Balance, Core Strength & Fall Prevention

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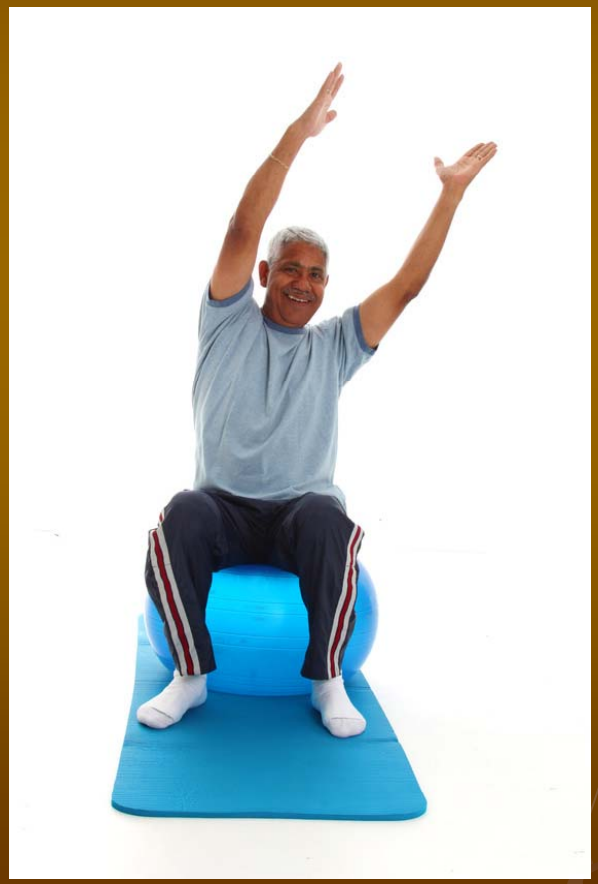
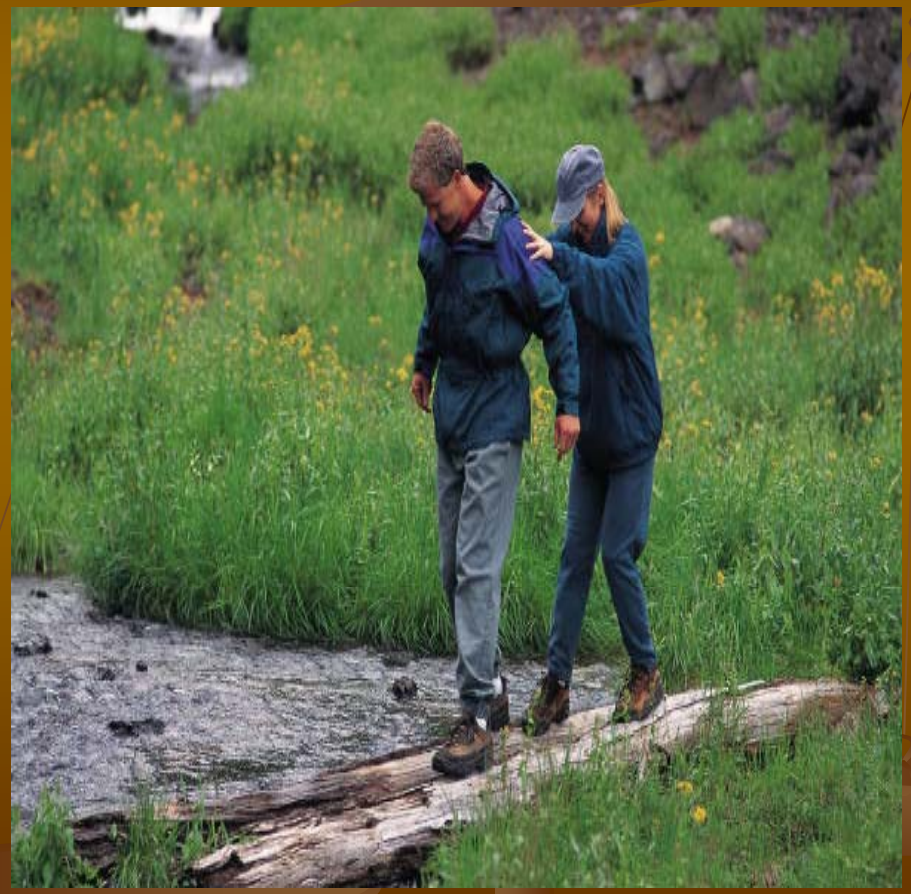
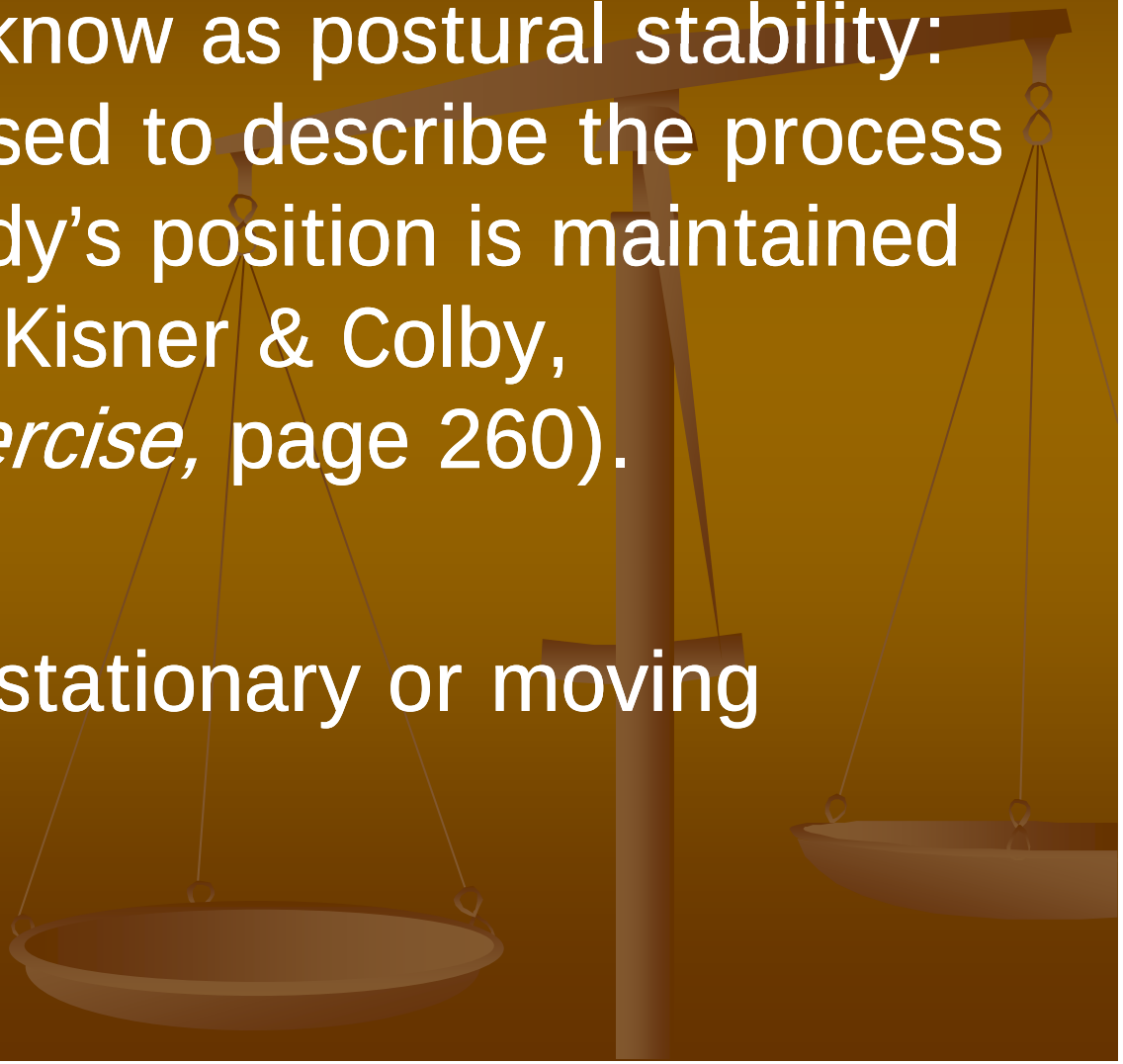




What is Balance?

