CRITICALLY APPRAISED TOPIC

FOCUSED CLINICAL QUESTION

In a 65 year old male with history of falls ((≥1 fall within past year) and unsteady balance (Berg score ≤45) is non-supportive shoewear or decreased proprioception a greater predictor of increased falls risk?

AUTHOR

Prepared by	Mary Ann Rutz	**Date**	12/06/2015
Email address	rutz@med.unc.edu		

CLINICAL SCENARIO

Throughout my last clinical affiliation at Carolina Meadows, I had the opportunity to work with many older adults (over 65 years old) of which many had experienced recent or recurrent falls. The patients I worked with wore a variety of shoes including: tennis shoes, average sandals, and sandals with no posterior strap support on the heel. When patients reported their falls history patients often fell while wearing various types of shoes, as well as when barefoot. The main reasons for personally choosing to do a review of the literature related to shoewear and proprioception in regards to falls risk, was partly to learn more about current shoewear recommendations. The other reason was to learn about the influence of proprioception with older individuals who have balance instability. If I was able to find appropriate shoewear suggestions, my plan was to utilize these to enhance balance training interventions with potential application to the home environment.

The type or style of footwear worn by patients is important for clinicians and students to review because the geriatric population is continuously growing. In fact, the current estimate for people who will be in the 65≥ years portion of the population in 2060 is 98 million people![1] Certainly as this population increases the number of these patients seen throughout various PT settings such as in acute care will also rise. As a future PT it will be essential to ensure an older patient wears appropriate footwear to decrease chance of a future fall.

SUMMARY OF SEARCH

[Best evidence appraised and key findings]

*10 articles are included which adhered best to my inclusion/exclusion criteria. Level of evidence was varied between 2A to level 3 with 2 systematic reviews being the highest quality evidence. Study design for these articles included: 2 crossover studies, 1 single-cohort design, 3 prospective cohorts, 2 systematic reviews (cohort studies), 1 case control, and 1 nested case control.

*Statistical significance has been found with use of orthoses and balance outcome measures (ex: SLS, tandem stance, TUG, BBS).[4,6]

*A higher likelihood of fall occurrence with specific shoewear styles or conditions for the older community dwelling population has been established.[3] Besides being barefoot, specific shoewear condtions these individuals should avoid are: use of solely socks, or slippers.[3]

*Potential future research may involve continued investigation of: various insole materials, types of shoewear, and increased use of objective balance, gait speed, or general mobility measures.[3,4,6]

*Orthoses composed of several materials have been examined in the literature.[4,6] Some examples of these materials include: spike insoles, textured insoles, vibratory insoles, and semi-rigid insoles.[4,6]

CLINICAL BOTTOM LINE

Cumulative evidence reviewed supports both decreased proprioception and non-supportive shoewear contribute to increased falls risk. Although a clear distinction between prioprioception and shoewear influence has not been established, perhaps future research will be able to sufficiently address this. Results from the critically appraised evidence support use of tennis shoes, orthoses, and avoidance of solely socks, slippers, or being barefoot within the home environment. Physical therapists can potentially use evidence presented to assist with both patient education and with clinical application. Such as, reviewing shoewear used in the home, possibly advise orthotic use, or include outcome measures used in the literature. Further research with shoewear and proprioception interventions is certainly necessary to promote further gains with an older patient's balance capacity and reduce falls risk.

This critically appraised topic has been individually prepared as part of a course requirement and has been peer-reviewed by one other independent course instructor

SEARCH STRATEGY

Terms used to guide the search strategy			
Patient/Client Group	**I**ntervention (or Assessment)	**C**omparison	**O**utcome(s)
geriatric older adult aging ageing elderly	shoe wear shoe style footwear footgear	(not applicable)	falls risk falls fall risk of falls

Final search strategy:

For PubMed, Cinahl, and Cochrane:

1. Geriatric* OR aging OR ageing OR older adult* OR elderly
2. Shoe wear OR footgear OR footwear OR shoe style
3. Proprioception OR "sense of balance" OR kinesthesia
4. Falls risk OR falls OR fall OR risk of falls
5. Shoe insoles OR orthotics OR orthoses
5. 1 AND 2 AND 4
6. 1 AND 3 AND 4
7. 1 AND 2 AND 3 AND 4
8. 1 AND 4 AND 5, 1 AND 3 AND 4 AND 5, 1 AND 2 AND 3 AND 4 AND 5

A limitation I experienced from using the COCHRANE database was that my results were somewhat limited due to some of the articles being currently revised, so I was not able to access and appraise those studies.

Databases and Sites Searched	**Number of results**	**Limits applied, revised number of results (if applicable)**
PubMed: 1 AND 2 AND 4:	123	Humans, Publication Date (5 years) 33 results, Language (English) 31 results
1 AND 3 AND 4:	2555	Humans, Publication Date (5 years) results 1094, Language (English) 1063 results, article types (clinical trial, comparative study, journal article, Meta-Analysis, Multicenter Study, Randomized Controlled Trial, Review, Systematic Reviews) 46 results
1 AND 2 AND 3 AND 4:	42	Humans, language (English) Results:40
1 AND 4 AND 5:	155	Humans, language (English) Results 138, Publication Date (5 years) 49
1 AND 3 AND 4 AND 5:	21	No limits used
1 AND 2 AND 3 AND 4 AND 5:	5	No limits used
Cinahl: 1 AND 2 AND 4:	44	Language (English), Age (65+years, aged 80 and over) 19 results
1 AND 3 AND 4:	85	Language (English), Age (65+ years, aged 80 and over) 69 results, Publication Date (2010-2015) 30 results

1 AND 2 AND 3 AND 4:	4	No limits used
1 AND 4 AND 5:	28	Age (65+years, aged 80 and over) 23 results
1 AND 3 AND 4 AND 5:	3	No limits used
1 AND 2 AND 3 AND 4 AND 5:	2	No limits used
Cochrane: 1 AND 2 AND 4:	32	No limits used
1 AND 3 AND 4:	47	No limits used
1 AND 2 AND 3 AND 4:	3	No limits used
1 AND 4 AND 5:	29	No limits used
1 AND 3 AND 4 AND 5:	3	No limits used
1 AND 2 AND 3 AND 4 AND 5:	2	No limits used

INCLUSION and EXCLUSION CRITERIA

Inclusion Criteria
Systematic reviews, controlled trials, uncontrolled trials, longitudinal studies Published in English Published up to August 2015 Studied a population of older adults (at least 65 years old) with history of falls (≥1 fall within past year) and unsteady balance (Berg score ≤45) A protocol that included a shoe wear intervention Measurements taken prior to and following the shoe wear intervention such as: balance (BERG, 4 test balance scale) Self-report measure of number of falls prior to and following the shoe wear intervention
Exclusion Criteria
Abstracts, conference proceedings, letters to the editor, dissertations, narrative review articles Studies that involved adults with neurological diagnoses

