BRAIN-BALANCE CONNECTION

Functional Fitness for Maximal Wellness
Presented by Dr. Rodney Sepich, M.D., C.M.D.
Friday, April 24, 2015  10:00 a.m.  Foxdale Village Auditorium
FALLS AND BALANCE
WHAT YOU CAN DO TO HELP

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I’ve fallen…and I can’t get up!!!
Goals

• Review components of balance system.
• Review disorders of the components of balance system.
• Discuss ways to maintain your balance system.
Prevalence of Balance Problems

• Jonsson et al (2004) found that the overall prevalence of balance problems at age 70 was 36% (women) and 29% (men).

• Balance symptoms were more common among women than men, and increased with increasing age.

• At ages 88-90 years the corresponding values were 51% (women) and 45% (men)

CDC data

- 2.1 million nonfatal fall injuries were treated in emergency departments among the elderly in 2008
- 1/3 of folks over 65 fall each year!
COMPONENTS OF BALANCE
Three Components of Balance System

1. Cerebellar and Vestibular System
2. Visual System
3. Proprioception
CEREBELLUM
Functions of the Cerebellum

- It receives information about the desired program of muscle contraction from the cortical motor areas and receives continuous updated sensory information from the periphery about the present state of muscles and compares that state with the desired program and if there are any deviations, it acts in order to restore them in order to induce the appropriate performance of a movement.
Functions of the Cerebellum

• Control of Muscle Tone
• Control of Posture and Equilibrium
• Control of Voluntary Movements
Vestibular System
Functions of the Vestibular System

• Plays a dominant role in the subjective sensation of motion and spatial orientation of the head
• Adjusts muscular activity and body position to maintain posture (works with cerebellum)
• Stabilizes in space the fixation point of the eyes when the head moves, providing a stable image upon the retina (works with the eyes)
'You have to expect some cutbacks with the government health plan...'}
The Visual System
Functions of the Visual System

• Position in space
• Three dimensional view and Depth Perception
• Helps coordinate muscle movement in conjunction with cerebellum
Proprioception

*Proprioception*: The ability to sense stimuli arising within the body regarding position, motion, and equilibrium
Proprioception
Functions of Proprioception

- Allows humans to control their limbs without directly looking at them.
- Inside every muscle and joint lie tiny meters called muscle spindles and Golgi tendons that constantly measure the amount of tension and degree of contraction.
- This information travels up a discreet highway in the spinal cord called the spinocerebellar tract, and makes its way to the cerebellum.
- The cerebellum accepts information from every muscle and joint in the body, and calculates where the limbs must be in space.
Causes of Balance Disorders

• Disorders of the Vestibular System
• Disorders of the Cerebellum
• Disorders of the Visual System
• Disorders of Proprioception
Disorders of the Vestibular System

• Drugs: Ototoxic medications known to cause permanent damage include certain aminoglycoside antibiotics, such as gentamicin (family history may increase susceptibility), and cancer chemotherapy drugs, such as cisplatin and carboplatin.

• Drugs known to cause temporary damage include salicylate pain relievers (aspirin, used for pain relief and to treat heart conditions), quinine (to treat malaria), and loop diuretics (to treat certain heart and kidney conditions).
Disorders of the Vestibular System

- **Benign paroxysmal positional vertigo (BPPV) or positional vertigo:** A brief, intense episode of vertigo triggered by a specific change in the position of the head. You might feel as if you're spinning when you bend down to look under something, tilt your head to look up or over your shoulder, or roll over in bed. BPPV occurs when loose otoconia tumble into one of the semicircular canals and weigh on the cupula. The cupula doesn't flex properly and sends wrong information about your head’s position, causing vertigo. BPPV can result from a head injury, or can develop just from getting older.
Disorders of the Vestibular System

- **Ménière's disease**: Episodes of vertigo, hearing loss, tinnitus (TIN-nih-tuss, a ringing or buzzing in the ear), and a feeling of fullness in the ear. It may be associated with a change in fluid volume within parts of the labyrinth, but the cause or causes are still unknown.

- **Vestibular neuronitis**: An inflammation of the vestibular nerve that can be caused by a virus, and primarily causes vertigo.
Disorders of the Vestibular System

- **Perilymph fistula [PERRY-limf FIS-tew-lah]:** A leakage of inner ear fluid into the middle ear. It causes unsteadiness that usually increases with activity, along with dizziness and nausea. Perilymph fistula can occur after a head injury, dramatic changes in air pressure (such as when scuba diving), physical exertion, ear surgery, or chronic ear infections. Some people are born with perilymph fistula.

