Up-to-Date Shoe-Wear Recommendations for Balance & Special Considerations

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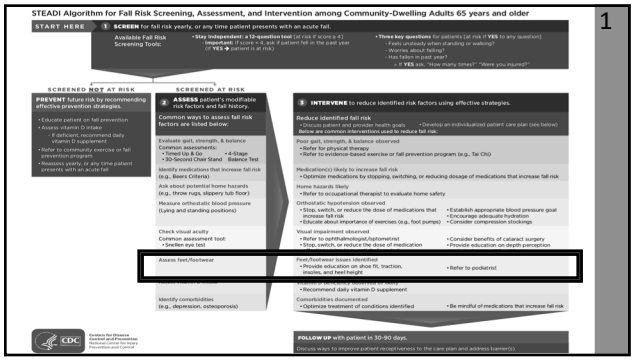
Objectives

1. Identify the most up-to-date shoe-wear recommendations for balance
2. Understand the reasoning and physiology behind shoe-wear recommendations
3. Identify how foot pain and deformities can hinder balance and a way to intervene
4. Engage in interdisciplinary discussion about obstacles and challenges in home health

Objectives cont.

5. Understand the evidence for special considerations (dementia, diabetes, and chronic conditions)
6. Learn about UNC DPT's experience in Guatemala and relevant barriers
7. Understand current research and implications for future research

Fall Risk Screening/Evaluation



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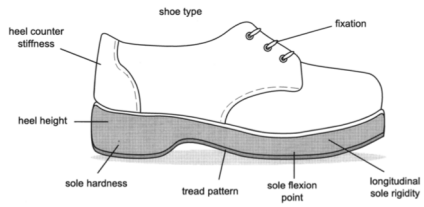

Anatomy of a Shoe[2]

Disclaimer…[3]

Balance*

- Measures
  - BBS, FGA, TUG, 4 Stage Balance Scale
- Can easily track in studies and therapy

Falls**

- Need to track over time
  - Difficult
- Indirect prediction via some balance measures

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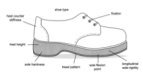
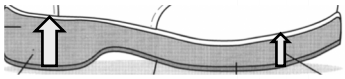
Shoe Characteristics



1. Heel Height/ Heel Lift[2,4,5]



Heel Lift[3,6-8]

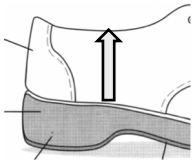
Avoid:

- > 2.5 cm/ ~1 in heel lift in any type of shoe**
  - Supination at heel strike**
  - Anteriorly-shifted COP*
  - Reduced BOS

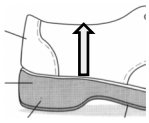
Look for:

- < 2.5 cm/ ~1 in heel lift
  - Shoe stores should have this info

2. Collar Height[2]



Collar Height[3,6,7,9]

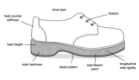


Avoid:

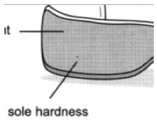
- Low-collared shoes*
  - Less stability at TCJ and STJ

Look for:

- High-collared shoes
  - Increases proprioception*
  - Improves frontal plane stability



3. Sole Rigidity & Thickness[2,4]



Sole Rigidity and Thickness[3,5,6,8]

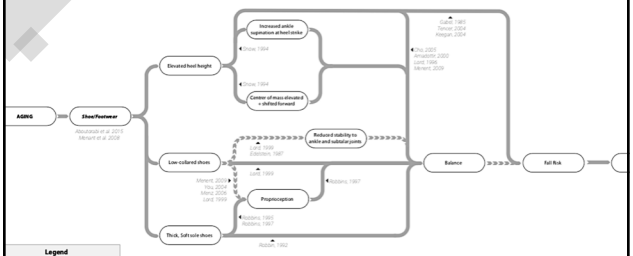
Avoid:

- Compliant soles*
  - < A-33 density
- Thick soles*
  - Both increase postural sway
- Flexible soles

Look for:

- Firm soles*
  - A-50 density
- Thin soles*

3



4. Outsole Characteristics[4]

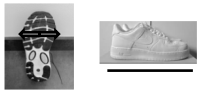
Outsole Characteristics[3,6-8]

Avoid:

- Narrow BOS*
- Rocker bottom/ convex sole

Look for:

- Wide base
- Flat soles
  - Textured soles to avoid slipping



5. Insole Characteristics[4]

Insole Characteristics[3,6-8,10]

Look for:

- Rigid
- Textured
  - i.e. spiked, ridged*
- Vibrating
- Proactive
  - ~ 1.75 cm arch height

6. Shoe Type and Specs

Shoe Type[3,6-7,9]

Avoid:

Look for:

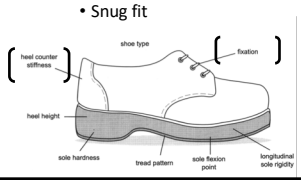
Additional Shoe Features[3,4-5,7,9]

Avoid:

- Elastic, absent or unfastened laces
- Flexible heel counter
- Poorly fitting shoes
- Worn shoes

Look for:

- Standard laces
- Firm heel counter
- Snug fit



Shoe-Wear Assessment Form[2]

- 7 consistent variables used in research
- Good starting point

General shoe style/covering
❍ barefoot ❍ socks only ❍ stockings only ❍ backless slipper
❍ mule ❍ high heel ❍ courtshoe ❍ boot
❍ slipper ❍ sandal ❍ moccasin ❍ athletic shoe
❍ walking shoe ❍ Oxford shoe ❍ ugg boot ❍ thong
❍ surgical/bespoke footwear

Heel height
❍ 0-2.5 cm ❍ 2.6-5.0 cm ❍ >5.0 cm

Fixation
❍ none ❍ laces ❍ straps/buckles ❍ Velcro™ ❍ zips

Heel counter stiffness
❍ minimal ❍ <45° ❍ >45°

Longitudinal sole rigidity
❍ minimal ❍ <45° ❍ >45°

Sole flexion point
❍ at level of MTPJs ❍ before MTPJs

Tread pattern
❍ textured ❍ smooth (i.e. no pattern) ❍ partly worn ❍ fully worn

Sole hardness
❍ soft ❍ firm ❍ hard

Internal Foot/Ankle Characteristics

1. Plantar Soft Tissue and Sensory Changes

Soft Tissue Changes[3]

- Poor tissue hydration
  - Flattening of fat pads
  - Increased stiffness
- Sensory loss
- Decreased proprioception**

- Indirect relationship with falls/balance
- Direct relationship with **pain** and **deformities** → associated with balance impairments and falls

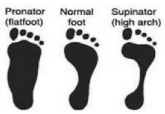
2. Foot Deformities

Hallux Valgus**[3,11,12]

- Strongest relationship with falls
- Associated with impaired PF strength
- Tx
  - Tape, stretch
  - Shoes with wide toe box
  - Cushion for pressure relief
  - Orthotics
    - Addresses other deformities
    - Decreases pronation
  - Surgery?

Pes Planus*[3,8]

- Medial loading + pain
- Poor position, poor mechanoreception
- Associated with presence of other deformities that drive pronation
  1) Forefoot varus
  2) Tibial varum/ Genu varus
  3) Tight triceps surae
- Tx
  - Supportive shoes
  - Orthotics

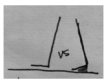


Pes Planus* cont.[8]

1) Forefoot varus
- Posting strip: medial forefoot wedge

2) Tibial varum/ Genu varus
- Posting strip: medial rearfoot wedge

3) Tight triceps surae
- Heel lift
- Arch cookie
- Stretch



Drivers of Pes Planus and Insole Modification Summary[8]

Pes Planus	Insole Posting	Reasoning
1) Forefoot Varus	Medial forefoot post	Less driving force into pronation
2) Tibial Varum or genu varus	Medial rearfoot post	""
3) Tight triceps surae	Heel lift	Less ROM at TCJ needed during gait. Prevents compensatory motion @ other joints

3. Ankle ROM and Strength

Ankle ROM and Strength[3]

ROM
- Limited ROM**
  - DF @ TCJ
  - DF @ 1st MPJ
  - Inversion/eversion
- Tx
  - Multimodal interventions best**

Strength
- General m mass loss**
  - Type II > Type I
  - Poor power/ F production
- Poorer neural activation
- Tx
  - General strengthening program**
  - Specific foot/ankle strengthening**

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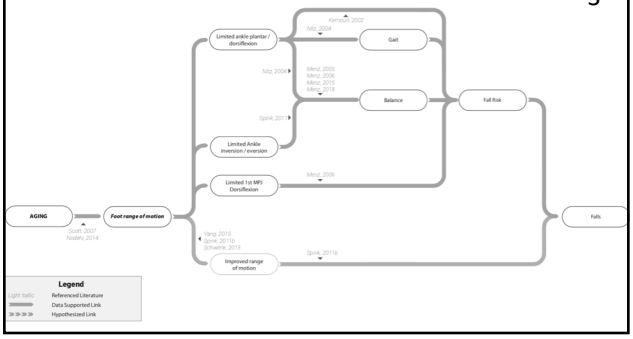