RESULTS OF SEARCH

Summary of articles retrieved that met inclusion and exclusion criteria

*D&B: Downs and Black

Author (Year)	Study quality score	Level of Evidence	Study design
Horgan et al. (2008)[2]	Revised D&B Score: 13/21 Questions which did not apply (8): 4,14,15,19,21-24	2b	Crossover trial (quasi-randomised distribution)
Kelsey et al. (2010)[3]	Revised D&B Score: 14/21 Questions which did not apply(8): 4,8,14,19, 21-24	2b	Prospective cohort
Gross et al. (2012)[4]	Revised D&B Score: 15/23 Questions which did not apply(6): 5,17,21-24	2b	single-cohort design (controlled laboratory study)
Iglesias et al. (2012)[5]	Revised D&B Score: 13/23 Questions which did not apply(6): 5,19,21-24	2b	Prospective cohort
Hatton et al. (2013)[6]	AMSTAR Score: 06/11	2A	Systematic Review (cohort studies[11])
Qui et al. (2012)[7]	Revised D&B Score: 11/23 Questions which did not apply(6): 9,13,17,19,23,24	2b	Prospective cohort
Menant et al. (2008)[8]	AMSTAR: 6/11	2A	Systematic review (cohort studies[11])
Koepsell Tet al. (2004)[9]	Revised D&B Score: 15/24 Questions which did not apply(5): 4,8,13,17,19	3	Nested case-control
Tucker et al. (2010)[10]	Revised D&B Score: 14/23 Questions which did not apply(6): 4,8,13,19,23,24	3	Case control
Lipsitz et al. (2015)[11]	Modified D&B Score: 13/23	2b	Crossover study (randomized, single-blind)

	Questions which did not apply (6): 5,19,21-24		

BEST EVIDENCE

The following 3 studies were identified as the 'best' evidence and selected for critical appraisal. Reasons for selecting these studies were:

- Gross et al. 2012: One of the higher Modified D&B scores, recent study, patient selection (ex: history of a fall, age>65 years), outcomes (ex:1-leg stance, tandem stance), inclusion of custom orthotics (with study)
- Kelsey et al. 2010: One of the higher Modified D&B scores, recent study, patient selection (ex: age>70 years),outcomes (ex: falls, shoewear), follow-up study (average 27.5months, up to 44.4 months)
- Hatton et al (2013): Level of evidence (systematic review, 14 studies), patients (ex:healthy, >60 years), use of D&B quality tool, outcomes (ex: static, dynamic balance, footwear), recent study

SUMMARY OF BEST EVIDENCE

(1) Description and appraisal of "Footwear interventions: a review of their sensorimotor and mechanical effects on balance performance and gait in older adults" by Hatton AL et al, 2013

Aim/Objective of the Study/Systematic Review:
The objective stated for this systematic review was "to assess the evidence for how footwear interventions can influence static and dynamic balance performance and gait in older people and to explore proposed theories for the underlying sensorimotor and mechanical mechanisms by which such changes may occur."[6p517]
Study Design
Systematic review (cohort studies) <u>Search Strategy:</u> *Footwear intervention encompassed: shoe inserts (ex: foot orthoses, shoe insoles) *Search: Medline, EMBASE, CINAHL, AMED (online databases); "hand searches"[p517] of available article references *Publications available prior to December 2012 <u>Selection Criteria:</u> *Complete articles ("Full length"[p517]) *Published in English *Study participants: older adults at minimum 60 years old or above, both healthy and unhealthy (i.e. acute, chronic medical conditions), involved with a footwear intervention *Outcome measures available: specific to either gait or static/dynamic balance <u>Exclusion Criteria:</u> *Publications such as: review articles, conference abstracts, single clinical case studies *Investigations restricted to: standard shoewear (only), shoewear features (only), foot orthoses with athletic activity, lower-extremity amputees with prosthetics, immobilization of lower extremity joints with braces/ankle-foot orthoses, shoewear interventions without gait or static/dynamic balance assessments *Cadaveric investigations <u>Methods:</u> • Preliminary search: titles/abstracts with various key words (shoewear terms: foot orthoses, orthotics, orthotic devices, insoles, shoe inserts, wedging, footwear interventions, plantar surface; balance terms: cutaneous receptors, sensory input, afferent input, tactile stimulation, balance, balance control, balance performance, balance reactions, balance recovery, reactive balance, posture, postural stability/control, static, dynamic, physical performance, stance, quiet standing, unperturbed, perturbation, gait terms: walking, function, functional ability) • Hatton (ALH) involved with preliminary search • Preliminary Search total: 2,163 articles • Final total: 14 articles met inclusion/exclusion criteria

- 3 classifications or groups used (14 articles): p518 Static balance performance during quiet standing, dynamic balance performance during walking, dynamic balance performance during perturbed standing or functional tasks
- Downs and Black Quality Index Tool utilized (14 articles, score adjusted)

Static Balance Performance During Quiet Standing: Table 1p520 [When outcomes measured]

- Gross et al, 2012:[2] pre custom foot orthoses, immediate following custom foot orthoses, 2 weeks post foot orthoses intervention (3 times) [Noted: Assessors not blinded]
- Hatton et al, 2012:[11] immediate (1 time) [Noted: Assessors/participants not blinded]
- Palluel et al 2008,[5] 2009:[6] immediate, 5 min following wear of spike insoles (2 times) [Blinding not clearly specified]
- Priplata et al, 2003:[7] immediate (1 time) [Noted: Blinding not clearly specified]
- Qiu et al, 2012:[8] immediate (1 time)
- Wang and Yang, 2011:[12] immediate (1 time) [Noted: Blinding not clearly specified]

Dynamic Balance Performance Assessed During Walking: Table 2p522

- De Morais Barbosa, 2013: immediate, one month (4 weeks) post foot orthoses intervention (2 times) [Noted: random allocation of participants, assessor not blinded]
- Galica et al, 2009: immediate (1 time)
- Gross et al, 2012: immediate, 2 weeks post custom foot orthoses intervention (2 times)
- Hartmann et al, 2010: post 3 months (12 weeks, 1 time) [Noted: Insole/training group participants random allocation (computer), investigators not blinded]
- Hatton et al, 2012: immediate (1 time)
- Mulford et al, 2008: immediate, post arch support intervention 6 weeks (2 times) [Noted: investigators not blinded]
- Perry et al, 2008; Maki et al, 2008: immediate, post insole intervention 3 months (12 weeks, 2 times)
- Stephen et al, 2012: Immediate (1 time) [Noted: assessors/participants blinded]

Dynamic Balance Performance Assessed During Perturbed Standing or Functional Tasks Table 3:p524

- De Morais Barbosa, 2013: immediate, one month (4 weeks, 2 times)
- Gross et al, 2012: immediate, 3 months (12 weeks, 2 times)
- Mulford et al, 2008: immediate, 6 weeks (2 times)

Setting

The authors of this systematic review did not mention the settings for the appraised articles. Following an individual review of the articles' the settings included: university laboratories, a local shoe store, outpatient clinics, and two examples of countries included: Switzerland, the U.S.A.

