Using Pedorthic Modalities to Prevent Falls in the Elderly

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Goals:
Understanding
Opportunities
Programs
Research
Falls Prevention?

• Falls are the second leading cause of accidental death in the United States
• Seventy five percent of falls occur in the older adult population
• 70 billion dollars a year are spent on health care and rehabilitation as a result of falls
Older Adults are more Vulnerable!

- Preventable injuries such as injuries caused by falling down have increased dramatically year after year among people 65 and older.
- In 2006, the Centers for Disease control reported that unintentional falls were the #1 reason adults over 45 visited the emergency room.
Facts About Falls

• Thirty percent of the people over 65 will fall each year
• In 2006 ninety percent of the 380,000 hip fractures treated annually occurred as a result of a fall
• There were 1,050 hip fractures a day in 2006
Facts About Falls

- As baby boomers increase in age, the face of the American population will change dramatically.
- It’s estimated that every day 10,000 people now turn age 65.
- By the year 2030, a projected 71 million Americans will be age 65 or older, an increase of more than 200 percent from the year 2000, according to the U.S. Census Bureau.
Break Down of Total Falls in 2010

- Ages 45-54: 817,043
- Ages 55-64: 633,428
- Ages 65+: 1,840,117
After Falls

• Nearly 66% are discharged to nursing facilities

• About 50% will not return to independent living

• Up to 30% of all hospital based falls result in serious injury.
1/3 of the People that Fall, sustain a hip fracture and are hospitalized, Die Within One Year!
The Fear of Falling Produces

• Cycle of fear
• Loss of self confidence
• Inactivity
• Decreased quality of life
• Poor health
• All increasing the risk of falls even more
YOU CAN DO SOMETHING ABOUT THESE NUMBERS!
Shoes, BUT MUCH MORE!

- Aging
- Diabetes
- Peripheral Neuropathy
- Arthritis
- Vascular issues
Aging

- Balance issues, imbalance
- Speed of gait
- Strength/weakness
- Timing
- Tripping
- Side effects of medicine
- Postural sway
- Visual Issues/Sight
Diabetes

- Potential ulcerations
- Potential amputations
- Loss of sensation
  Hands
  Feet
- Visual issues
- Balance problems
Peripheral Neuropathy

- Loss of sensation
  - Feet
  - Hands
- Compromised muscle function
- Sight issues
- Hydration issues
- Proprioception
Arthritis

• Pain
• Deformities
• Loss of function
• Motion limitations
• Surgical issues
• Loss of fatty tissue
Vascular

- Compromised healing
- Dry skin
- Cracked skin
- Temperature regulation
Multi-factorial Causation

Intrinsic Risk Factors
- Gait & balance impairment
- Peripheral neuropathy
- Vestibular dysfunction
- Muscle weakness
- Vision impairment
- Medical illness
- Advanced age
- Impaired ADL
- Orthostasis
- Dementia
- Drugs

Extrinsic Risk Factors
- Environmental hazards
- Poor footwear
- Restraints

Precipitating Causes
- Trips & slips
- Drop attack
- Syncope
- Dizziness

Generalized Deconditioning

FALL
Muscle weakness, gait impairment, and poor balance are critical parts to one’s risk of falling.

These are all factors that can be modified by clinicians with several key tools.
Four Key Components To Address Balance Concerns

1. Fall Risk Assessment – A means by which you can measure a patient’s balance objectively. (Either with special equipment or with simple tools)

2. Strength Training Program - Physical Therapy/Occupational Therapy: collaboration with a therapist who has experience with balance/fall prevention.
3. Ancillary Services/DME Assistive Devices - Custom AFO designed to stabilize and support the body to help prevent imbalance

4. Patient Education – The risks and what they can do to reduce their risk of falling.
It All Starts Here...

The Assessment
### Table 1. Screening tests for balance deficits

<table>
<thead>
<tr>
<th>Test</th>
<th>Method</th>
<th>Scoring</th>
<th>Interpretation</th>
</tr>
</thead>
</table>
| Single leg stance test | Observe patient standing on one leg with their eyes open on a firm surface for 10 seconds. Repeat two more times. | 1: completed all three trials  
2: completed one or two of three trials  
3: unable to complete any trials | A score of 2 or 3 indicates significant sensory and strength impairment |
| Timed Up and Go (TUG) test | Patient to stand from being seated in a chair, walk at a comfortable speed for 3 metres to a line on the floor, turn, return to the chair, and sit down. | Time in seconds from beginning to end of test | A time of 15 seconds or longer identifies those with a high risk of falling |
**Moore Balance Functional Fall Risk Assessment Tool**