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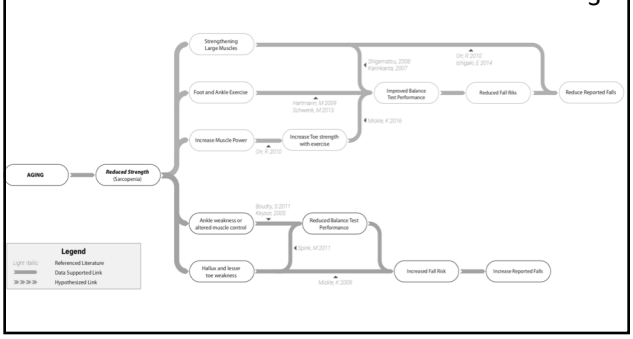


4. Pain

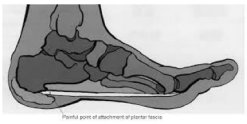
Foot Pain**[3,10,13]

- Strongest link to falls
- Associated with deformities and sensory impairment
  - Pes planus*
  - Plantar fasciitis**
  - Arthritis**
- Mechanisms
  - Fear of falling, gait deviations, reduced PA, less NM activation
- Tx
  - "Multimodal podiatry intervention"
  - Custom orthoses

Treatment[8,14]

Plantar Fasciitis

- Risk factors
  - Limited DF @ TCJ
  - High BMI
  - Runners
  - Work
- Tx
  - Manual therapy
  - Stretch
  - Taping
  - Orthotics to address deformities



Treatment[3,8,15]

Metatarsalgia

- Change in distribution of weight
  - i.e. Pronation loads medially
- Tx
  - Metatarsal pad
    - Immediately proximal to metatarsal head(s)
  - Orthotics to address deformities
  - Avoid high heels

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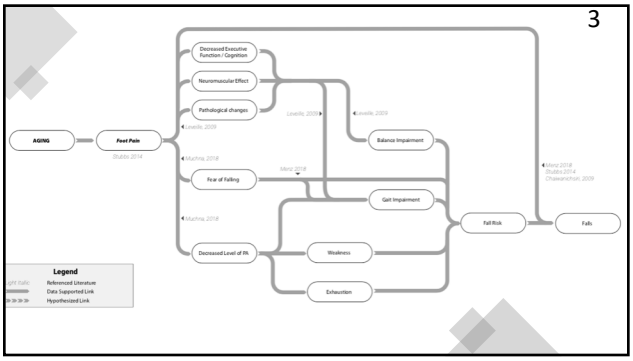

Orthotics/Insole Modifications

- ✓ROM
- ✓Deformities
- ✓Pain

Guatemala Research Plan

- Screen for falls
- Assess feet
- Pre-intervention balance measures
- **Insole modifications**
- Post-intervention balance measures
- General shoe recommendations
- Survey for feasibility

Research: Night-Time Falls in SNF Residents with Dementia

- Falls prevention in individuals with dementia
- Effectiveness of lighting surrounding bathroom doors
- Shoe-wear patterns I have seen
  - Shoe and/or orthotic intervention as a future capstone?

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Special Considerations | Dementia[16]

- General shoe-wear recommendations
  - + Velcro® fixation

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LET'S TALK

Special Considerations | Diabetes and Neuropathy[3,17,18]

- Prophylactic measures
  - Daily inspections + self-care
  - Avoid barefoot/sock walking & sandals/slippers at all times!
  - Change shoes regularly
- Diabetic ulcers
  - Off-loading foot-wear
  - Custom shoe-wear to ensure good fit

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Summary

- **Favorable Shoe Characteristics:**
  - Low heel height
  - High collar & stiff heel counter
  - Thin & rigid soles
  - Flat & wide outsoles
  - Athletic or canvas shoes
  - Wear shoes!
- **Foot characteristics**
  - Address foot deformities, pain, ROM deficits, and strength
  - Aim for neutral alignment for best proprioception
- **Implications for future studies**
  - Long-term benefits?
  - Include the exclusion criteria!