- Balance is also know as postural stability: “generic term used to describe the process in which the body’s position is maintained in equilibrium” (Kisner & Colby, *Therapeutic Exercise,* page 260).

- Balance can be stationary or moving

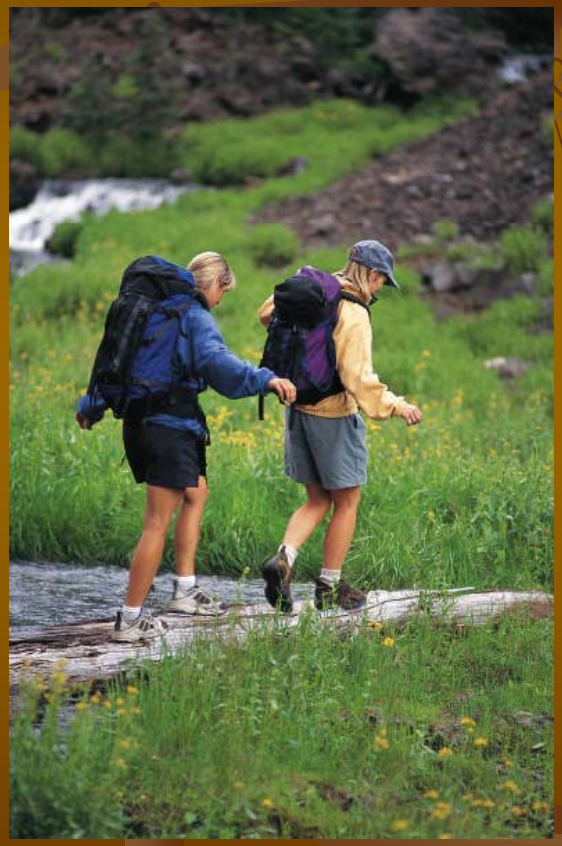


What is Balance?

Not slipping or falling

Why Is Balance Important?

- **Humans MOVE to get around!**
- **The ability to transfer and walk safely depends on coordination among sensory, nervous, cognitive, cardiopulmonary, musculoskeletal, and contextual effects (environment, lighting, support surface, specific task).**



Terms and Definitions

- **Base of Support**
  - **Contact area with supporting surface**
  - **Feet together, Feet apart, Standing on 1 Foot.**
  - **When a Base of Support is reduced, fall risk increases.**

Terms and Definitions

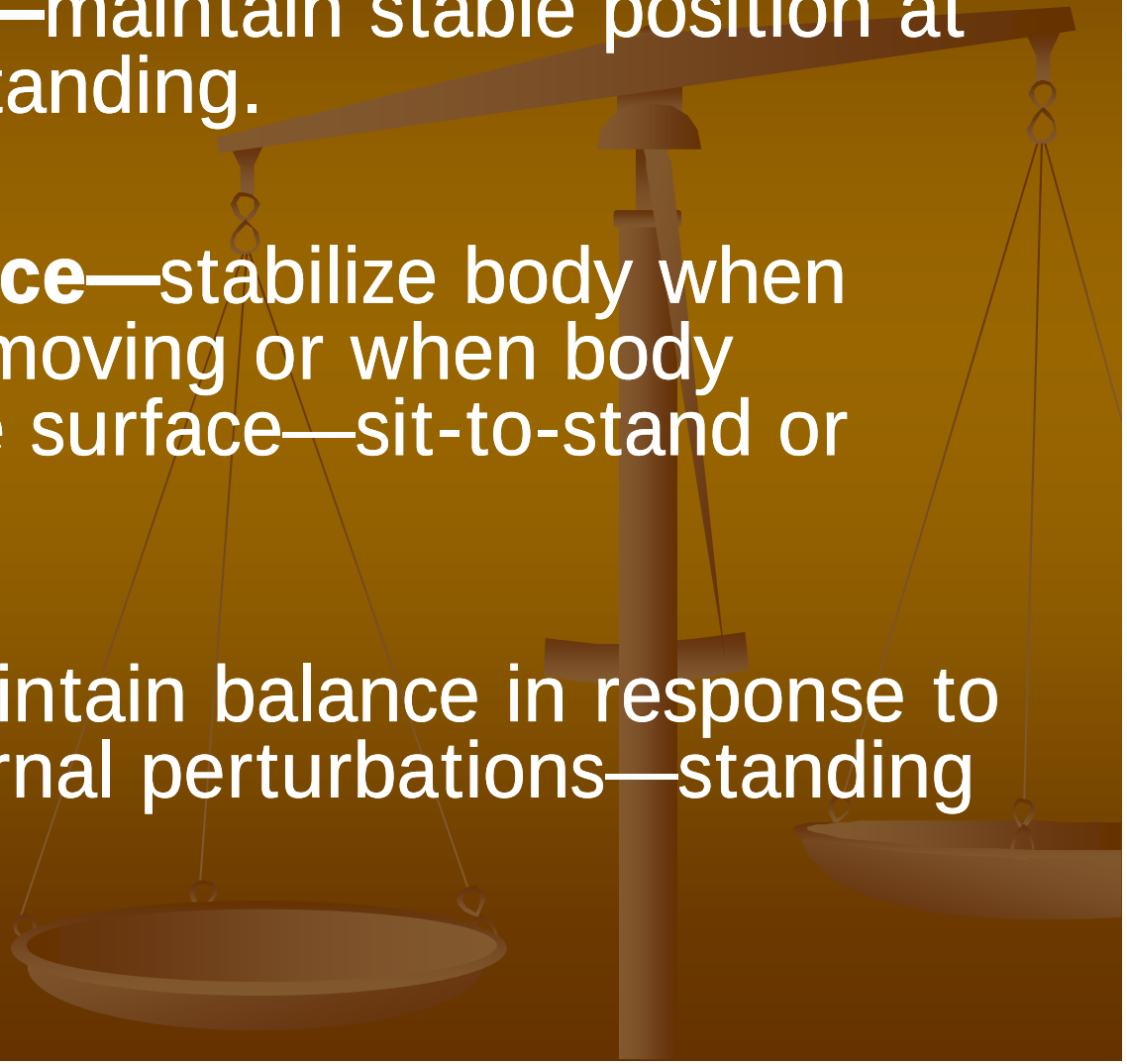
- **Stability Limit**

  Maximum distance a person can lean in any direction without changing the base of support. 8 degrees forward & 4 degrees backward & 16 degrees lateral is maximum limit when standing.