<table>
<thead>
<tr>
<th>Vestibular (Dizziness)</th>
<th>3.5</th>
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<tbody>
<tr>
<td>0</td>
<td>No complaints of dizziness</td>
</tr>
<tr>
<td>6</td>
<td>Intermittent complaints of dizziness</td>
</tr>
<tr>
<td>10</td>
<td>Dizziness that interferes with ADLs</td>
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<table>
<thead>
<tr>
<th>History of Fall, Near Falls</th>
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<tbody>
<tr>
<td>3.4.8.10.11</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>6</td>
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<table>
<thead>
<tr>
<th>Walk and Talk</th>
</tr>
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<tbody>
<tr>
<td>6</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>10</td>
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</table>

<table>
<thead>
<tr>
<th>Foot Deformity</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
</tr>
</tbody>
</table>

**Grading of falls risk: Circle total score**

- **0-9**: Low falls risk
  - Implement actions for identified individual risk factors, & recommend health promotion behavior to minimize future ongoing risk (eg – increased physical activity, medication assessment, good nutrition, footwear assessment, Podiatric specialist referral, home safety education).

- **10-20**: High falls risk
  - Implement actions for identified individual risk factors, and implement additional actions for high falls risk (Fall Prevention Center referral, home safety assessment and education, medication assessment, footwear assessment, Physical/Occupational Therapy referral, Moore Balance Brace, other assistive devices as needed).

- **>20**: Extreme falls risk
  - Implement actions for identified individual risk factors, and implement additional actions for extreme risk (Fall Prevention Center referral, implementation of home modification devices [e.g. bathing, toileting and stairs] care giver education, medication assessment, footwear assessment, Physical/Occupational Therapy referral, Moore Balance Brace, other assistive devices as needed).
Find a Shoe to Address All These Issues??

- Starts with Shoe evaluation
- Shoe fit
- Shoe construction
- Soles
- Shoe modifications
Shoe Evaluation

- Sole wear
- Compression of midsole
- Loss of support
- Loss of cushioning
- Worn insole
- Worn linings
Professional Shoe Fitting

• The “Fore Foot” test
Professional Shoe Fit

• What to measure
• When to measure
• How to evaluate proper fit
Professional Shoe Fitting

The Brannock device
Invented by Charles Brannock in 1926-27, in New York USA
Professional Shoe Fitting

• The Brannock Device provides the following information:
  – Heel to toe length
  – Heel to ball (1st MPJ) length
  – Width, but
  – does not measure “depth” or volume
Professional Shoe Fitting

- The shape of the shoe must fit the shape of the foot
Professional Shoe Fitting

- **Foot elongation weight bearing**
  Toe 3/8” to ½”
  (orthotics will influence this)

Some heel slip is normal
(but not always tolerated)
Shoe Construction, Parts of a Shoe

- Lasts
- Components of a shoe
- Materials
- Closures
- Lack of closure???
Soles

• Traction/sticky
• Smooth
• Weight
• Materials
• Shapes
  • Wedge
  • Heel
• Combinations
SHOE ANATOMY

- Must have a variety of sole unit options
Shoe Modifications

- Stretching
- Tips
- Rocker soles
- Flares
- Counter modifications
- Upper Modifications
Last Shoe Thoughts?

- Two pair???
- Shoe horns, long handle
- Buy in person, not mail order
Postural Sway

- Increased postural sway is a significant risk factor for falling.
- This can be managed by appropriate footwear and stability around the foot and ankle.
- Most falls occur in the house BAREFOOT or in HOUSE SHOES.
CUSTOM FOOT ORTHOSES
Changes of postural steadiness following use of prefabricated orthotic insoles.

- **Abstract:** Orthoses are designed to assist a malaligned foot in adapting to the environment and reduce the frequency of injury. Literature is divided on the benefits of orthotics insoles for postural stability. The current study was conducted to determine the effect of prefabricated orthotic arch supports on postural stabilization. Twelve healthy young adults participated in this study and were tested with and without prefabricated orthotics. Different variables were computed from movement of center of pressure (COP) during orthotic use as suggested in the literature. The mean position of COP was significantly shifted forward and toward the dominant side. Neither the COP movement nor the velocity changes following the use of orthotics revealed significant differences. Mediolateral range of COP movement and the 95% confidence circle area of sway was significantly reduced (P = .022 and 0.048 respectively), but changes in 95% confidence circle and ellipse areas of fractal dimension were not significant (P = .053 and P = .057 respectively).

- **In conclusion,** orthotic insoles significantly improved postural sway initially by reducing mediolateral range of postural sway and 95% confidence circle area of sway at the cost of increased fractal dimension area variables and power.
The effect of prefabricated and proprioceptive foot orthoses on plantar pressure distribution in patients with flexible flatfoot during walking.


• BACKGROUND: Previous studies have suggested that orthoses with different constructions could alter gait parameters in flexible flatfoot. However, there is less evidence about the effect of insoles with proprioceptive mechanism on plantar pressure distribution in flatfoot.

• OBJECTIVES: To assess the effect of orthoses with different mechanisms on plantar pressure distribution in subjects with flexible flatfoot.