Participants

Article:	*Type of sample:*	*How recruited:*	*Key Demographics:*	*Number of drop outs:*
Gross et al 2012: Study groups: Static Balance Performance During Quiet Standing, Dynamic Balance Performance Assessed During Walking, Dynamic Balance Performance Assessed During Perturbed Standing or Functional Tasks Table *Study design not included	*Random	*Flyers placed in community (ex: senior centers, local retirement developments)	*13 participants, older adults, 7 females, 6 males, Average age: 81.4 years, fallers (≥1 fall within last year), poor SLS standing balance (SLS balance ≤5sec)	*Dropouts not explicitly mentioned
Hatton et all Study group: Dynamic Balance Performance Assessed During Walking	*Purposive	*Clinical staff of the National Health Service Falls and Elderly Care Services, UK	*30 participants, older adults, 21 females, 9 males, average age: 79 years, fallers (≥2 falls within last year)	*N/A drop outs

Palluel et al, Palluel et al Study group: Static Balance Performance During Quiet Standing *Study design not included	*Not clearly specified	*Not specified	*38 (total) healthy participants, 11 older adult females, 8 older adult males, average age older adults: 69 years, 9 young adult females, 11 young adult males, average age young adults: 25.9 years	*Not clearly specified
Priplata et al Study group: Static Balance Performance During Quiet Standing *Study design not included	*Random	*Posters in local areas or communities (to Boston University)	*27 healthy participants (total), 8 female older adults, 4 male older adults, average age: 73 years, 5 female young adults, 10 male young adults, average age: 23 years	*N/A drop outs
Qiu et al Study group: Static Balance Performance During Quiet Standing *Study design not included	*Random	*Database (elderly, healthy adults)	*17 participants (total), three older female adults, 4 older male adults, average age older adult: 72 years, 4 healthy female young adults, 6 healthy male young adults, average age young adult 27 years	*N/A drop outs
Wang and Yang Study group: Static Balance Performance During Quiet Standing *Study design not included	*Not clearly specified	*Not clearly specified, long-term care center	*42 participants (total), 26 older adults, average age older adults: 83.3 years, 16 healthy young adults, average age young adults: 25.2 years	*N/A drop outs
De Morais Barbosa et al Study groups: Dynamic Balance Performance Assessed During Walking, Dynamic Balance Performance Assessed During Perturbed Standing or Functional Tasks Table *Study design not included	*Purposive	*Outpatient clinic (Rheumatology Division of the State University of Campinas/UNICAMP)	*89 participants, older adults, females, average age: 72.4 years, osteoporosis diagnosis	*5 drop outs
Galica et al Study group: Dynamic Balance Performance Assessed During Walking *Study design not included	*Not clearly specified	*MOBOLIZE Boston Study or MBS (population investigation, falls risk factors)	*36 participants, older adults, 18 "nonfallers,"[6p522] 17 females, 1 male, average age: 77 years, 18 fallers, 17 females, 1 male, average age 78 years	*N/A drop outs
Hartmann et al Study group: Dynamic Balance Performance Assessed During Walking	*Not clearly specified	*local community in Switzerland (Zollikerberg, Zurich)	*42 participants total, older adults, healthy, three groups with 14 participants each (insole, training, control), insole group: 10 females, 4 males, average age 76.4	*3 dropouts in training group

*Study design not included			years, training group: 9 females, 5 males, average age 79.4years, control group: 10 females, 4 males, average age 76 years	
Mulford et al Study groups: Dynamic Balance Performance Assessed During Walking, Dynamic Balance Performance Assessed During Perturbed Standing or Functional Tasks Table *Study design not included	*Random, Not clearly specified	*advertising, word of mouth, community programs	*67 participants, older adults, 44 females, 23 males, average age 69.9 years	*Not clearly specified
Perry et al, Maki et al Study group: Dynamic Balance Performance Assessed During Walking *Study design not included	*Not clearly specified	*Not clearly specified	*40 participants, older adults, 19 females, 21 males, impaired foot-sole sensation	*1 drop out
Stephen et al Study group: Dynamic Balance Performance Assessed During Walking *Study design not included	*Not clearly specified	*Not clearly specified	*29 participants, 13 females, 16 males, older adults, healthy, average age: 71.9 years	*N/A

Intervention Investigated

Article:	*Intervention:*	*Who provided treatment:*	*Location:*	*Number of hours with treatment:*
Gross et al 2012:	*Use of semi-rigid custom made foot orthotics *orthoses materials: thermal cork, NickelPlast	*PT (Mike Gross) made custom orthotics for participants	*Following baseline outcome measures: custom orthoses molds made *Not clearly specified (location), likely outpatient clinic	*Participants wore orthoses: an average of 10.2 hours daily (for the 2 week intervention period) *Range of orthoses use: 6.2 to 14.2 hours
Hatton et all	*Use of textured, smooth insoles *Textured (intervention) insole materials: Evalite Pyramid EVA, 3mm thick, pyramidal peak spread (2.5mm) *Smooth (Control) insole materials: medium density EVA, 3mm thick	*Investigator ALH (testing)	*University laboratory	*N/A

