

BRIEF REVIEW ΒΡΑΧΕΙΑ ΑΝΑΣΚΟΠΗΣΗ

Falls, footwear and footwear interventions in older adults A brief review

Footwear plays an important role in the maintenance of foot health, and in the prevention of falls in older adults. Footwear needs to be evaluated with the older person walking, standing and sitting. Footwear interventions can alter static and dynamic balance performance and gait, and reduce the risk of falls in older people. This is a review of the current knowledge on footwear assessment and effective footwear interventions for reducing the likelihood of falls in older people.

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Πτώσεις, υποδήματα
και παρεμβάσεις υποδημάτων
σε ηλικιωμένους: σύντομη
ανασκόπηση

Περίληψη στο τέλος του άρθρου

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1. INTRODUCTION

Falls in older people are a major public health problem, representing an important source of preventable morbidity and mortality.¹ More than 30% of people aged over 65 years will experience a fall each year, with half of the falls occurring at home.² It is well recognized that falls result from the interaction between environmental hazards and physiological risk factors, including poor lower limb proprioception, visual impairment, muscle weakness, poor cognition, slow reaction time, etc.^{3–6} Foot problems (e.g., foot pain, reduced range of motion, toe weakness and toe deformity), which constitute a relatively neglected area of risk for falls, are estimated to affect one in three people aged older than 65 years who are living in the community.^{7,8} In addition to these intrinsic factors, extrinsic factors, such as environmental factors and unsafe footwear, may also cause falls,^{6,9} and a link can be identified between shoes, feet and daily activity in the risk of falling.¹⁰

The majority of older people have been observed to be

wearing footwear of the incorrect size, which is associated with lack of foot sensitivity and the appearance of a variety of foot conditions and deformities.⁶ Footwear also has the potential to influence balance in either a detrimental or a beneficial manner, and is therefore an important consideration in relation to falls prevention.¹¹ Footwear selection is therefore important, and may have an impact on the risk of falling and triggering further falls among older adults.⁷ Falls prevention programs have targeted lower-limb muscle weakness, improvement of general balance, medication intervention, and environmental modification.^{5,12,13} Given the emerging evidence that unsuitable shoes increase the risk of falls, current guidelines for falls prevention also recommend that older people should have their feet and footwear examined.¹⁴

This overview outlines the current tools for footwear assessment, and the evidence-based elements of a safe and comfortable shoe for older adults, with a view to helping health professionals provide effective interventions for falls prevention.

2. FOOTWEAR ASSESSMENT

In order for health professionals and researchers to conduct an accurate and efficient critique of an individual's footwear, a valid and reliable footwear assessment tool is required.¹⁵ Footwear assessment is an assessment of a patient's footwear suitability, and the most common footwear assessment tools are: (a) the Footwear Checklist,¹⁶ (b) the Footwear Suitability Scale,¹⁷ (c) the Footwear Assessment Score,¹⁸ (d) the Footwear Assessment Tool,¹⁵ and (e) the Footwear Assessment Form.¹⁹ Table 1 presents the various footwear assessment tools.

3. FOOTWEAR CHARACTERISTICS AND OLDER ADULTS

Shoes are the direct link between feet and the ground, and they play a major role in postural control.⁶ If inappropriately designed, they can decrease postural stability.²⁰ Inappropriate shoes may also modify the walking pattern.²¹ Inappropriate footwear refers to footwear of incorrect size and or with unsafe features. It has been suggested that the ideal safe shoe for older people at risk of falling should have a low, broad heel, a thin, firm midsole, a high collar and a textured, slip-resistant outsole.¹¹ Elements such as elevated heels and backless styles, can impair balance control and increase the risk of falling.²² Ankle boots with optimal heel support and nonslip soles, and shoes with soles designed to facilitate proprioceptive feedback may also be good options.⁶ A further element which may influence the risk of slipping is the material of the shoe, and its tread design can affect the coefficient of friction on the walking surface.^{9,23}

In addition, patients with foot pain and or with forefoot disorders (e.g., metatarsalgia, hallux valgus, etc.) should avoid tight-fitting or high-heeled shoes. For patients with forefoot disorders, conservative treatment includes corrective shoes and the application of insoles or orthoses such as pads or supports.²⁴

Wearing socks and insoles may also affect the ability of the foot to detect tactile input influencing postural balance.

Table 1. Footwear assessment tools.

Tool	Population
Footwear Checklist	General population
Footwear Suitability Scale	Patients with diabetes mellitus
Footwear Assessment Score	Patients with diabetes mellitus
Footwear Assessment Form	Older adults with postural instability
Footwear Assessment Tool	General population

Wearing thick socks reduces plantar pressure sensitivity and increases postural sway, which may increase risk of falls. Orthopedic insoles and footwear with similar design could potentially be a cost-effective method in maintaining postural balance when wearing thick socks.²⁵ Use of footwear with the proper features can be an appropriate intervention for improving balance in older people and thus reducing falls.²⁶

3.1. Basic characteristics of footwear

3.1.1. Fit. A proper fit can have a positive impact on pain and thus on overall quality of life. Shoes that are too narrow or too small are likely to cause pain.²⁷ Shoes that are too loose result in lower gait speed, shorter stride length and a less regular gait pattern.²⁸ Clinicians may recommend adapted wider shoes for certain conditions (e.g., claw or hammer toes) that could impair balance.²⁹

3.1.2. Heel height. Older adults are advised not to wear high heels. High heels increase the risk of falls, especially when the heels exceed 2.5 cm.^{30,31} The gait parameters step length, step width, walking speed, movements of center of mass and base of support are all affected.²⁸