- **Mal de Debarquement [dee-BARK-ment] syndrome (MdDS):** A feeling of continuously rocking or bobbing, typically after an ocean cruise or other sea travel. Usually the symptoms go away a few hours or days after you reach land. Severe cases, however, can last months or years.
Disorders of the cerebellum

• **Head trauma.** Damage to your brain or spinal cord from a blow to your head, such as might occur in a car accident, can cause sudden-onset ataxia, also known as acute cerebellar ataxia.

• **Stroke.** When the blood supply to a part of your brain is interrupted or severely reduced, depriving brain tissue of oxygen and nutrients, brain cells die.
Disorders of the Cerebellum

- **Transient ischemic attack (TIA).** Caused by a temporary decrease in blood supply to part of your brain, most TIAs last only a few minutes. Loss of coordination and other signs and symptoms of a TIA are temporary.

- **Cerebral palsy.** This is a general term for a group of disorders caused by damage to a child's brain during early development — before, during or shortly after birth — that affects the child's ability to coordinate body movements.

- **Multiple sclerosis (MS).** MS is a chronic, potentially debilitating disease that affects your central nervous system.
Disorders of the cerebellum

- **Chickenpox.** Ataxia can be an uncommon complication of chickenpox and other viral infections. It may appear in the healing stages of the infection and last for days or weeks. Normally, the ataxia resolves over time.

- **Paraneoplastic syndromes.** These are rare, degenerative disorders triggered by your immune system's response to a cancerous tumor (neoplasm), most commonly from lung, ovarian, breast or lymphatic cancer. Ataxia may appear months or years before the cancer is diagnosed.
Disorders of the Cerebellum
(some of these are more common at 4-5 pm)

- **Tumor.** A growth on the brain, cancerous (malignant) or noncancerous (benign), can damage the cerebellum.

- **Toxic reaction.** Ataxia is a potential side effect of certain medications, especially barbiturates, such as phenobarbital, and sedatives, such as benzodiazepines. **Alcohol** and drug intoxication; heavy metal poisoning, such as from lead or mercury; and solvent poisoning, such as from paint thinner, also can cause ataxia.

- **Vitamin E or vitamin B-12 deficiency.** Not getting enough vitamin E or vitamin B-12, because of the inability to absorb enough of the vitamin or other reasons, can lead to ataxia.
Disorders of the Cerebellum

• Hereditary ataxias
Disorders of the Visual System

- Binocular Vision Dysfunction
- Double Vision
- Eye Movement Disorders
- Anything that affects visual clarity (cataract, armd, glaucoma, corneal disorders, etc)
- Visual processing (Stroke may affect)
The Visual System

- When vision, vestibular/cerebellar and proprioception are isolated and balance is tested, it has been found that vision is the most significant contributor to balance, playing a bigger role than either of the two other intrinsic mechanisms.

The Visual System

Correcting cataracts improves balance.
Disruption of binocular vision worsens balance.

People my age can still have stars in their eyes ... they’re called cataracts!
Cataract Surgery Improves Mortality

• Timely cataract surgery resulting in enhanced vision was associated with a 40% reduction in mortality risk compared with no surgery

Correction of Visual Impairment by Cataract Surgery and Improved Survival in Older Persons
Fong, Calvin Sze-un et al.
Ophthalmology, Volume 120, Issue 9, 1720 - 1727
Researchers find diminished balance in those with poor vision.

• Even uncorrective refractive error cause diminished function of vestibular system. This likely means the visual system is needed to calibrate the vestibular system.

Disorders of Proprioception

- Multiple Sclerosis
- Spinal Cord Injury
- Neuropathies
- Brain injury (Stroke, Tumors, etc)
2 of 3 Concept

- If any 2 of the 3 major systems are working, you can maintain good balance.
How do you improve your balance?

• Take care of your eyes with regular exams
• Update your glasses
• Treat Glaucoma
How to improve your balance

• Cataract Surgery
• Avoid Macular Degeneration (don’t smoke, use vitamins if eye doc recommends)
• Vision Therapy can help balance after stroke, brain injury, or binocular vision dysfunction
How do you improve your balance

- Avoid neuropathy
- Avoid medications that worsen your balance
- Avoid aging: Cerebellar dysfunction is considered normal at age 80.
Preventing Falls in Bathroom

Grab bars are a proven way to make the bathroom safer. Grab bars need to be secured into wall studs, so get professional help.