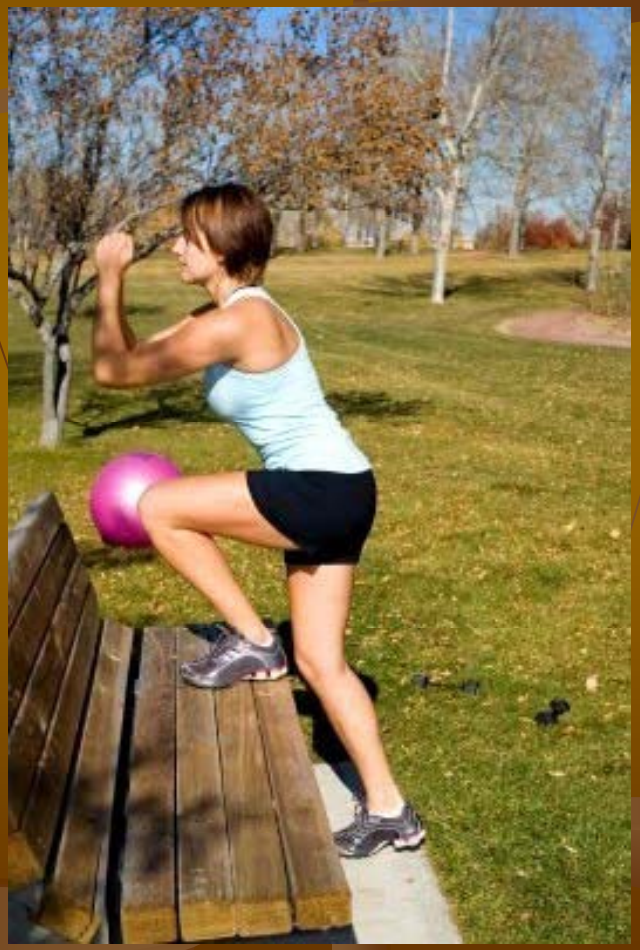
- **Mobility**
  - **Ability to move independently & safely from one place to another.**

Types of Balance Control

- **Static Balance**—maintain stable position at rest—sitting or standing.
- **Dynamic Balance**—stabilize body when support surface moving or when body moving on stable surface—sit-to-stand or walking.
- **Automatic**—maintain balance in response to unexpected external perturbations—standing on bus, train.



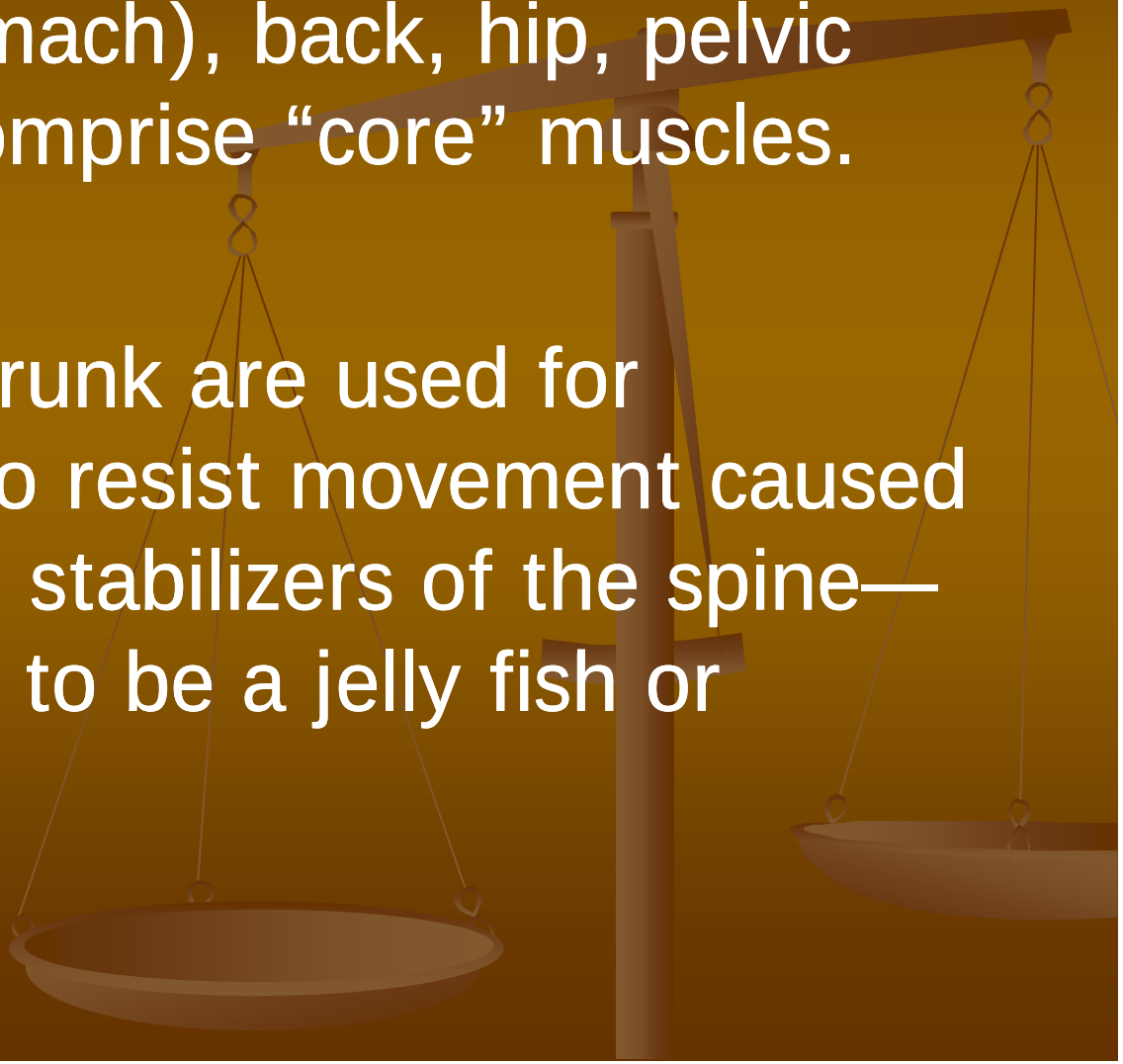
What Happens If We Lose Our Balance?



What is CORE Strength?

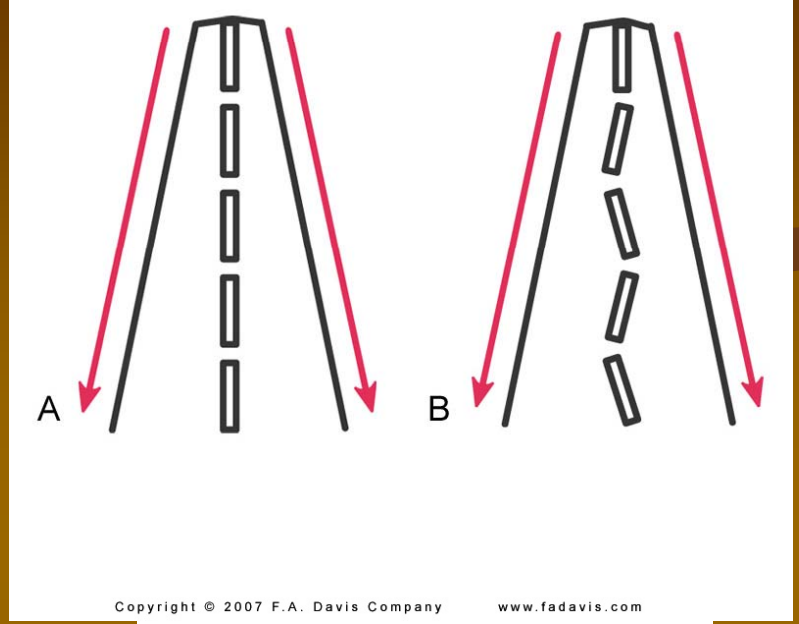
- Abdominal (stomach), back, hip, pelvic floor muscles comprise “core” muscles.

