A guide to understanding balance and mobility for health staff

As people age their balance and mobility reduces. To prevent falls it is important to maintain or improve a person's balance and mobility. This document will provide you with a background to understanding balance and an of balance and mobility tests. These tests will indicate if your client has a balance and mobility issue.

Background

The maintenance of balance is a highly complex skill whereby the body's centre of mass is controlled within the limits of postural stability. Sensory information coming through the visual, vestibular and somatosensory pathways needs to be integrated and analysed within the central nervous system so that an appropriate motor response can be made. An impairment at any point in this pathway may lead to problems with the maintenance of postural stability which in turn leads to an increase in risk of falls. Different combinations of muscle actions are required to maintain balance when undertaking the variety of everyday tasks we all face (ACSQHC 2009).

Impairment in balance is a key predictor of falls risk, therefore we need a variety of tools to reflect the different postural challenges that daily activities present. Conceptually it is helpful to break down the variety of these tasks into four primary actions in which we need to maintain balance: standing, leaning, stepping, and walking (Lord et al 2007). Within these actions it can be noted that there are requirements to maintain balance when stationary (static balance) as well as requirements to maintain balance when moving (dynamic balance). Assessment can then be tailored specifically to individual deficits so that appropriate intervention and referral can be planned.

Definitions

Gait - Human walking, or gait, has been described as the "act of falling forward and catching oneself" (Magee 1997). Due to the unique physiological challenges that walking presents, there is potential for a loss of balance leading to a fall (Lord et al 2007).

Fall – 'A fall is an event which results in a person coming to rest inadvertently on the ground or floor or other lower level' (World Health Organisation (WHO) definition of a fall, Best Practice Guidelines for Community Care *Preventing Falls and Harm from Falls in Older People, pg 4,* (ACSQHC 2009).

Static balance – the ability to maintain postural stability and orientation with centre of mass over the base of support and body at rest (O'Sullivan and Portney 2014).

Dynamic balance – the ability to maintain postural stability and orientation with centre of mass over the base of support while the body parts are in motion (O'Sullivan & Portney 2014).

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Balance and mobility assessment tools

For those professionals that would like to further assess their clients, there are a range of tools available to assess the specific balance and mobility deficits. Selections of these tools are listed below and in Tables 1 and 2 under the various domains.

Standing balance:-

Near Tandem Stand Test – this test is a measure of balance and ankle strength. The person is asked to stand with their feet in a near tandem position for a period of 10 seconds with eyes closed. Equipment required is a stopwatch and a 2.5 cm square cardboard template for foot positioning. Test takes less than 5 minutes.

Five Times Sit to Stand – this is a measure of balance and leg muscle strength and involves timing a person standing up and sitting down from a chair five times, starting with feet in line with knees and arms folded. This test takes less than 5 minutes.

Lateral stability:

Alternate Step Test – this test involves weight shifting and is a measure of lateral stability, requires placing right and left feet (no shoes) as fast as possible on a step 18 cm high and 40 cm deep for 4 repetitions.

Stepping balance:

Four Square Step Test – Test of Dynamic balance that assesses person's ability to step over objects forwards, sideways and backwards.

Balance during walking:

Timed Up and Go – This test measures balance, mobility and co-ordination. This is a timed test with the person asked to start from a sitting position in standard chair, stand up and walk 3m as quickly as possible, turn around and walk back and sit down in the chair.

Gait Speed – this is usually measured over a specific distance on a flat surface from 2.4 to 10m

Tools that measure multiple domains/confidence/efficacy:

Short Physical Performance Battery (SPPB) – assesses lower extremity function. This test comprises repeated chair stands, tandem stand, side by side stand and 2.4 m walk.

de Morton Mobility Index (DEMMI) – this measures overall mobility including static and dynamic balance and has shown good validity across from acute and rehab to the community setting.

Berg Balance Scale – measures static balance and falls risk by using 14 separate items.

Tinetti – Performance oriented Mobility Assessment (POMA) measures balance and gait using 9 balance and 7 gait measures and takes 10- minutes to administer.

Quickscreen® falls risk assessment tool assesses lower limb strength, balance and co-ordination as well as other falls risk factors (previous falls, vision, medication, peripheral sensation).

Activities Specific Balance Confidence ABC – measures confidence a person feels carrying out a range of activities of daily living.

Modified FES – measures confidence a person feels carrying out 14 indoor and outdoor activities (Delbaere et al 2011).

iconFES – a validated tool that measures fear of falling using pictures to describe a range of activities and situations.