Palluel et al, Palluel et al	*Use of: spike, non spike insoles, Arena NewMarco sandals, *Insole materials: semi rigid PVC *Spike insoles: semi rigid plastic spike covering (ex: pool shoe wear)	*Not clearly specified, likely investigators	*Not specified	*2 outcome test sessions (45 min length, minimally 2 day spread)
Priplata et al	*Use of vibrating insoles *Insole materials: viscoelastic silicone gel, vibration parts: tactors *Vibration part locations: one beneath heel, two beneath forefoot	*Investigators, not specified	*Not clearly specified likely Boston University laboratory	*N/A
Qiu et al	*Use of varied textured insoles, 3 conditions (barefoot, firm/soft insoles) *Insole materials: 320 density EVA (hard), 270 density EVA (soft)	*Investigators, not specified	*Not clearly specified, likely Queensland University laboratory	*N/A
Wang and Yang	*Use of vibrating insoles *Vibration component locations: One beneath heel, two beneath forefoot	*Investigators, not specified	*Not clearly specified	*N/A
de Morais Barbosa et al	*Use of custom foot orthoses (medial arch support 12mm thickness, metatarsal pad 6 mm thickness), 2 groups: intervention, control *Custom foot orthoses: made in Orthosis and Prosthetics Unit (Clinical Hospital of UNICAMP) *Orthoses materials: EVA	*A nurse, not clearly specified	*Outpatient clinic	*Intervention group participants: self-report insole wear duration (range: under 4 hours to greater than 8 hours)
Galica et al	*Use of custom sandals *Vibration components located inside sandal sole	*Investigators, Not clearly specified	*Not clearly specified,	*N/A
Hartmann et al	*Use of custom shoe insoles (MedReflex) *insoles contain "raised projections"[6p522]	*Investigators, Not clearly specified	*Not clearly stated	*Training program: both insole and training group (twice weekly for 3 months, 24 sessions) *Warmup (10min), aerobic exercise (15min), strength training, balance training, stretching (10 min)

Mulford et al[4]	*Use of arch supports	*Investigators	*Local shoe store	*N/A (participants individually fit with arch supports following pre intervention outcomes)
Perry et al, Maki et al	*Use of a "sole sensor facilitatory insole,"[6p522] standard insoles, and Rockport shoes *Insole materials: elastomeric material 3mm thickness; additional lateral/posterior edge (intervention group) *2 groups (intervention, control)	*Investigators, not clearly specified	*Not clearly specified, likely laboratory	*N/A (participants individually fit with insoles/shoes, self-reported use of insoles)
Stephen et al	*Use of custom sandals *Vibration components located inside sandal sole (1st, 5th Met head, heel)	*Investigators, Not clearly specified	*University laboratory	*N/A

Outcome Measures

Article:	*Outcome Measures:*	*Maximum possible score, range of measure:*	*Administered by whom, where:*
Gross et al 2012:	*SLS on both R and L LE, tandem stance with eyes open *SLS, tandem stance: in quiet stance *Tandem gait test on level ground, quantity of appropriate steps (positioned), spatiotemporal gait factors (gait speed, cadence, step duration/length) *Alternating step test (adjusted from Berg Balance Scale (BBS) step test), quantity of alternated steps	*SLS: eyes open, hold: unlimited time *Tandem stance: hold: maximum 30 sec *Tandem gait test: eyes open, participant set walking speed (pace) *Limit of 20 consecutive appropriate steps (maximum) *Characteristics of Tandem gait test: heel toe ambulation (straight line), inside 12cm radius (2 strips of tape as border) *Characteristics of Alternating step test: use of platform, maximum duration: 20 sec	*Investigators, Not clearly specified
Hatton et all	*Double-limb standing, CoP or Center of Pressure in AP, Ml directions, CoP velocity, *using Kistler force platform *Double-LE support standing: in quiet stance *Range, SD of CoP *Walking on level ground, various spatiotemporal gait factors (gait speed, cadence, step/stride length, BOS, step time, cycle time, swing time, stance time, single/double limb support times, *using GAITRite technology)	*Double-limb standing: eyes open, eyes closed, hold: maximum 30 sec	*Investigator ALH, university laboratory

	*Participant set walking pace (speed)		
Palluel et al, Palluel et al	*Double-LE support standing, CoP motion (average CoP location, surface area, average speed, root mean square, median frequency AP, ML *Measured with: Vicron motion analysis system, reflective marker (R shoulder) *Double-LE support standing: *in quiet stance *Position for double-limb stance: arms by side, feet abducted 30deg, 5cm between medial border of heels *Standing, walking session *Touch test: use of Semmes-Weinstein monofilaments (great toe, 1st MET head, 5th MET head)	*Double-limb standing hold: maximum 32 sec *Noted in individual review: older adults: 10 trials, young adults: 20 trials (with/without vibrations)	*Investigators, Not clearly specified
Priplata et al	*Double-limb standing, various sway parameters (ex: maximum sway radius, AP and ML excursions, critical mean square displacement) *Double-LE support standing: in quiet stance *Position for double-limb stance: feet abducted 40deg, 8cm between heels	*Double-limb standing hold: maximum 30 sec	*Investigators, Not clearly specified
Qiu et al	*Double-limb standing, various CoP measures (ex: AP and ML CoP displacement, CoP path length, AP and ML SD, 90% confidence elliptical area of CoP) *Double-LE support: in quiet stance *Surface: firm, foam, barefoot *Position for double-limb stance: 10cm between feet *Force plate used	*Double-limb standing, eyes open, eyes closed, hold: maximum 30 sec *Noted: 4 trials of 30 sec duration (100 Hz)	*Investigators, Not clearly specified
Wang and Yang	*Double-limb standing: prior to/post 10 min walk, DFA, CoP scaling exponents with AP and ML directions *Double-LE support: in quiet stance	*Double-limb standing, eyes open, hold: >65 sec	Investigators, Not clearly specified
De Morais Barbosa et al	*Timed Up and Go (TUG) *Berg Balance Scale (BBS) *Manchester Foot Pain and Disability Index (MFPDI) *Numeric Pain Scale (NPS)	*TUG: level ground ambulation length, 6m with two transfers (sit to stand, stand to sit) *Characteristics of BBS: potential maximum score 56 points (use of ordinal 5-point scale, dependent on capacity to execute task, 0: incapable, 4: independent capability) *MFPDI: self-reported, 19 questions, Total score: 0 to 38, assesses 3 categories:	Nurse, outpatient clinic

		functional limitation, pain intensity, personal appearance *NPS: Pain rating (Range: 0:no pain, 10:extremely severe pain)	
Galica et al	*Walking trials (3), average gait speed, total distance length, vibration on for 3min of 6 min trials *Performed: On a 23m elliptical track	*Walking trial time duration: 6 min *Gait speed: taken at 3 min	*Investigators, Not clearly specified
Hartmann et al	*Gait analysis: ambulation in 4 conditions (gym floor, soft foam, spatiotemporal gait factors (gait speed, cadence, step duration/length, use of DynaPort technology) *Falls Efficacy Scale- International (FES), muscle power (knee/ankle joint, Biodex System 3 dynamometer)	*4 gait conditions involve: firm surface (gymnasium floor), soft surface (foam rubber), use/non-use dual task component (count down from 200 by three)	*Investigators, Not clearly specified
Mulford et al	*TUG *BBS *Numeric Pain Distress Scale (pain)	*Level ground ambulation length: 6m with two transfers (sit to stand, stand to sit) *Characteristics of BBS: potential maximum score 56 points (use of ordinal 5-point scale: 0-4, dependent on capacity to execute task, 0: incapable, 4: independent capability) *Numeric Pain Distress Scale: range from 0: no pain to 10: extremely severe pain	*Investigators
Perry et al, Maki et al	*"Gait perturbation protocol"[12p596] with ambulation, center of mass (CoM) and base of support (BOS) measures (lateral displacement, minimum COM-BOS distance with SLS) *Participant set walking pace (speed)	*Characteristics of protocol: 8m length walkway, not level ground, incorporated 6 inclined platforms *Testing: 3 trials (both: insoles), 4 walkway arrangements	*Investigators, laboratory
Stephen et al	*Treadmill ambulation, stride-to-stride variations (step/stride length) *Set speed: 1.4 $m.s^{-1}$	*Walking duration: 30 sec	*Investigators, Not clearly specified