- Muscles of the trunk are used for movement OR to resist movement caused by gravity & are stabilizers of the spine—would you want to be a jelly fish or octopus?

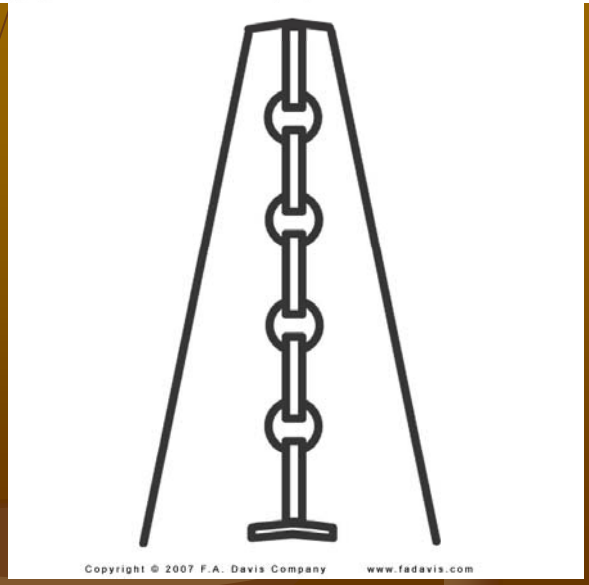


2 Major Types of CORE Muscles

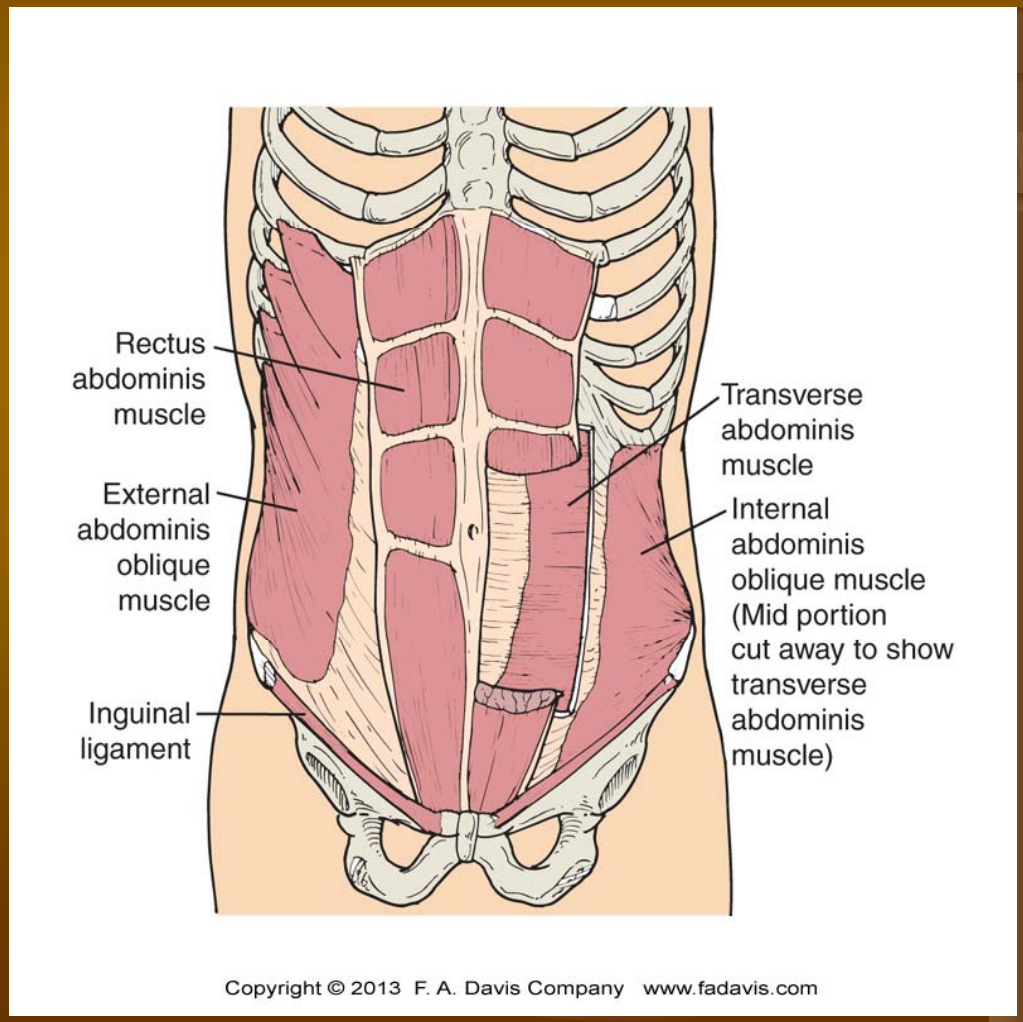
Superficial muscles, large guy wires, respond to external loads on trunk that shift body, general stability. Instability can occur.



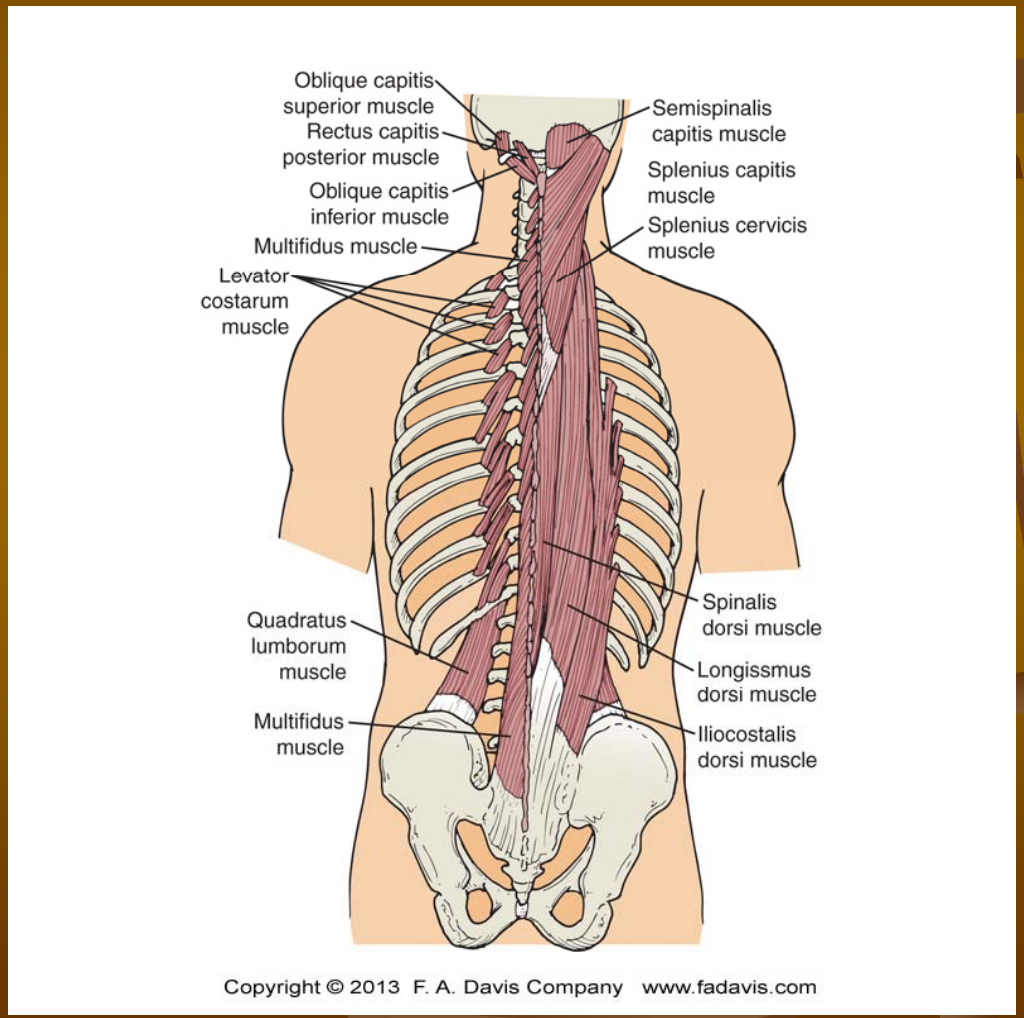
Deep muscles, have direct attachments across vertebrae, provide segmental stability, help maintain each segment in stable position to reduce instability.