Further information on the tools above and links to the tools above are in Tables 1 and 2.

Table 1 lists some simple balance and mobility tests, most of these tests can be completed in 5 minutes or less and with minimal equipment.

Table 1 Simple balance and mobility tests

Assessment Tool	What this tool measures	Testing time	Equipment required	Link to test instrument/video
Near Tandem Stand test	Standing Balance and ankle strength	<3 min	2.5 cm cardboard square, stopwatch	Part of SPPB and QuickScreen®
Five times sit to stand	Standing balance and leg muscle strength	< 3min	Chair Stopwatch	http://bit.ly/17jyeXB and QuickScreen®
Alternate Step test	Strength, balance and coordination	< 3 min	Stopwatch and 18 cm step	http://bit.ly/1Md4E8f and QuickScreen®
Four square step test	Dynamic balance	< 5 min	Stopwatch Four canes	http://bit.ly/16WcJel
Timed up and Go	Balance, mobility and coordination	< 3 min	Stopwatch Standard armchair	http://bit.ly/1Ci2rk5
Gait speed 10m walk test	Functional mobility, gait	5 min	Stopwatch Clear measured pathway	http://bit.ly/19b2xjX

Table 2 lists more comprehensive balance/ mobility and confidence assessment tools and links to further information and the tools.

Table 2 Comprehensive balance/ mobility and confidence assessment tools

Assessment Tool	What this tool measures	Testing time	Equipment required	Link to test instrument
QuickScreen® Clinical Falls Risk assessment	Balance and mobility and other falls risk factors (including previous fall, medications & vision)	10 min	All tools included in kit (stopwatch, squares string, vision chart, monofilament pen	http://bit.ly/17eNlk6
Berg Balance Scale	Balance and functional mobility using 14 items	30 min	Stopwatch Chair with armrests Measuring tape Object to pick up Step	http://bit.ly/1zYuu74
Tinetti Performance Oriented Mobility Assessment (POMA)	Balance and gait using 9 balance and 7 gait measures	10 – 15 min	Stopwatch Armless chair 5 m clear walkway (uses 4.57m)	http://bit.ly/1F0mh6L
Short Physical Performance Battery (SPPB)	Balance and gait, strength and endurance	10 minutes	Stopwatch Armless chair	http://www.grc.nia.nih.gov/branches/leps/sppb/
De Morton Mobility Index (DEMMI)	Measures overall mobility including static and dynamic balance	10- 20 min	Stopwatch Bed Chair with armrests Pen	http://www.demmi.org.au
Activities-Specific Balance Confidence Scale(ABC)	Rates Balance confidence in performing 16 ambulatory activities	10- 20 min	Paper Survey/ Pencil or Pen	http://bit.ly/1L0Z42Y
Modified Falls Efficacy scale	Measure of confidence carrying out 14 indoor and outdoor activities	5 min	Paper Survey/pencil pen	http://bit.ly/17Dt48S
icon-FES mobile App	Measures fear of falling using pictures that show a range of activities and situations	5-10 min	iPad – results can be downloaded to computer	http://www.neura.edu.au/apps/iconfes/instructions

References

Australian Commission on Safety and Quality in Healthcare (2009) Preventing Falls and Harm from Falls in Older People: Best Practice Guidelines for Australian Community Care.

Delbaere, Kim, Smith, Stuart T. and Lord, Stephen R (2011).Development and initial validation of the iconographical Falls Efficacy Scale, *J Gerontol A Biol Sci Med Sci* 66A (6): 674-680.

Lamb, Jørstad-Stein, Hauer and Becker (2005). Development of a common outcome data set for fall injury prevention trials: the Prevention of Falls Network Europe Consensus. *J Am Geriatr Soc 53:* 1618-1622.

Lord, Sherrington, and Menz (2007) Falls in Older People: Risk Factors and Strategies for Prevention (2nd Edition): Cambridge University Press.

Magee (1997) Orthopaedic Physical Assessment (3rd edition). Philadelphia, W.B. Saunders Company.

O'Sullivan and Portney (2014) Physical Rehabilitation (6th edition). Philadelphia, FA Davis.

Rehabilitation Measures Database, this database includes some of the test measures mentioned above and provides brief overviews, instructions and normative data. http://www.rehabmeasures.org/rehabweb/allmeasures.aspx?PageView=Share