Main Findings

Article:	*General Results:*	*P value data:*
Gross et al 2012:	*Improved SLS, tandem stance time with foot orthoses worn *Significance with outcome (time): following intervention/when participants were given the orthoses	*SLS time Post:Pre (intervention) P=0.002 *Tandem stance time Post:Pre P=0.013 *Tandem gait test quantity steps 2 weeks following intervention P=0.007

		*Alternated step test Post:Pre (P=0.002)
Hatton et all	*Use of textured insoles: No significance found (standing balance) *Immediate testing *Use of textured insoles: significance found with decrease of some spatiotemporal gait factors (gait speed, step/stride) length	*Textured: Smooth insole gait speed P:0.02 *Textured: Smooth insole step length P:0.04 *Textured: smooth insole stride length: P:0.03 *Double-LE support standing Eyes open/closed P>0.05 (AP/ML, CoP speed) *Noted in individual review: limited data from 26 participants used with gait outcomes (error)
Palluel et al, Palluel et al	*Use of spike insoles 5 min duration: Older adults: significance found with reduction of CoP surface area, AP/ML root mean square; young adults: reduction with ML root mean square *Researchers deduce results indicate improved balance stability (CoP)	*Standing session: older adults reduced CoP surface area, AP RMS or root mean square spike: p:0.001,0.003 (t_0:t_5); non spike insole p:0.001,0.004 (t_5) *Standing session: young adults surface area p>0.93, average speed p>0.99, AP RMS p>0.39 (no significance) *No effect found: CoP ML P>0.11; CoP AP P>0.09
Priplata et al	*Use of vibrating insoles for 5 min: significance found with older adults AP/ML root mean square reduction, young adults ML root mean square reduction	*Older adults: young adults ML range P:0.008, critical mean square displacement P:0.012
Qiu et al	*Use of both hard, soft textured insoles: Significance found with reduction AP/ML sway (older adults)	*90% confidence elliptical area of CoP *Noted: Postural sway or C90 area matched older adults: young adults (with soft/firm insoles); ML sway/ML SD matched older adults:young adults (with soft insoles); p<0.05 found in regards to path length (PL), AP/ML sway, ML SD
Wang and Yang	*Use of vibrating insoles: significance found with DFA scaling exponent (AP), older adult participants (fallers)	*older adults: DFA scaling exponents 95% C.I AP direction control: 1.434, 1.547; vibration: 1.329, 1.451; control:vibration p value: 0.009
De Morais Barbosa et al	*Use of foot orthoses: significance found with TUG time (decrease) and BBS (increase with scores) *Significance found: BBS, TUG, NPS, MFPDI (Intervention group post intervention) *Following one month use of orthoses (feet)	*Intervention group: self-report orthotic use >8hrs daily (increased BBS) compared to 4-8hrs daily P<0.022 *Low MFDI scores (better progression) P<0.05
Galica et al	*Use of custom vibration insoles: significance found in both fallers/”non	*Gait analysis significance of participants: stride P: 0.003,

	fallers"[6p523] for stride/stance time variations (decrease in time) *Fallers: decrease in time variations with stride, stance, and swing	stance P<0.001, swing P:0.009 *Gait speed of participants: no effect P:0.19
Hartmann et al	*Use of shoe insoles: no significance found with three groups (gait analysis, muscle power)	*Gait Analysis: Pre intervention significance found regarding: gait speed, cadence, step duration P<0.001 *Pre/post gait analysis improvement: insole group 1-12%, training group: 1-8%, decline with control group: 0 to -5%. *Muscle strength increase: insole group 15 to 79%, training group 20 to 79%, general decline control group -4 to -14%
Mulford et al	*Use of arch supports: significance found post intervention, decrease in time with TUG; BBS scores (increase) *Following 6 weeks intervention (TUG,BBS)	*Berg: Post to Pre intervention p:0.000 *Tug: Post to pre intervention p:0.000 *Numeric Pain Distress Scale: Post to pre intervention p<0.05 (feet, knee, hip, back)
Perry et al, Maki et al	*Use of custom insoles with ambulation: significance found with lateral stability	*Mean lateral stability margin (lateral orientation): Higher (custom:standard insoles) P:0.007; mean stability margin (anterior platform orientation): higher (custom:standard insoles) P:0.035
Stephen et al	*Use of custom vibration insoles: significance found with stride-to-stride variation (decrease with participants who had more gait variability)	*Stride-to-stride variation: some of study participants p<0.001

Original Authors' Conclusions

The researchers' found most of the articles reviewed supported use of a variety of insole types with the older adult population. In consideration of an older adult's overall balance (ex: static, dynamic) or gait capability, as well as use of supplementary insoles like: arch supports, with vibration components, or custom made orthotics; each insole type has demonstrated promising effects for an older adult in this systematic review.

The authors note additional research is necessary in regards to: shoewear design such as with insole characteristics like materials used or shape, effects involved with custom made foot orthoses (ex: sensorimotor, mechanical), participant pre/post intervention balance capability (comparison), shoewear intervention duration length (ex: long-term), and potential confounders (ex: attention to a task).

Small sample size, limited available data analysis (ex: MDC), and exclusion of data for some studies with the authors' Downs and Black scores such as: potential negative effects from an intervention (i.e. shoewear), potential investigator bias, how participants were chosen, or power calculations, were other limitations mentioned by the researchers.