Abdominal Muscles

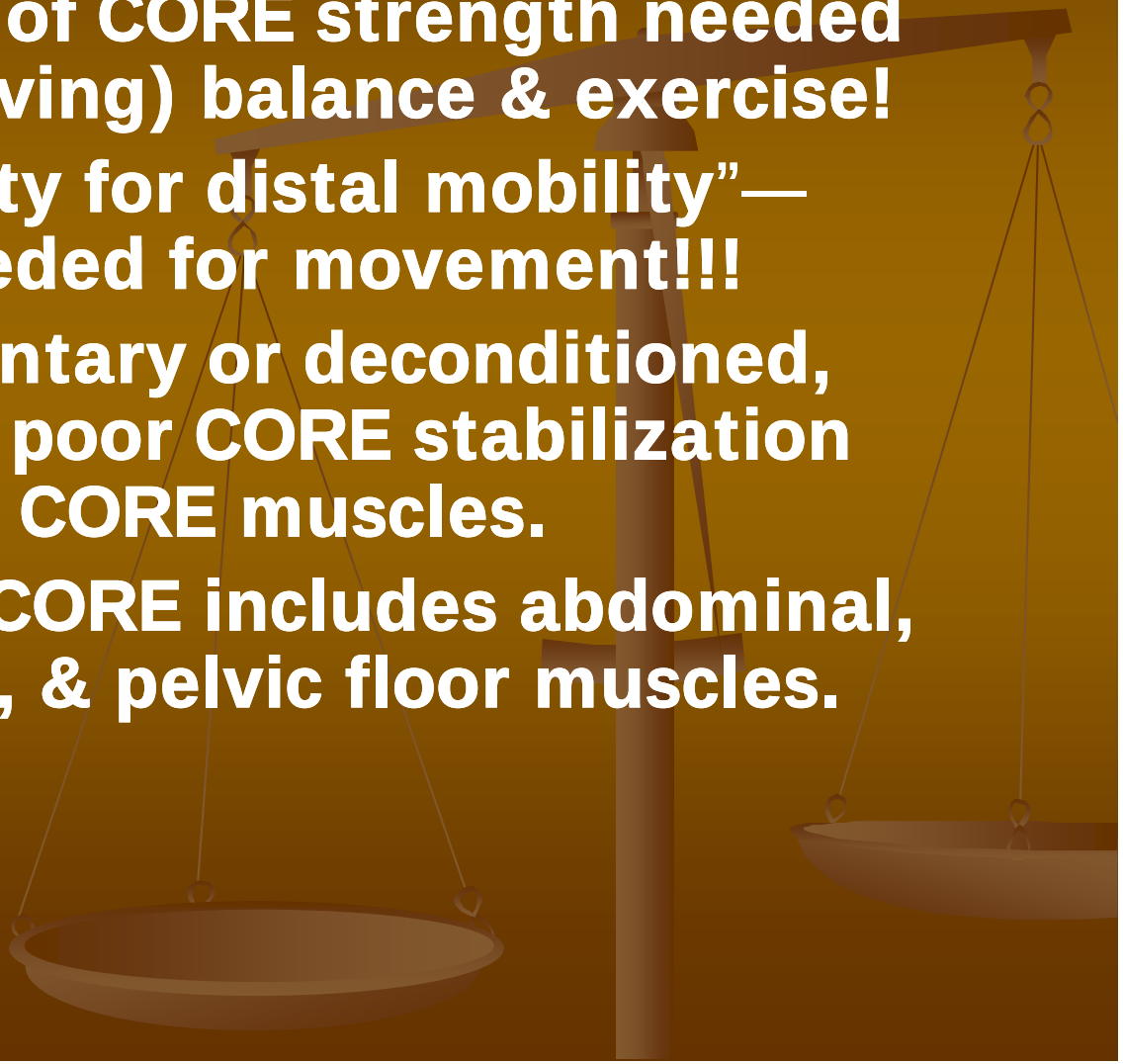


Muscles of the Back



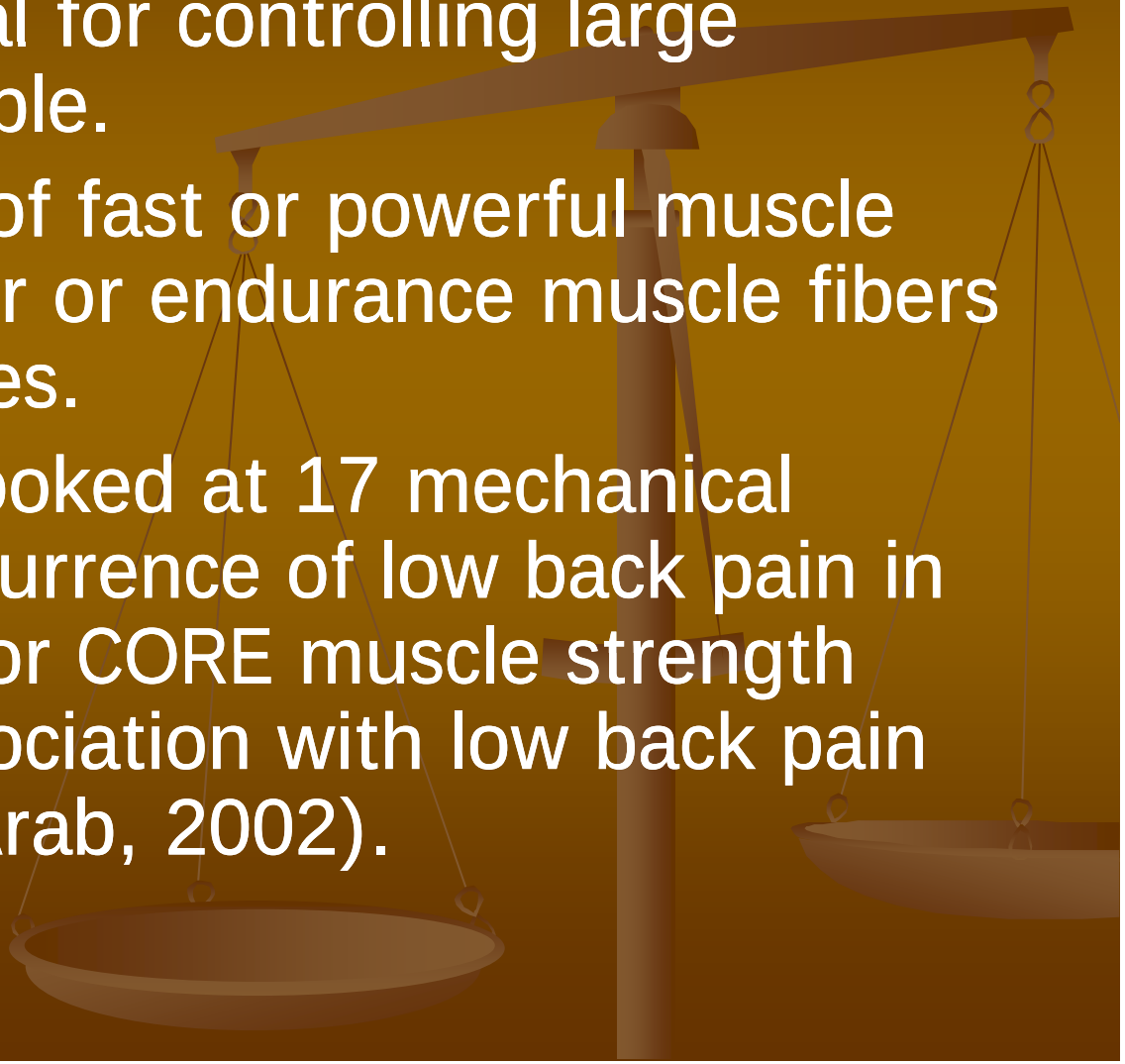
Clinical Pearls

- **Minimal amount of CORE strength needed for dynamic (moving) balance & exercise!**
- **"Proximal stability for distal mobility"— Strong CORE needed for movement!!!**
- **If person is sedentary or deconditioned, they WILL HAVE poor CORE stabilization and weakness in CORE muscles.**
- **Remember that CORE includes abdominal, back, hip flexors, & pelvic floor muscles.**



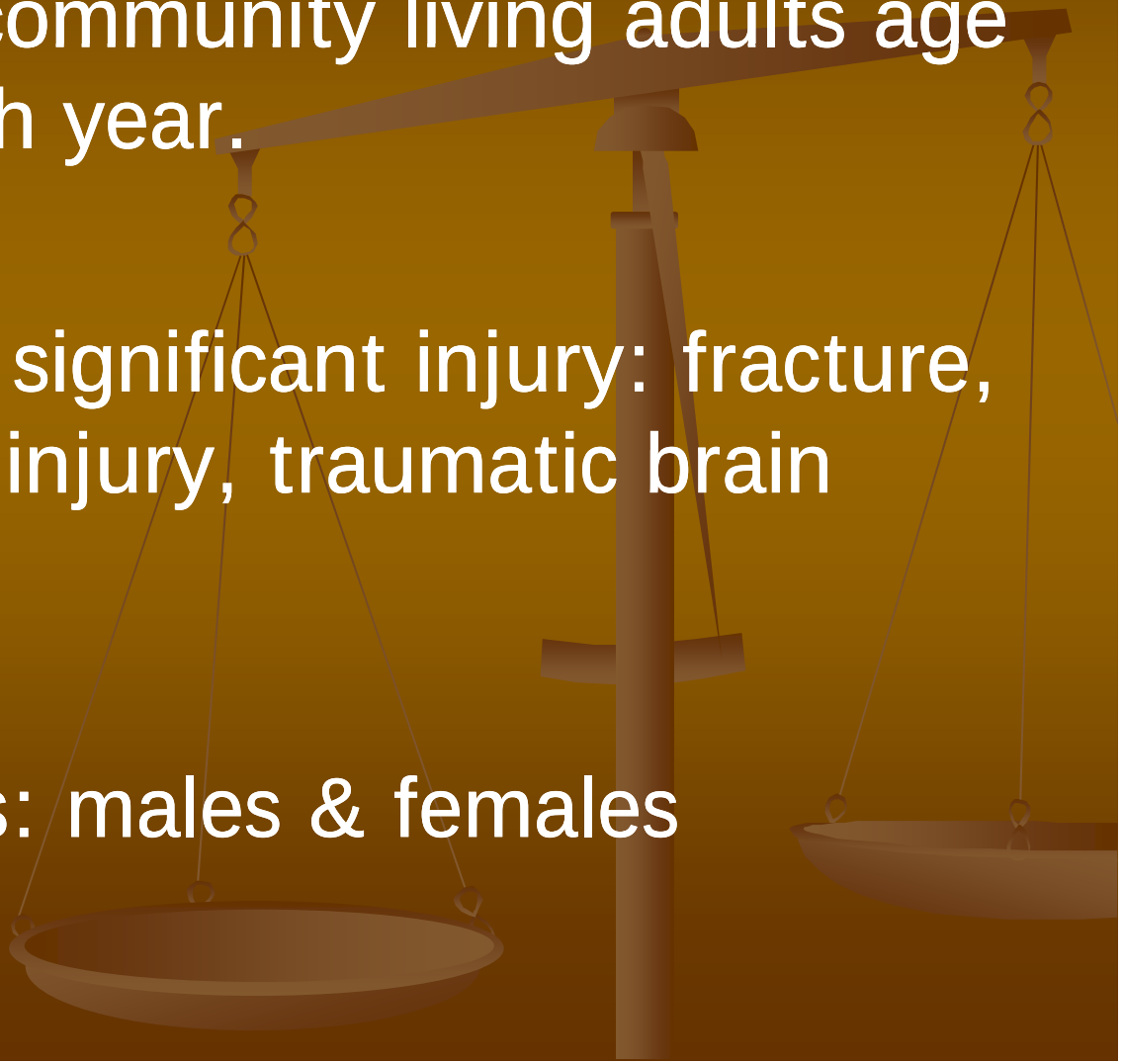
Role of CORE Muscle Strength

- Strength is critical for controlling large loads/unpredictable.
- Greater number of fast or powerful muscle fibers than slower or endurance muscle fibers in all back muscles.
- In a study that looked at 17 mechanical factors & the occurrence of low back pain in 600 subjects, poor CORE muscle strength had greatest association with low back pain (Nourbakhsh & Arab, 2002).



What Are the Statistics on Falls?

- More than 1/3 of community living adults age 65 & older fall each year.
- 10% falls result in significant injury: fracture, serious soft tissue injury, traumatic brain injury
- Similar injury rates: males & females

