Building Better Balance

The Effects of MS on Balance

Individuals with MS experience a decline in their balance due to various MS–related impairments. Some of these impairments can be improved with exercise while others must be accommodated for with lifestyle or environmental changes. Changes in strength and flexibility can be addressed in an exercise program. Spasticity, which adversely affects strength and flexibility, can be addressed with medication, exercise and/or bracing. Other changes such as declining visual ability (loss of visual acuity, declining visual fields, light-dark adaptation, increased sensitivity to glare, loss of peripheral vision and depth perception) are more complex and may require assessment by another health professional such as a neuro-optometrist or neuro-ophthalmologist. MS-related changes that can occur in balance-associated systems are illustrated in the table below.

CHANGES IN BALANCE-ASSOCIATED SYSTEMS

SENSORY SYSTEM	CHANGES	FUNCTIONAL IMPACT
Visual	**Reduced:** • Visual acuity • Depth perception • Contrast sensitivity • Visual field • Color intensity **Results in:** • Poor integration and slower processing of sensory input • Altered perception of the body's position in space • Impaired ability to perceive or anticipate changes in surface or detect hazards in the environment	• Difficulty negotiating curbs, stairs • Difficulty mobilizing a wheelchair or scooter • Difficulty moving in low or changing light • Increased difficulty controlling balance • Difficulty controlling balance in a crowd or other environments with a moving visual field. • Increased risk for falls
Sensory	• Numbness, Paresthesias • Reduced muscle spindle activity • Reduced joint receptor activity **Results in:** • Compromised postural stability • Decreased sensation in the feet	• Joint instability that may compromise major aspects of balance and mobility • Increased risk for injury and falls • Decreased ability to walk over uneven or unstable terrain.

		• Loss of proprioception-kinesthesia; awareness of body in space
Vestibular	• Gradual decline in hair cells in vestibular system **Causes:** • Impaired sensitivity to head movement • Reduced vestibulo-ocular reflex (VOR)	• Increased postural sway (frequency and amplitude) • Difficulty with gaze stabilization • Difficulty compensating for deficits in the visual or somatosensory systems • Frequent feeling of unsteadiness and/or dizziness.

CHANGES IN BALANCE-ASSOCIATED SYSTEMS

SYSTEM	CHANGES	FUNCTIONAL IMPACT
Motor	**Decreased:** • Muscular strength • Muscle endurance • Muscle flexibility • Motor control (i.e. using the correct muscle at the correct time, using the correct amount of power). • Range of motion **Increased:** • Spasticity • Muscle tone **Results in:** • Inability to anticipate changes • Decreased speed of response • Decreased intensity of response • Decreased reaction time and movement time • Mistaken strategy selection • Over/under-compensation to • Changes in sequencing muscle activation	**Decreased ability to:** • Balance with altered base of support (narrow base of support or compliant surfaces) • Mobilizing wheelchair or scooter • Adjust to changing environments (e.g., moving surfaces) • Adapt when sensory information is incomplete • Execute transitional movements smoothly **Increased:** • Energy expenditure in walking and other mobility tasks. • Risk of falling
Cognitive	**Decreased ability to:** • Reason • Problem-solve	**Diminishes ability to:** • Pay attention/focus on tasks • Perceive sensation

	• Plan and organize • Concentrate • Remember • Relate concrete to abstract concepts • Divide attention between tasks **Increased:** • Risk of impairment • Difficulty storing and manipulating data	• Assess sensory input and generate appropriate responses • Choose and safely utilize appropriate equipment (e.g. assistive devices, orthotics). • Modify home environment

For a more comprehensive background read Chapter 6 in Spirduso, W.W., Francis, K.L., and MacRae, P.G. (2005). Physical Dimensions of Aging. (Second Edition). Champaign, IL: Human Kinetics

The Role of Exercise in Reducing Falls

Exercise has many health benefits. It reduces the risk of developing heart disease, high blood pressure, and diabetes. It increases HDL or "good" cholesterol, controls weight, and makes us feel better. But how does exercise lower the risk of falling and reduce the chance of injury when there is a fall? Exercise may:

- Increase endurance
- Increase muscle strength, range of motion and flexibility
- Decrease feelings of fatigue
- Protect bone mass (weight-bearing activity)
- Help manage stress and improve confidence
- Reduce feelings of fear and depression
- Create an overall feeling of well-being
- Sometime reduces pain.