3.1.3. Sole width, hardness and sole resilience. The hardness of the sole influences sensory awareness of foot position, which is related to stability, balance and mobility.^{28,31}

3.1.4. Collar height. For static balance and stepping, shoes with a high collar (collar height 11 cm) are more beneficial than normal shoes with a low collar.^{28,30}

3.1.5. Insoles. Insoles enhance somatosensory function, due to better alignment of the joints in the feet, potentially improving muscular contribution to stability.³² Step width when doing a tandem walk was significantly narrower in shoes with textured insoles.¹¹ In testing, balance was improved with flat and textured insoles.³³ Cupped insoles, for better fit of the heel, improved the dynamic postural stability and standing balance.²⁸

3.1.6. Opening and closing mechanisms, doffing and donning. Ageing frequently leads to problems with doffing and donning, i.e., putting shoes on and taking them off. Easy and effective closing mechanisms are, therefore, usually preferred.²⁸

4. FOOTWEAR INTERVENTIONS FOR OLDER ADULTS

The term "footwear intervention" is used to define collectively all types of shoe inserts, including shoe insoles

and foot orthoses. These interventions have the capacity to enhance balance control and gait in older people.^{1,34} Footwear interventions can significantly alter static and dynamic balance performance and gait.³⁴ Conventional understanding of the role of footwear interventions in balance performance and gait in older people focuses on their mechanical influence in optimizing kinematics, including foot position and proximal lower-limb alignment, and providing shock attenuation, motion control, redistribution of plantar pressures, pain relief or a combination of all.^{34,35} Footwear interventions that provide plantar tactile stimulation can provide the central nervous system with vital information regarding the location of peak foot pressure relative to alterations in upright body position.³⁶ In addition, vibrating and textured insoles appear to have

good immediate benefits for balance and gait.²² Table 2 presents studies on the effects of a variety of interventions (e.g., textured insoles, custom orthoses)^{37–45} on several measures of static or dynamic balance.

5. CONCLUSIONS

Evidence suggests that the assessment of the feet and footwear of older adults is important in the estimation of the risk of falls. In addition, footwear interventions can improve certain fall risk-related motor outcomes and reduce falls in older people. Providing older adults with the right advice or referral for specialized footwear can have a significant impact on the success of clinical interventions.

Table 2. Footwear interventions.

Study	Participants	Interventions	Outcome measures	Results
Priplata et al ³⁷	12 elderly fallers, 15 young adults	Spike insoles	36 sec double limb standing, away	Reduction in sway parameters
Mulford et al ³⁸	67 elderly	Arch supports	TUG, STS, time to rise from a chair and 3 min walk and back	TUG improvement
Galica et al ³⁹	18 elderly non fallers, 18 fallers	Custom sandals, 3 vibrating actuators	3 min walking speed, 6 min walk: elliptic track	Reduced stride, stance, swing time
Wang and Yang ⁴⁰	26 elderly fallers, 16 young adults	Vibrating insoles	30 sec double limb standing before and after walking, DFA	Reduction in DFA
Gross et al ⁴¹	13 elderly fallers	Semi rigid custom-modified foot orthoses from thermal cork 6 from thick Nickel Plast	Tandem stance, single limp standing	Greater tandem and single limp standing
Hatton et al ⁴²	30 elderly fallers	Textured insoles constructed with EVA	30 sec double limb standing, spatiotemporal gait parameters	No effects in limb standing, reduced step length, stride length
Qiu et al ⁴³	7 elderly fallers, 10 young adults	Textured insoles surfaces	30 sec double limb standing, range of AP, CoP	Reduction in postural sway
Stephen et al ⁴⁴	29 healthy elderly	Sandals with vibrating insoles	Treadmill walking 30 min, stride to stride variability	Reduction in stride to stride
De Morais Barbosa et al ⁴⁵	80 elderly osteoporotic women	Custom foot orthoses with EVA/medial arch support and metatarsal pad	TUG, STS, time to rise from a chair and 3 min walk and back	TUG improvement

TUG: Timed up and go test; STS: Sit to stand test; EVA: Evalite Pyramid Lightweight EVA, Algeos UK, Liverpool; AP: Anteriorposterior; CoP: Center of pressure; DFA: Detrended fluctuation analysis

ΠΕΡΙΛΗΨΗ

Πτώσεις, υποδήματα και παρεμβάσεις υποδημάτων σε ηλικιωμένους: σύντομη ανασκόπηση

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Τα υποδήματα διαδραματίζουν σημαντικό ρόλο στη διατήρηση της υγείας των ποδιών και στην πρόληψη των πτώσεων των ηλικιωμένων. Είναι σημαντικό να πραγματοποιείται αξιολόγηση των υποδημάτων όταν ο ηλικιωμένος περ-

πατάει, κάθεται και είναι όρθιος. Οι σχετικές με τα υποδήματα παρεμβάσεις έχουν τη δυνατότητα να επηρεάσουν τη στατική και τη δυναμική ισορροπία, καθώς και τη βάδιση, και να μειώσουν τις πτώσεις στην πληθυσμιακή ομάδα των ηλικιωμένων. Ο σκοπός της παρούσας ανασκόπησης είναι η καταγραφή των πληροφοριών που σχετίζονται με την αξιολόγηση υποδήματος και την αποτελεσματικότητα των παρεμβάσεων στα υποδήματα για την πρόληψη των πτώσεων σε ηλικιωμένα άτομα.

Λέξεις ευρητήριο: Αξιολόγηση, Ηλικιωμένοι, Παρεμβάσεις, Πτώσεις, Υποδήματα

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