- Rubber tub mats or adhesive strips can prevent disastrous falls in the tub.
- Floor mats should have rubber backings.
Preventing Bathroom Falls

• If you find it hard getting in and out of the bath, or standing for any length of time under the shower, a bath chair or seat that fits across the bath and a hand-held shower will help.

• If it is difficult to sit down on and get up from the toilet, there are devices that will help, such as a riser for the seat or a frame with arm rests.

• Use a night light in the bathroom so you aren’t fumbling around in the dark at night. You need the light for your vision to work!....the most important part of your balance

• Organize shower to prevent reaching.
How do you avoid balance problems

• Maintain good vascular health.
• Deep Brain Stimulation improves balance performance in persons with Parkinson’s
How do you improve your balance?

• Exercise to improve your whole balance system.
• What kind of exercise?
Sand?

- Exercising in sand improves balance
Exercise to Music

- Exercising to Music resulted in greater reduction of falls.
- The exercises included walking in time to music and responding to changes in rhythm, and the movements got increasingly more difficult over time.
- Archives of Internal Medicine, published online Nov. 22, 2010; doi: 10.1001/archinternmed.2010.446
Activities that improve balance:


• **Taekwondo:** Front. Aging Neurosci., 13 March 2013 | doi: 10.3389/fnagi.2013.00010
Activities that improve balance:

- **Hearing:** doi:10.1016/j.apmr.2004.12.036
- **Hydrotherapy:** [http://dx.doi.org/10.1123/ijare.2013-0014](http://dx.doi.org/10.1123/ijare.2013-0014)
Activities that improve balance

Any exercise that requires an element of balance helps!

• Just do it.
Modern Exercise Programs

“Let’s take a walk together. You do two miles and I’ll follow you on Twitter.”
Which will you be?
Summary

• 1. Take care of your eyes.
• 2. Take care of your eyes.
• 3. Exercise.
• 4. Exercise.
• 5. Be careful between 4 and 5 pm.
• 6. Don’t go to bathroom in the dark.
RED WINE MAKES THEM LIVE LONGER, 
BUT THEY GET TO BE A REAL PAIN.

IT HAS A TIMID NOSE WITH THE 
USUAL NOTES OF OAK 
AND VANILLA.

I CAN'T BELIEVE YOU'RE 
DRINKING MERLOT.
HOW WE IMPLEMENT BALANCE TRAINING
Center of gravity over base of support training

Functional Fitness

Manipulating the 3 components of balance
Balance training focuses on how to maintain our center of gravity over our base of support while manipulating the 3 components of the balance system.
Center of Gravity

- A human head weighs between 8 and 10 pounds on average.
- When your head moves forward away from its neutral position, the force through the spine increases.
- In fact, for every 1 inch your head moves forward, the relative weight of the head over the body doubles due to the effects of gravity.

Postural training is the cornerstone of balance training!
BASE OF SUPPORT

**Body position:**
- Lying down
- Kneeling
- Sitting
- Standing

**Foot position:**
- Wide
- Narrow
- Split Stance
- Tandem
- Single Leg
FUNCTIONAL FITNESS

• Body weight progression= Efficient at Moving You

• Closed chain exercises= Body Weight + Multi-Joint movement

• Tri-planar motion= Diagonal + Rotational Movements
VISION + AUDITORY + PROPRIOCEPTION = BALANCE

4 WAYS TO MANIPULATE THE VISUAL COMPONENT OF BALANCE TRAINING:

• Engage it
• Occupy it
• Diminish it
• Take it away
When adding rotation through the visual system the rectus medialis nerve engages causing the automatic reflex contraction of the inner thigh.

Balance training should include keeping your hip adductors strong.
VISION + **AUDITORY**+ PROPRIORCEPTION= BALANCE

NO= Lateral Canal
YES= Superior Canal
EAR⇒SHOULDER= Posterior Canal

All 3 head motions need to be implemented during balance training.
VISION + AUDITORY + **PROPRIOCEPTION** = BALANCE

- Proprioceptors that control balance are located in the skin, muscles, and joints.
- Bare footed balance training your proprioceptors are getting the loudest feedback to the CNS.
- Our goal in balance training is to muffle the impulse to make the other systems more efficient.
HOW WE TRAIN BALANCE : )
ZUMBA

https://www.youtube.com/watch?v=-HF5SMsXnPQ