Maximize Function with an Integrated Approach

The Free From Falls program takes an integrated approach to improving function in everyday activities. By using exercises that focus on building better balance in doing real-life activities in real-life situations, participants will be able to make the most effective use of their time and effort. It's about training all muscles to work together for a specific purpose rather than isolating them to work independently.

When successfully combined into the following six components of Building Better Balance, functional exercise can help maximize balance and mobility and compensate for symptoms due to MS.

An Integrated Approach to Building Better Balance

Center of Gravity Training

Center of Gravity Training is intended to improve position and posture. Improving the center of gravity will help participants maintain a better upright position in space, whether they are seated or standing, and improves speed, confidence and efficiency to move the body through space. In addition, it leads to increased balance control when the body moves away from the center or midline (for example, if you were to sway or lean forward and return to a neutral standing or seated position).

Multisensory Training

Our ability to perceive where we are in space and how we should respond to changing sensory conditions during our daily lives depends on three sensory systems: visual, vestibular and somatosensory. Multisensory training includes all three components:

Visual: The visual system provides important information that allows the body to adjust for the obstacle in its path, such as the height of a curb or an uneven ground surface. Impairments in vision and depth perception increase the risk for falls. That's why it is important to get an eye exam annually and to wear glasses or use other strategies if necessary to compensate for visual problems. Sometimes it's necessary to see a neuro-opthamologist to address visual problems that are directly related to MS.

Vestibular: The inner ear provides the brain and eyes with crucial information on the position of your head and its movement in space with respect to gravity. An intact vestibular system allows for the following kinds of activities without losing your balance: walk on a cruise ship or a plane in flight, ride an elevator or turn quickly when walking. Impairment in the vestibular system could make you more likely to lose your balance and fall.

Somatosensory: This is the body's ability to perceive touch and spatial orientation. For example, this system allows you to know both the type of surface you are standing on and the position of your feet if your eyes are closed.

Postural Strategy Training

Coordination and balance involve a sequence of muscle actions to control movement. Problems with coordination and balance are quite common among people with multiple sclerosis, and result in poor posture and alignment. The three postural control strategies (ankle, hip and step) are most commonly used to assist in maintaining and controlling our balance while performing daily tasks, around the home and in the community.

Mobility Enhancement

Gait patterns may appear quite normal under a controlled environment. However, environmental distractions, cognitive tasks and changes in walking surface can reveal an underlying disturbance in balance. Appropriate gait involves the ability to move about safely and efficiently in a variety of environments, such as stepping on and off escalators, crossing busy streets, stepping over obstacles, or walking in crowded malls. Walking, stopping and turning are all movements that also require a change in postural orientation. Mobilizing a scooter or wheelchair also requires trunk and postural control, the ability to maneuver the device across varying terrains and maintain sitting balance.

Strength Training

Many daily activities require different levels of arm and leg power (e.g., lifting groceries, carrying packages, stair climbing, rising from a chair and walking). Strength training uses resistance to challenge muscles, which helps improve muscle strength, bone density, muscle mass, flexibility and balance, and prevent injury. As strength improves, muscles are able to work harder and longer.

Flexibility and Range of Motion

The term "range of motion" refers to the normal range of movement for a joint, including how far the joint can be flexed, extended or rotated. Improving the range in joints and muscles enhances balance and mobility. For individuals living with MS, lack of movement can sometimes translate to loss of flexibility, limiting range of motion. Flexibility exercises can improve joint integrity, prevent injury, release stress and help manage spasticity.