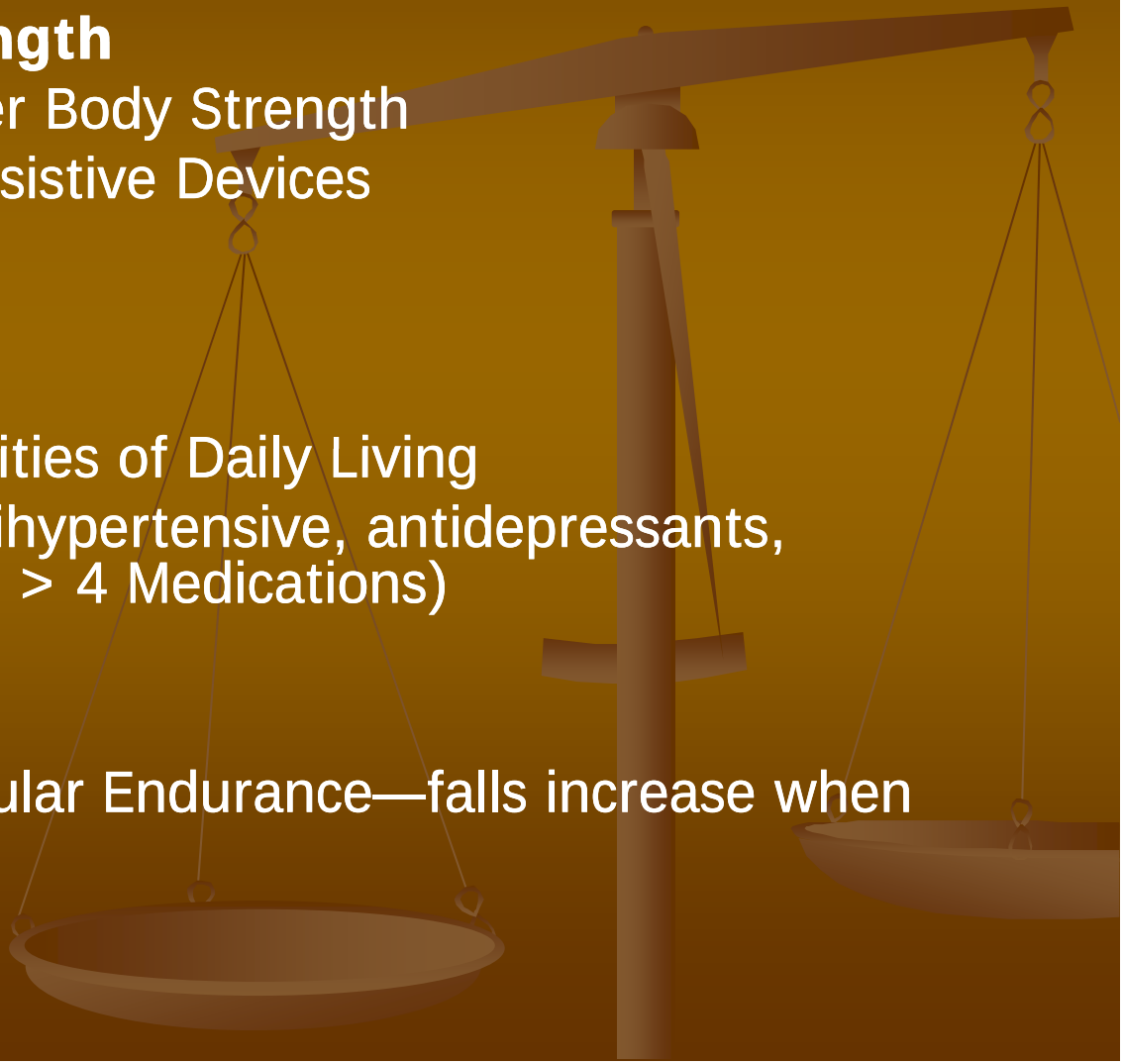


Losing Balance-- Consequences of Falls

- Injuries resulting from a fall rank as 6th leading cause of death in this population.
- Estimated costs for 2.6 million fall-related injuries in the US is approximately $19 billion. Estimated $43.8 billion in 2020.
- Elderly fallers are likely to lose confidence, restrict activity levels, and decline in functional activity and independence.

Risk Factors for Falls

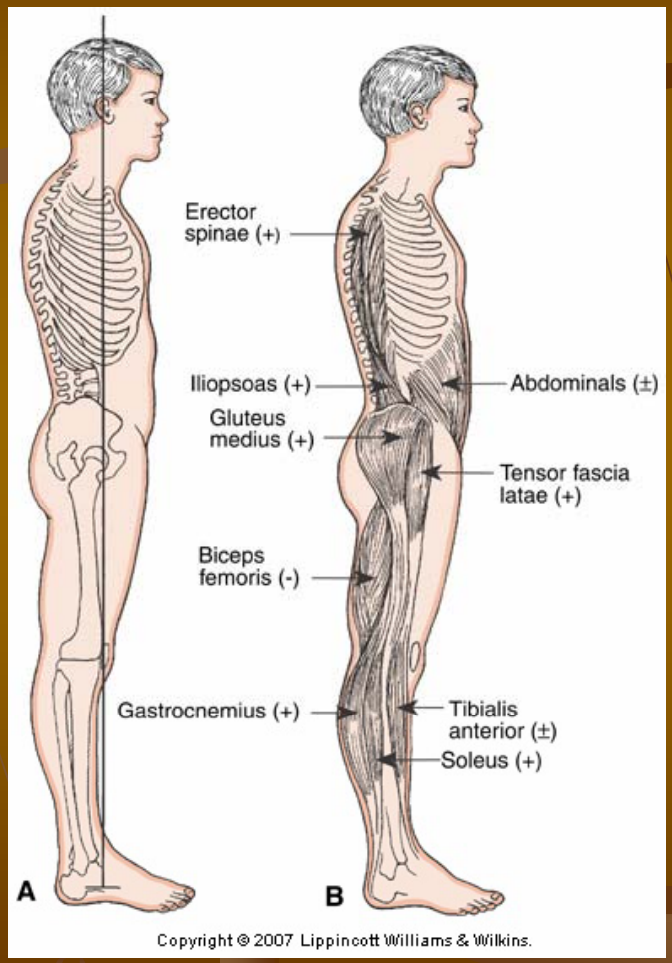
- **Previous falls--#1 Risk Factor**
- **Decreased CORE Strength**
- Decreased Upper & Lower Body Strength
- Walking Speed/Use of Assistive Devices
- Balance Impairments
- Depression
- Visual Impairment
- Difficulty with Basic Activities of Daily Living
- Specific Medications (antihypertensive, antidepressants, tranquilizers, sedatives & > 4 Medications)
- Cognitive impairment
- Age $\geq$ 80 years old
- Aerobic Endurance/Muscular Endurance—falls increase when fatigued



Musculoskeletal Deficits

- Musculoskeletal impairments include poor posture, decreased flexibility & CORE strength.