Critical Appraisal

Validity

Strengths: 14 articles assessed by researchers (2 randomized controlled trials), systematic review (a high level of evidence), articles primarily published within the past 8 years (1 article published in 2003), specific inclusion/exclusion criteria, utilization of Downs and Black tool (methodological quality), organization (14 articles divided into 3 main groups or categories), articles appraised utilized outcome measures (ex: TUG, BBS)

Limitations: Pertinent data of the appraised studies was either not available or lacked insufficient detail such as: additional participant characteristics (ex: drop outs, demographic information), study findings or data analysis (ex: confidence intervals, p values, average outcome scores), study characteristics (location, study setting, intervention outcome assessors, blinding of assessors, power calculation), possible bias (common for investigators to assess outcome measures/significance)

Methodological quality: AMSTAR Score: 06/11

Potential sources of bias: One researcher completed preliminary search (possibly limited amount of research evaluated), separate calculation of study significance by researchers not included (potential calculation error)

Interpretation of Results

It's apparent results surrounding use of various shoewear interventions (i.e. types of foot orthoses) with the elderly population are mixed in terms of application to overall balance and gait (ex: TUG, BBS). Both positive and potentially negative results were found and discussed by the authors regarding the shoewear interventions evaluated. An example of positive effect from an orthoses intervention is evident in the de Morais Barbosa et al study,[15] for at completion of the intervention participants performed the TUG with decreased times. A potentially negative result is evident from Hatton et al[11] where following participant double LE support in standing no major clinical findings or significance resulted, so indeed there is a possibility the intervention insole is not effective for older adults (the authors' further compare Hatton et al's[11] results to other studies and provide interesting information/reasoning).

It appears the researchers were correct with their conclusion concerning support or evidence that use of a variety of shoewear interventions with the older population is encouraging, as a majority of the studies demonstrated outcome improvements (ex: TUG, BBS). Certainly, also noted by the authors', it's evident there are various limitations with articles reviewed in this study, such as: number of participants involved, decreased time duration of the investigations (no study length exceeded three months), and lack of standardization with outcomes used. It is quite apparent that more research is needed regarding shoewear interventions (also brought up by the researchers).

However, it's important to note the researchers did not clearly indicate or provide a separate analysis for the fourteen article results including significance. This indicates potential bias or discrepancy with interpretation of the articles' results.

A positive aspect of this systematic review for readers, is the exposure to 14 total articles in place of a critical appraisal of only one journal article.

(2) Description and appraisal of the "Effects of Foot Orthoses on Balance in Older Adults" by Gross MT et al, 2012.

Aim/Objective of the Study/Systematic Review:

The purpose of this investigation was to evaluate the effects of foot orthoses and standing balance ability with the older population. Researchers were particularly interested in potential positive balance effects from use of orthoses. Standing balance ability investigated included both dynamic and static balance.

Study Design

*Single-cohort design (controlled laboratory study)

*There was no random allocation (only a single experimental group)

*Participants were screened by the researchers

*Outcomes taken a total of 3 times (screen, pre/post orthoses, post follow up)

*Intervention assessors were not blinded

*Quantitate data analysis involved: absolute difference calculations, Friedman rank test (alpha=0.05), Friedman rank test with Bonferroni correction

Setting

This study took place in Chapel Hill NC. However, the exact clinical setting of this study was not clearly established. However, it's very likely the intervention took place in an outpatient physical therapy clinic with availability of resources to design the foot orthoses.

Participants

*13 participants, average age of about 82 years, range: 70 to 90 years old, 7 women, 6 men

*<u>Recruitment Strategy</u>: use of flyers throughout the nearby vicinity (retirement communities, senior centers)

*<u>Inclusion criteria</u>: above 65 years old, self-report of a recent fall (within past 12 months), standing balance limitation (SLS test <5 sec), independent ambulator on flat ground (no assistive device, minimum length: 10m), English comprehension, minimum 20/40 vision requirement with or without corrective lenses (Snellen eye chart)

*<u>Exclusion criteria</u>: moderate to severe dementia (<3 on 6-item screener score), LE amputation, recent LE surgical procedure (within past 6 months), neurological condition, vestibular condition, experienced symptoms of weakness, dizziness with changing position (supine/sitting to standing), individuals with foot orthoses, consumption of alcohol, sedatives, cold/narcotic/antidepressant medications, stimulants within a day period (influence with postural stability)

*Drop out data not provided

Intervention Investigated

Experimental

*Baseline screen: personalized orthoses were designed (1st testing session)

*Chief investigator created orthoses

*Chief investigator: extensive past experience with orthotic design (24 years)

*Orthoses: semi-rigid materials, inclusion of thermal cork, NickelPlast, heel lift, accounted for: limb length inequality, dorsiflexion, lower quarter structural alignments (ex: tibial varum, genu varus), optional metatarsal pad (participant comfort)

*2nd testing session (PRE/POST): roughly 2 weeks after baseline screen, primary outcomes re-tested with and without orthoses, optional: orthotic modifications (participant comfort)

*Orthoses regimen: maximum daily use of orthoses was requested (by investigators), use of self-report daily log (orthoses duration)

*3rd testing session (follow up): roughly 2 weeks after second testing session, primary outcomes re-tested

Outcome Measures

*The researchers administered the outcome measures

*Participants tested in casual shoewear (walking/tennis shoes)

*Screen tests: 6-item screener test (cognition >3 mistakes), Single leg stance test or SLS (3 trials, ≥5 sec, self-chosen LE)

*Primary measures: Single leg stance test, tandem stance test, tandem gait test, alternating step test

*SLS: both LE, length of time: maximum duration, use of stopwatch, 3 trials (average)

*Tandem stance test: tandem stance position (with both LE leading), duration: up to 30 sec, use of stopwatch, 3 trials (average)

*Tandem gait test: walking path 12cm diameter (marked with tape), up to 20 steps, 3 trials (average), correct foot placement noted (quantity of steps)

*Alternating step test: duration: 20 sec, quantity of alternated steps, 3 trials (average), adapted from Berg Balance Scale

*Secondary measures: height, weight, age, bilateral LE structural alignment screen (abnormalities noted)

Main Findings

Among the 13 participants there was a high combined average of about 11 reported falls within the past year. However, the researchers report a reduced quantity of falls was more common (<4 falls). Duration length concerning daily orthotic use varied between participants, from as little as 4 hours to about 14 hours. Furthermore, participants tolerated use of the orthoses well, for there were no major complaints and there was only one orthotic adjustment. Participants were tested within approximate two week intervals, at most there was a 7 day difference.

Significance was found with both the pre and post orthotic test session, as well as with a comparison of the pre orthotic and follow up test session. Listed p values for the former sessions concerning the 4 outcome measures is available in Table 4, a few examples of given p values were 0.001 and 0.002. Positive changes throughout the study in regards to the 4 outcome measures, is available in Table 2, for instance: the average SLS time increased from 3.3 sec (screen session) to 8.1 sec (post orthotic session).

Original Authors' Conclusions

The authors conclude their investigation supports use of personalized orthoses with the older population. The researchers further distinguish which types of older individuals may benefit from an orthotic intervention. Older individuals who have fallen repeatedly in the past, or who have instability while standing or walking are among those who could benefit.

