A Balancing Act:
The Assessment and Rehabilitation of Older Adult Fallers

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Why am I talking about falls?
Background

In the UK over 65’s account for 16% of the population (Office for National Statistics, 2012)

30% fall annually (Scuffham et al, 2003)

~ 50% fall more than once / yr (Rubenstein et al, 2006)

~2% of which result in hip fracture

- costing the NHS £2 billion (Nevitt et al, 1991, HQIP 2011)

2925 deaths in older adults due to accidental falls in 2009 (~82% of all fall related deaths) (Data.gov.uk)
Recommendations for Assessment

NSF for Older People: Standard 6 - Falls (2001)

Identify and diagnose any risk factors for falls associated with an older person’s health (including any physical impairment) and environment, particularly those likely to respond to intervention.

Establish how the older person (and their carer) coped following any previous fall and if they have any strategies for coping with a fall in the future.

Identify any psychological consequences of the fall that might lead to self imposed restriction of activity.

Lead to an investigation and treatment for osteoporotic risk.

NICE guidelines (2004): Falls

Identify falls history

Assess gait, balance and mobility, and muscle weakness

Assess osteoporosis risk

Assess perceived functional ability and fear relating to falling

Assess visual impairment

Assess cognitive impairment and neurological examination

Assess urinary incontinence

Assess home hazards

Cardiovascular examination and medication review.
Recommendations for Assessment
AGS / BGS Clinical Guidelines 2010

**Focused History**

a) History of falls:
b) Medication review:
c) History of risk factors:

**Physical Examination**

a) Assess gait, balance, and mobility and lower extremity joint function
b) Neurological function: Inc. Cognitive, peripheral nerves, proprioception, reflexes and cerebellar function
c) Muscle strength (lower extremities)
d) Cardiovascular status:
e) Assessment of visual acuity
f) Examination of the feet and footwear

**Functional Assessment**

a) Assess ADL skills inc adaptive equipment
b) Assess perceived functional ability and fear related to falling
c) Assessment of current activity levels

**Environmental Assessment**

a) Environmental assessment including home safety
Older Fallers Assessment

Cardiac

Medication

Cognitive

Falls History
Fear of Falling

Vision

Somatosensory

Strength

Gait / TUG

Vestibular

Falls History
Fear of Falling
Why is vestibular function important?

Let’s look at how we balance..
Postural Stability

Cognitive Function
- Attention
- Executive Function
- Context / Goals

Orientation
- Verticality
- Gravity

Movement
- Reactive
- Anticipatory
- Voluntary

Physical
- Strength
- ROM

Sensory Function
- Integration
- Reweighting

Control Processes

All change with age

Adapted from Horak, 2006
Balance Inputs

- Vision
- Somatosensory
- Vestibular
Role of the vestibular system

Determines **position** and **motion** of head in space

Gaze stability (VOR)

Maintain head and posture **stability** (VSR & VCR)
<table>
<thead>
<tr>
<th>Symptom/Diagnosis</th>
<th>Reference/Note</th>
<th>Comment</th>
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<tbody>
<tr>
<td>73% of patients referred for multi factorial falls assessment have vestibular impairment</td>
<td>Jacobson et al, 2008</td>
<td>Did not dichotomise between 0/1/multi fallers</td>
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<tr>
<td>Proportion of individuals able to stand on foam with eyes closed reduces with age</td>
<td>Agrawal et al, 2009</td>
<td>No clinical vestibular tests, no dichotomising of falls history</td>
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Balance function and falls risk in healthy individuals, unexplained fallers and PVD patients: A pilot study

Research questions

1. What proportion of older adult fallers have an unrecognised vestibular disorder?

2. How does this compare to a healthy, non-falling age-matched population?

3. What are the differences in symptoms, gait and falls risk between older adults referred to:
   A) Neuro-otology clinics (PV)
   B) Falls clinics (F)
   c) Healthy non-falling older adults (H)
Vestibular Function in Fallers

80% of fallers have undiagnosed vestibular disorders

Compared to 19% in healthy (p<.01)

Fallers report similar levels of vestibular symptoms to age matched vestibular patients

Significantly more symptoms than healthy

Liston et al, Manuscript under review
Conclusions

Report to GP with balance problem
- Falls
- Dizziness / Disorientation
- Unsteadiness

Onward referral

Falls Clinic
- Older
- Report more falls
- Worse gait
- Higher falls risk

Vestibular function not assessed
80% have vestibular problem

Neuro-Otology
- Younger
- Report less falls
- Have better gait
- Have lower falls risk

Have full balance assessment including vestibular function
What effect does this have on the rehabilitation of fallers?
Current Falls Rehab

Multi-factorial interventions including gait and balance training, home modification and medical review are recommended (BGS, 2010).

