balance 5 weeks after wearing a senior sport shoe with heel elevation. However, a randomised crossover trial (12 elderly adults) reported an immediate reduction in balance control impairments with vibrating gel insoles. Finally, one controlled crossover trial (14 elderly adults) reported immediate improvements in postural perturbations after the application of flexible tubing to the plantar surface boundaries of the participants' feet.

**Authors' conclusions**
No definitive conclusions can be drawn because of the lack of studies and the poor quality of the evidence.

**CRD commentary**
This review answered a clear research question, searching for a wide range of study designs in three electronic databases. No language restrictions were applied to the literature searches but no specific attempts to locate unpublished studies appear to have been made, suggesting that publication bias may exist. Some precautions were taken to reduce
the risk of bias and error when selecting the studies, but only one author carried out the initial screening of titles and abstracts; this might have introduced errors or bias. The validity assessment, although assessing some aspects of study validity, was not extensive and mainly focused on the eligibility criteria. It is therefore difficult to assess the reliability of the study findings, although the types of study designs used and the authors’ own comments suggest that the studies were all of a poor quality. The analysis was also limited, with little information being given about the strength of the associations or the statistical significance of the effect sizes. Based on the small number of what appear to be poor-quality studies and the limited analysis presented, it is not possible to comment on the reliability of the authors’ conclusions and caution is therefore advised.

**Implications of the review for practice and research**

**Practice:** The authors did not state any implications for practice.

Research: The authors stated that future research should investigate the step-by-step effects of AFA using agreed general measures of balance that assess both the immediate and longer term effects of the intervention. More research is also needed to investigate the effects of new appliances, such as those that provide ankle compression, and the improvement of plantar sensation by the use of insoles with tubing or vibrating insoles. Research should also look at other environmental factors that may reduce the risk of falls.

**Bibliographic details**


**PubMedID**

16687248

**DOI**

10.1016/j.gaitpost.2006.03.010

**Indexing Status**

Subject indexing assigned by NLM

**MeSH**

Aged; Ankle; Foot; Humans; Orthotic Devices; Peripheral Nervous System Diseases /physiopathology; Proprioception /physiology; Shoes; Somatosensory Disorders /physiopathology

**AccessionNumber**

12007000270

**Date bibliographic record published**

08/10/2007

**Date abstract record published**

09/08/2008

**Record Status**

This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.