• METHODS: In total, 12 flatfoot subjects were recruited for this study. In-shoe plantar pressure in walking was measured by Pedar-X system under three conditions including wearing the shoe only, wearing the shoe with a proprioceptive insole, and wearing the shoe with a prefabricated foot insole.

• RESULTS: Using the proprioceptive insoles, maximum force was significantly reduced in medial midfoot, and plantar pressure was significantly increased in the second and third rays (0.94 ± 0.77 N/kg, 102.04 ± 28.23 kPa) compared to the shoe only condition (1.12 ± 0.88 N/kg and 109.79 ± 29.75 kPa). For the prefabricated insole, maximum force was significantly higher in midfoot area compared to the other conditions (p < 0.05).

• CONCLUSIONS: Construction of orthoses could have an effect on plantar pressure distribution in flatfeet. It might be considered that insoles with sensory stimulation alters sensory feedback of plantar surface of foot and may lead to change in plantar pressure in the flexible flatfoot.

• CLINICAL RELEVANCE: Based on the findings of this study, using orthoses with different mechanisms such as proprioceptive intervention might be a useful method in orthotic treatment. Assessing plantar pressure can also be an efficient quantitative outcome measure for clinicians in evidence-based foot orthosis prescription.
CUSTOM AFO CAN IMPACT RISK FACTORS FOR FALLING

• Decreased postural control can occur because of ankle instability.

• Loss of normal sensation, such as in diabetes and other causes of peripheral neuropathy, also lead to a loss of postural control.

Figure 1. Important resources required for postural control. CNS = central nervous system.
How Does a Custom AFO Benefit a Patient?

• Leads to sensory reorganization for postural control
• Reduces postural sway, thus giving the patient more confidence and less fear of a fall
• Restricts undesirable motion at the foot and ankle and enhances joint mechanoreceptors to detect disturbances and provide structural support for controlling postural sway.
• Reduces Fatigue
• Numerous studies have reported that a localized fatigue of the ankle muscles, known to alter the force-generating capacity of the ankle joint, also affect the function of the proprioceptive system.

• An AFO can prevent fatigue and improve proprioception in the foot and ankle.
Ankle Joint Motion

• Under dynamic conditions, rigid AFOs may compromise balance; by contrast, leaf-spring AFOs, which allow sagittal-plane motion, seemed to facilitate both static and dynamic balance.

Why Custom is Better

• A custom-made AFO (taken from a mold of the patient’s foot and ankle) guarantees maximum cutaneous mechanoreceptor sensory activity.
• It will cover part of the foot sole, and may contact part of the upper part of the foot, both ankle bones medially and laterally, and several inches of the leg above the ankle bones.
• This provides a significant amount of surface area and covers key areas of the foot/ankle to maximize skin mechanoreceptors.
The Moore Balance Brace (MBB)

- Increased sensorimotor function
- Improved postural control (sway)
- Increased stabilization against fatigue, osteoarthritis, and pain.
- Assist with Foot Drop
Recent Study

Stephanie C. Wu, D.P.M., M.S.,1 Ryan T. Crews, M.S.,1 Bijan Najafi, Ph.D.

• The Effect of Customized Ankle Foot Orthoses (AFO) on Gait and Balance in Older Adults

• “Key risk factors for falls such as muscle weakness, gait deficits and balance disorders[11] are common across the entire elderly population. It is possible that an appropriately designed AFO may be able to reduce fall risk in the general elderly population. Therefore, the purpose of this investigation is to determine whether a flexible AFO reduces fall risk in ambulatory elderly individuals”

• Scholl’s Center for Lower Extremity Ambulatory Research at Rosalind Franklin University, North Chicago, Illinois
Study Results

• During eyes open balance assessments, use of AFO with shoes reduced the COM sway significantly (p<0.05) by 68% and 75% when compared to shoes and barefoot respectively.
• Similar significant drops of 53% and 61% were observed when compared to shoes and barefoot during the eyes closed Romberg’s test with customized AFOs.
• No significant differences of functional reach distance were observed between the barefoot, shoes and shoes with AFOs conditions.
Study Results continued:

• However, an 18% significant drop of reciprocal compensatory index [4] values in medial-lateral direction was observed while using AFOs when compared to both barefoot and standard shoes conditions.

• Discussion and conclusion:

The results of this study indicate the use of an AFO provides an immediate reduction of fall risk in the elderly, without encumbering functional reach or gait. Additional studies are required to determine if the reduced fall risk actually translates into fewer falls.
Conclusion

Using the Moore Balance Brace along with proper footwear on elderly patients, was shown to reduce postural sway by more than 50% and to improve postural stability in the medial-lateral direction by 18% without influencing reach and distance or TUG times.
YOU CAN MAKE A DIFFERENCE!
THANK YOU

Dennis Janisse, C.Ped.