References

1. Algorithm for Fall Risk Screening, Assessment, and Intervention. Centers for Disease Control and Prevention. https://www.cdc.gov/steadi/pdf/STEADI-Algorithm-508.pdf. Published 2019. Accessed February 29, 2020.
2. Menz HB, Sherrington C. The Footwear Assessment Form: a reliable clinicaltool to assess footwear characteristics of relevanceto postural stability in older adults. *Clin Rehabil*. December 1999.
3. Neville C, Nguyen H, Ross K, et al. Lower-Limb Factors Associated with Balance and Falls in Older Adults: A Systematic Review and Clinical Synthesis. *J Am Podiatr Med Assoc*. November 2019. doi:10.7547/19-143
4. Anatomy of the Shoe. Shoe Guide. https://www.shoeguide.ca/shoe_anatomy/. Published February 20, 2019. Accessed April 13, 2020.
5. Richie D. Heel Elevation In The Shoe: What The Literature Reveals. PodiatryToday. https://www.podiatrytoday.com/heel-elevation-shoe-what-literature-reveals. Published November 1, 2018. Accessed April 14, 2020.
6. Aboutorabi, A., et al., A systematic review of the effect of foot orthoses and shoe characteristics on balance in healthy older subjects. Prosthet Orthot Int, 2016. 40(2): p. 170-81.
7. Gross MT. Shoe Wear Recommendations for the Older Adult. *Clin Geriatr*. May 2010.
8. Gross MT, Mercer VS, Lin F-C. Effects of foot orthoses on balance in older adults. *J Orthop Sports Phys Ther*. 2012;42(7):649-657. doi:10.2519/jospt.2012.3944
9. Panel on Prevention of Falls in Older Persons, American Geriatrics Society and British Geriatrics Society. Summary of the Updated American Geriatrics Society/British Geriatrics Society clinical practice guideline for prevention of falls in older persons. J Am Geriatr Soc. 2011;59(1):148-157. doi:10.1111/j.1532-5415.2010.03234.x
10. Gillespie LD, Robertson MC, Gillespie WJ, et al. Interventions for preventing falls in older people living in the community. *Cochrane Database Syst Rev*. 2012;9:CD007146. Published 2012 Sep 12. doi:10.1002/14651858.CD007146.pub3
11. PodiatryToday. Tailoring Orthotic Modifications For Hallux Valgus, Flexible Hammertoe Deformities And Morton's Neuroma. *PodiatryToday*. 2018;31(4):22-23. https://www.podiatrytoday.com/tailoring-orthotic-modifications-hallux-valgus-flexible-hammertoe-deformities-and-morton's-neuroma. Accessed April 14, 2020.
12. Bunions (Hallux Valgus): Management and Treatment. Cleveland Clinic. https://my.clevelandclinic.org/health/diseases/14386-bunions-hallux-valgus/management-and-treatment. Published October 31, 2016. Accessed April 14, 2020.
13. Menz HB, Auhl M, Spink MJ. Foot problems as a risk factor for falls in community-dwelling older people: A systematic review and meta-analysis. *Maturitas*. 2018;118:7–14. doi:10.1016/j.maturitas.2018.10.001
14. Martin RL, Davenport TE, Reischl SF, et al. Heel pain-plantar fasciitis: revision 2014. *J Orthop Sports Phys Ther*. 2014;44(11):A1-33. doi:10.2519/jospt.2014.0303
15. Physical and Occupational Therapy Clinical Practice Guidelines: Metatarsalgia. LANDMARK Healthcare. http://uni.ithhealthcare.com/RobotHelp/PT%20OT%20CPG/Orthopedic_-_Lower_Extremity/Metatarsalgia.htm. Published 2011. Accessed April 15, 2020.
16. REDUCING RISK OF FALLS FOR PEOPLE WITH DEMENTIA. Alzheimer Society of Manitoba. https://www.alzheimermb.ca/wp-content/uploads/2013/09/2014-Dementia-Fall-Risk-Checklist-template.pdf. Published November 2016. Accessed April 15, 2020.
17. Bus SA, Lavery LA, Monteiro-Soares M, et al. Guidelines on the prevention of foot ulcers in persons with diabetes (IWGDF 2019 update). *Diabetes Metab Res Rev*. 2020;36 Suppl 1:e3269. doi:10.1002/dmrr.3269
18. Lazzarini PA, Jarl G, Gooday C, et al. Effectiveness of offloading interventions to heal foot ulcers in persons with diabetes: a systematic review. *Diabetes Metab Res Rev*. 2020;36 Suppl 1:e3274. doi:10.1002/dmrr.3274

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