The researchers further highlight when significant results were found during the investigation. Two particular instances mentioned were the follow up and the pre/post orthotic sessions. The researchers especially noted the SLS, tandem stance, and alternated step test demonstrated significance with data analysis for the post orthotic session and follow up session (versus PRE). There were also promising results with the tandem gait test within the pre/post orthotic session (difference of a 2 step average). The authors further comment on the possibility of positive residual impact due to the orthoses intervention (data analysis).

The researchers also acknowledge study limitations such as: participant selection, study duration length, decreased available research (orthotics, balance), lack of standard shoe type (self-chosen tennis shoe), possible study bias (gait belt CGA), omission of supplemental tests (ex: proprioception, strength, reaction time), and lack of a control group. Also, other relevant research with the older population is further mentioned and discussed by the authors.

A few study strengths noted by the researchers involved: assessor quality with measurement performance (statistical analysis), and support from evidence with included outcome measures,

Researchers advocate for more orthotic investigations. One research suggestion involves increased study duration and orthotic use (effects). Investigators are also interested in potential impact of an orthotic intervention with decreasing falls risk and effects on general mobility. The authors further mention cost effectiveness related to orthoses, can be another area of new research. (ex: fall medical costs, types of orthoses).

Critical Appraisal

Validity

<u>Strengths:</u> recent study (2012), specific inclusion/exclusion criteria, organization, inclusion of outcome measures (ex: SLS), study findings (significance found), data analysis

<u>Limitations:</u> Methodological quality, level of evidence (2b), insufficient detail for both participant and study characteristics (ex: drop outs, demographic data, study setting), lack of a power calculation and blinding of assessors, possible bias (assessors, participants), no standard shoe style (self-chosen tennis shoe), possible study bias (gait belt CGA), no inclusion of additional tests regarding peripheral vision, sensation, muscle strength, proprioception, reaction time, no control group

<u>Methodological quality:</u> Revised D&B score 15/23, 2b

<u>Potential sources of bias:</u> assessor (outcome measures), participant selection (volunteer), participants (self-report logs)

Interpretation of Results

It seems the researchers are correct concerning the impact of orthotic use with participants in this investigation. Clearly study participants did make gains in regards to balance capability with each of the included measures. For instance, Figure 2 shows both the post orthotic and follow up session test measures were for a longer duration than the baseline measures. Another example of positive results is evident in Figure 3, which also demonstrates longer tandem stance hold duration at post orthotic and follow up sessions, in contrast to baseline (ex: baseline about 16 sec, post orthotic session about 25 sec).

The authors presented their investigation in a detailed, organized, and efficient manner. Both study strengths and limitations were mentioned in a very thorough manner by the researchers. One other possible limitation is inclusion of the self-report log. There is a chance of recall bias with self-report measures.

Indeed this investigation shows promise for future research, given the progress made within only 2 weeks. Concerning future orthotic research, certainly inclusion of self-reported falls and possible inclusion of another objective measure like the BERG could potentially help indicate intervention changes. The authors presented

other potential important areas to further address with the older population besides frequency of falls, such as: sensation, strength, and proprioception.

(3) Description and appraisal of "Footwear and Falls in the Home Among Older Individuals in the MOBILIZE Boston Study" by Kelsey et al, 2010.

Aim/Objective of the Study/Systematic Review:
The objective of this longitudinal study was to review likelihood of falls due to various shoewear conditions with the older population. Two non shoewear conditions investigated were use of socks or being barefoot, as well as use of slippers as a shoewear condition. Rearchers reviewed data collected to determine associations of these various shoewear conditions with chance of falls.
Study Design
*Prospective Cohort *Investigation signup period: September 2005 to December 2007 *Baseline outcomes (taken once) *Quantitate data analysis involved: negative binomial regression model, logic regression model *Blinding: assessor characteristics not clearly identified *Primary outcomes measured: baseline (location: participant home) *Secondary outcomes measured: throughout study duration *Random sample selection *Intervention group allocation did not apply to this study
Setting
*Areas nearby Boston, MA *Participant homes *Characteristics of home settings not given (i.e. apartment, house, town home)
Participants
*765 participants, total potential sample: 5655 *Age: 70 years old and above, average age: 78 years, range: 64 to 97 years *Quantity of falls within last year of study: about 63 percent (482 participants): 0 falls, about 30 percent (230 participants): 1-2 falls, about 6 percent (46 participants)t: 3-5 falls, about 2 percent (15 participants): over five falls *Gender: about 36 males, 64 females *Ethnicity: majority of participants were White (78 percent), followed by African American (about 16 percent), other ethnicities were under 3 percent (American Indian, Asian) *Education background: graduate degree (31 percent), high school (23 percent), college (15 percent), college or technical school experience (19.2 percent), did not graduate high school (11.1 percent) *Recruitment strategy involved: random selection, use of yearly town household listings, "door-to-door"[3p2] approach with households *Inclusion criteria: households with 1 person who met age requirement (at minimum, 70≥ years), English comprehension, independent ambulator for at minimum 20ft, plan to remain local for 2 years, Mini-Mental Status Examination of 18 points (at minimum), appropriate hearing capability for study follow up (via phone), appropriate vision to review print sources *Number of dropouts not included
Intervention Investigated
*Researchers monitored participants over an average of 27.5months

*Study duration length: 0.5 to 44.4 months

*Phone interviews used: participant self-report of 1≥ fall with study calendar, tardiness or unfinished self-report calendar mailed

*Fall criteria: unplanned, injury occurrence, happened within household

*Serious injury criteria included: sprains, dislocations, fractures, muscle tear or strain, ligament or tendon involvement

Outcome Measures

Baseline measures: recorded at home visit, clinical assessment

Primary measures: custom questionnaire specific to shoewear (extensive list selection), falls risk measures such as BERG Balance Scale, gait speed, physical function: SF 12 score, exercise: PASE score, participant self-reported monthly falls amount

Secondary measures: phone interview

*Study does not specify the baseline assessors, "trained interviewers"[3p2]

Main Findings

The researchers found out of a large selection or 9 categories of shoe types, only a few select types of shoes were predominantly used. Thirty six percent or about 275 participants preferred tennis shoes and oxford shoes were second most popular, at about 26 percent or 1999 participants (daily wear). The other top two shoe classifications for typical wear were loafers and slipper shoe styles, while the less common shoe styles were sandals, boots, socks, or bare feet.

In regards to quantity of falls recorded, a total of 1,647 occurred by study completion. However, this large number of falls were only associated with 485 participants. Approximately one-fifth of the data specific to shoewear style worn when the participant fell was not established. Only slightly less than fifty percent of the total falls with data concerning shoe style worn, had the fall location be within the participant's household and not elsewhere.