No single programme is recommended (NICE, 2004)

Subjects receiving exercise based interventions have a reduction in falls rate compared to vision and home modification (Day et al, 2002)
OTAGO

A progressive exercise programme to improve strength and balance function and encourage mobilisation.

Can reduce falls rate by up to 40% in targeted populations (Campbell, Robertson et al. 1997; Campbell, Robertson et al. 1999)

Average reduction in falls rate in community dwelling older adults is 35% (Robertson, Campbell et al. 2002)
What are the OTAGO exercises like?

1) Gentle Warm up
2) Strengthening
3) Balance

Has No Vestibular Training Component
Multi-Sensory Rehab

A customised intervention to improve:

1) Selection of appropriate sensory modality
2) Speed of sensory reweighting
3) Postural control
4) Gait (Hu and Woollacott, 1994)
1st study attempting MSR in fallers (3 or more)

“Individualised” MSR vs Seated exercises
Intervention provided for 36 weeks

Reduces falls by 30%

Support surface not altered in gait until wk 24
“Vestibular” exercises not included until wk 32
Multi-Sensory Rehab

3 studies investigating MSR in older adults

1 study in fallers (Beling and Roller 2009)
1 study in OA/RA (Williams, Brand et al. 2010)
1 study in mild balance dysfunction (Yang et al 2012)

Subjects provided with group VRT type exercises in conjunction with normal programme.

Significant improvement in falls risk, falls rate, balance confidence and gait parameters (Beling and Roller 2009, Williams, Brand et al. 2010).

No exercise control groups, no customised exercises
Interventions

Otago + Home Exercise Programme (HEP)

**HEP - Either**
1) Stretching (sham)
2) MSR (active)

8 week programme
2 Otago classes / week
2 home visits / week
HEP performed twice daily (4-6 exercises)
Stretching
Multi-Sensory Rehab
Conclusions

**Guidelines recommend** strengthening, balance and gait exercises

Current best practise can **reduce falls by up to 40%**

Addressing vestibular function **can reduce falls risk further** than conventional programmes

However, the effect on falls rate is as yet unknown
So what else can we look into?

Dual tasking?
Posture, Attention and Dual Tasking

Postural tasks require **attention** – amount varies according to:

- Age
- Balance Ability
- Inherent difficulty of task  

Woollacott and Shumway-Cook, 2002

Deficits in **attention** associated with:

- ↓ dual tasking ability
- ↑ falls risk  

Siu et al 2009, Ble et al 2005

Dual tasks can cause interference

- Impaired performance of physical / cognitive task (or both)
- Interference is greater in older adults

Dual tasking is common in everyday life – the rule rather than the exception
Assessing Dual Task Ability

“Stops walking when talking” Lundin-Olsson et al, 1997
→ Able to predict falls in older adults Beauchet et al, 2009

Postural sway in quiet and perturbed standing
→ differentiates between healthy younger & older adults & fallers

Choice stepping reaction test (CSRT)
→ sensitive to predicting falls in older adults Lord and Fitzpatrick, 2001

Bi-modal Spatial Multi Tasking

Providing contextually similar but discrete tasks via separate sensory modalities

1 Auditory driven spatially loaded task (non-postural)

1 Visually driven spatially loaded task (postural)

Tested in Healthy Young vs. Older adults
Protocol

- **Visually Coded Spatial Task**
  - Requires a step response driven by change in monitor colour
  - Temporally random

- **Auditory Coded Spatial Task**
  - Requires button press response
  - Respond to Uni-Aural presentation of the words “left” and “right”
  - Congruency of stimulus reported
  - Temporally regular (every 4s)


Both performed independently and in combination.
Dual Task Costs

Dual Task Costs (%)
- i.e. The % increase or decrease in performance when DT

\[ \text{DTC} = \left( \frac{\text{Dual} - \text{Single}}{\text{Single}} \right) \times 100 \]

Menant et al 2010, Van Impe et al 2011

Response time for both tasks (VS & AS)
Dual Task Costs: Response Time

Visuo Spatial Task (Step)
DTC’s significantly higher in older adults (P<.01) (29% vs. 73%)

Audio Spatial Task (Button)
DTC’s significantly higher in younger adults (p<.05) (69% vs. 40%)
Conclusions

Some Older Adults do not prioritise posture if the task is complex enough

Is this evidence of a modification of posture first?

Could this provide a useful Ax or Rx paradigm?
In Summary

Falls are common in older adults.

Vestibular dysfunction is significantly more prevalent in fallers than healthy older adults.

Techniques to improve sensory integration and promote vestibular function significantly improve the Otago

Bimodal multi tasking may be a useful tool in the future for the Ax and Rx of fallers
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References


*http://data.gov.uk/dataset/accidental_falls_mortality_rate* accessed 07-10-11