Researchers also did not find a relationship between recorded falls (frequency) and shoe style primarily used at study completion. Three particular shoewear conditions including use of socks, loafers, or barefoot, were related to a large portion (roughly 50 percent) of recorded falls, even with further comparison and examination of the participant data. With further data analysis involving these former shoewear conditions, researchers discovered in relation to non-serious and more severe injury, there was an increased chance for severe injury when results excluded some conditions like medical issues or dizziness.

Original Authors' Conclusions

Authors conclude type of shoewear used by participants (at home) does influence likelihood of fall occurrence. Specific to the nine shoewear conditions studied, the three associated with injury (severe) are important to consider. These three shoewear conditions were being barefoot, sock or slipper use. Researchers advocate for additional research, especially in regards to shoewear used (falls), safe shoewear (ex: design), and the three shoewear conditions associated with both increased falls and injury risk. Researchers further recommend fall prevention interventions promote increased use of shoewear with the older population.

In the discussion section, the authors also mention beneficial study characteristics. A few of these attributes relate to the participant sample, such as quantity of participants and random selection. The researchers also recognized one possible study design limitation pertained to lack of an additional study group (ex: non fallers). Another weakness authors noted was the omission of specific shoe style features (ex: shoe tread, contact area, shoe fit). Throughout the discussion section the researchers include several relevant studies and further comment on more study weaknesses. Other examples of study weaknesses involve: interview survey questions, use of self report measures, and participant selection (application to general population).

Critical Appraisal

Validity

Strengths: study tracking duration length (1 year: 93 percent of study sample), statistical analysis (accounted for possible confounding, gender or age variability, multiple calculations), participant sample (random selection, quantity), fairly recent study (2010)

Limitations: self-report measure (calendar falls report), phone interview (recall), lack of shoewear data for recorded falls, one study group, no inclusion of shoewear features, no inclusion of participant drop out data, no information on assessor blinding, insufficient detail with participants and home environment (i.e.

apartment, stairs, medical conditions), level of evidence (2b), lack of repeated clinical baseline measures (ex: BERG, gait speed)

Methodological quality: Revised D&B Score: 14/21

Potential sources of bias: possible participant recall bias with self-report measure and phone interview, possible assessor bias (outcome measures)

Interpretation of Results

In consideration of the various shoewear conditions evaluated, the authors conclusions appear valid concerning the relationships found with falls risk and type of shoewear used. Certainly after consideration of the nine showear conditions, it would seem very likely having decreased shoewear support such as when one is barefoot or using slippers in contrast to shoewear conditions of increased support, like tennis or oxford shoes would affect fall outcomes. As the researchers mentioned, there is indeed possibility of decreased standing stability with some shoewear conditions, such as stocking use.

Although no study design is flawless, this study had a few positive characteristics. The researchers were able to follow a group of 765 participants over an increased span of time, which is not usually feasible for research investigations. Another positive study characteristic was participant selection was not biased. Moreover, participants selected were not volunteers or a convenience sample made by the researchers, and were randomly chosen.

The researchers also noted there were some study limitations. This study may have benefitted from inclusion of frequent objective outcome measures throughout the course of study instead of only at baseline. The researchers did not provide sufficient details related to participant characteristics, such as medical conditions and usual level of physical activity. Also, inclusion of manual muscle or functional lower body strength testing would of given the readers a clinical depiction of the participants. Another study weakness identified pertains to omission of participant household characteristics. It's possible home environments had various designs which contributed to more falls for some individuals than others. Some examples of possible contributing factors for falls are: a rug, clutter, or close proximity of furniture with walkways.

EVIDENCE SYNTHESIS AND IMPLICATIONS

Implications for future research:

Evidence presented within the three articles can be applied to my clinical scenario of a patient with a repeated falls history and a low BBS score.[3,4,6] However, given the variety of levels of quality with the evidence additional research and review of material is warranted.[3,4,6,13] Multiple areas of study weaknesses were found throughout each of the critically appraised articles.[3,4,6] Some common limitations noted consisted of: limited assessor blinding, lack of standardization with outcome measures, insufficient inclusion of participant or study characteristics (ex: study location, demographic information, past medical history), lack of a control group, and limited participant drop out or follow up data.[3,4,6]

Regarding my clinical question about falls risk and whether proprioception or non-supportive shoewear may be more influential, it appears no definite answer is available.[3,4,6] Future research may be able to help distinguish a response to this question, and certainly evidence so far demonstrates shoewear (ex: orthoses, type of shoe) does seem to play a part with balance.[3,4,6]

Potential future areas of research related to proprioception and shoewear include: type of shoewear typically used (amount of support, comfort, fit, safety), type of orthotic materials used (ex: custom, insert), orthoses effects (balance, falls, neurophysiology), cost-effectiveness of various orthotic materials, associated healthcare costs, and investigation of other areas that can impact balance (ex: sensation, reaction time).[3,4,6] Additional longitudinal, systematic reviews, or cohort studies with both a control and experimental group are needed.[3,4,6] Moreover, study investigations which include a variety of outcome measures (ex: strength, mobility), have a longer duration (ex: one month), and avoid assessor, participant, and participant selection bias (blinding, recall, volunteer) can help improve quality of evidence used by clinicians.[3,4,6]

Implications for clinical practice:

Quality of evidence available to help guide clinical practice is mixed.[3,4,6,13] There was mid to lower range in quality of evidence found with the top 10 search results with a range of level 2A to level 3.[13] This indicates there is certainly an insufficiency of higher level studies available for clinical practice use. However, an exception to the other article types included such as a cohort study, there were 2 systematic reviews also in the top 10 search results, which are certainly higher quality studies in comparison.[13] In regards to methodological quality of the top 10 search results, none of the revised PEDro scores had a numerator over 15 points, and the two systematic review scores were also somewhat low with 6/11 scores.

Although available research reviewed regarding proprioception and shoewear with falls risk was not of the highest quality level, this research can still help promote changes with clinical practice, such as with my patient. For example, as a PT clinician I can potentially include an orthotic intervention to supplement current therapy.[4,6] I can also use objective outcome measures which are evidence based like the BBS, SLS, or TUG test.[3,4,6] As patient education is certainly a large portion of therapy, I can further educate my patient on topics covered in the literature such as: shoewear use (in the home) or provide patient education about falls risk statistics (ex: likelihood to fall within home, healthcare costs due to falls).[3,4,6] Other physical therapists who work in a geriatric setting may be able to find ways to also educate other professional peers in their work environment (ex: in-service) or potentially programs associated with falls risk about study findings (ex: shoewear, orthotics).[3,4,6]

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