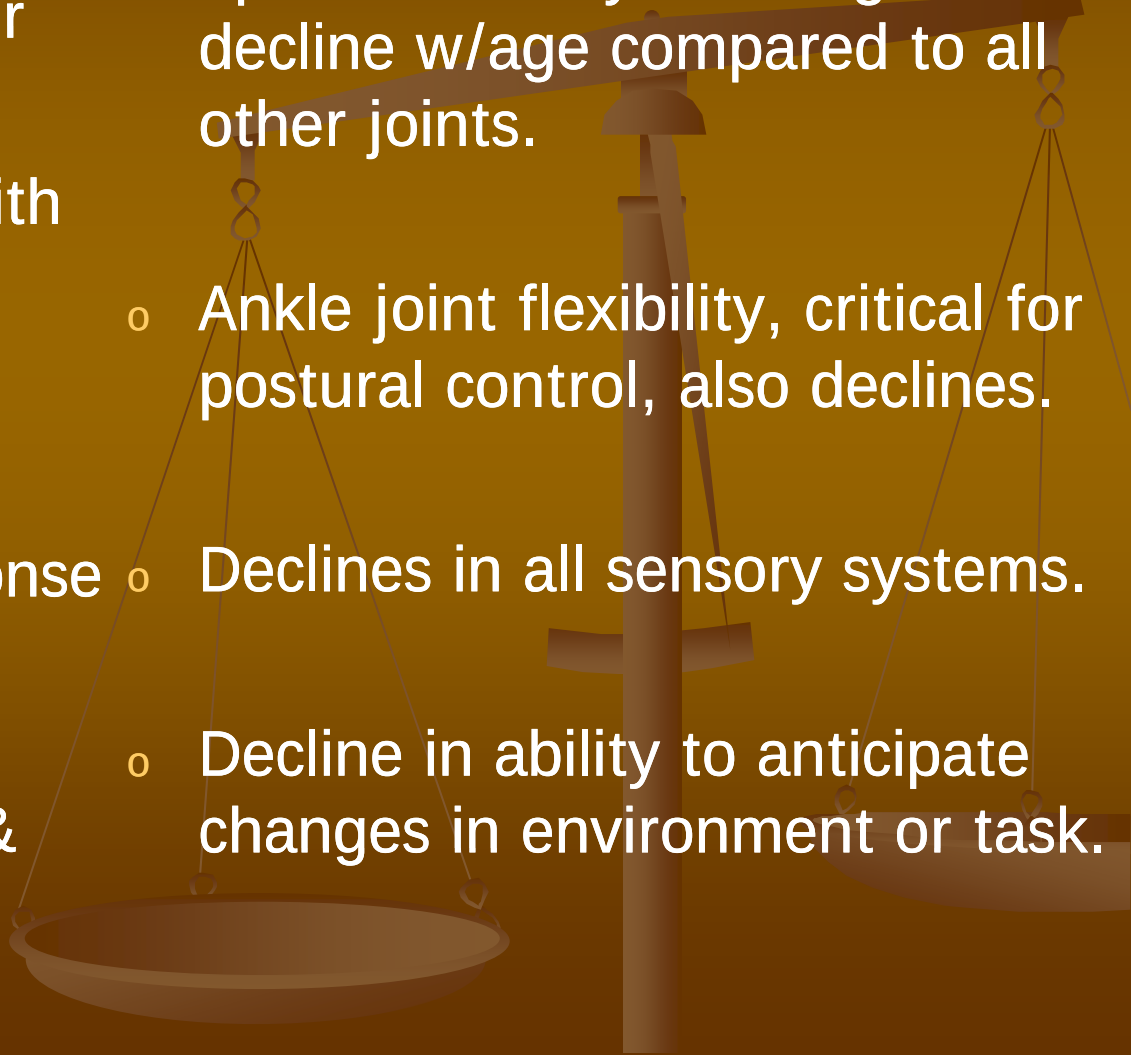
- Weak ankle strength & flexibility.



Shumway-Cook & Woollacott, Fig. 7.5

Deficits with Aging

- Strength declines with age. Loss of fast twitch motor units.
- Endurance decreases with age.
- Visual changes
- Decrease reaction time, movement time & response time.
- Reduced balance when challenged w/stronger & faster force.
- Spinal flexibility shows greatest decline w/age compared to all other joints.
- Ankle joint flexibility, critical for postural control, also declines.
- Declines in all sensory systems.
- Decline in ability to anticipate changes in environment or task.



Can Age Related Changes in Balance Be Reversed?

- Growing research evidence suggests that exercise can reverse, or at least slow the rate of decline.
- Consistent exercise can **INCREASE CORE STRENGTH & BALANCE regardless of age & function.**

Can Age Related Changes in Balance Be Reversed?

- Research suggests that in healthy adults, adults with existing balance problems and older adults, moderate to large improvements in balance & mobility and a reduction in fall risk or fall incidence with consistent, specific exercise.

Falls: How Can Older Adults Prevent Them?

- **Exercise regularly/Balance Exercises**
- Ask doctor or pharmacist to review medicines–both prescription and over-the counter–to reduce side effects and interactions.
- Have eyes checked by an eye doctor at least once a year.
- Improve the lighting in the home.
- Reduce hazards in the home that can lead to falls.
- **KNOW YOURSELF—Balance changes?**

http://www.cdc.gov/HomeandRecreationalSafety/falls/adultfalls.html

Recommendation (Sherrington)

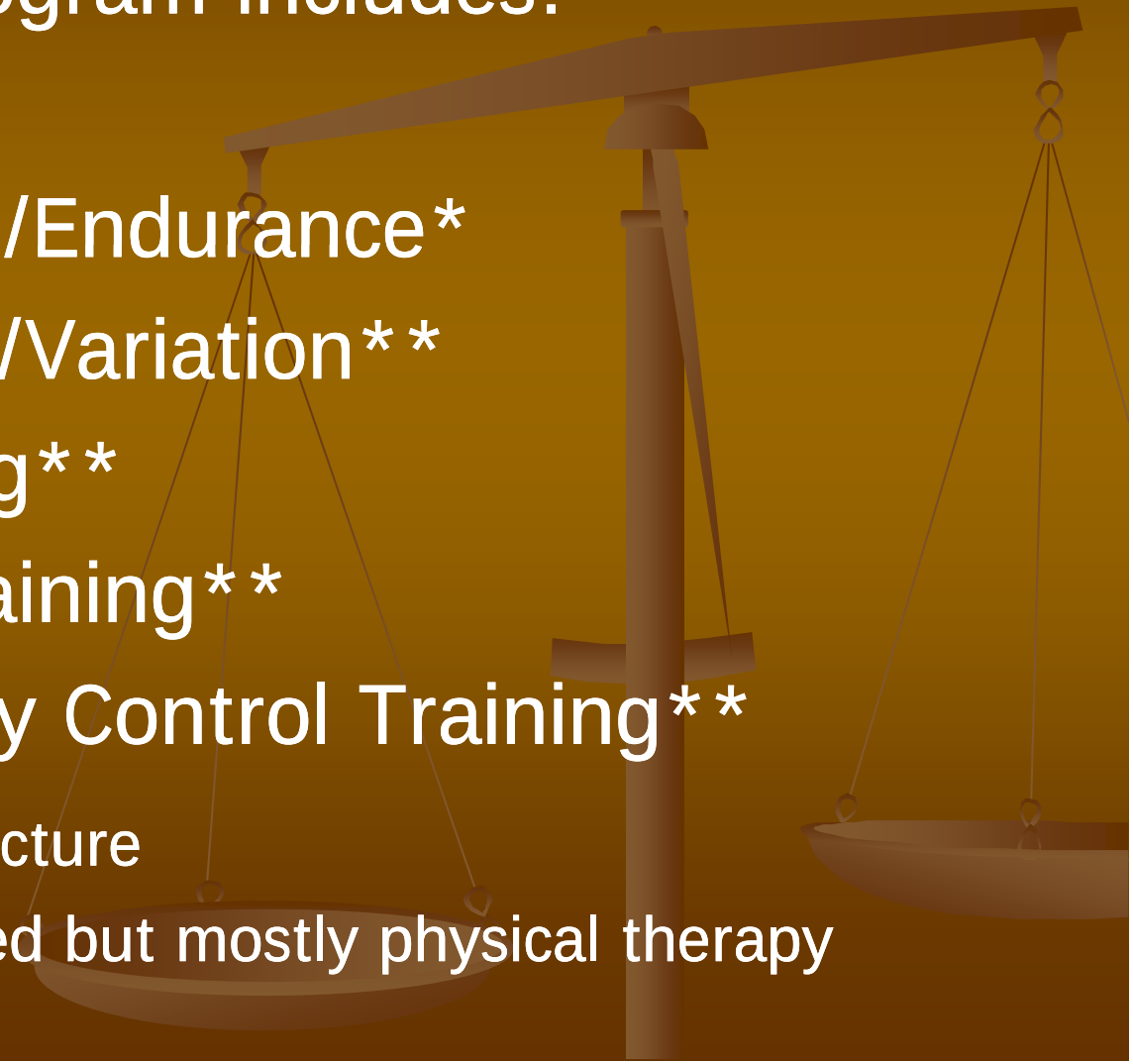
Exercise must provide a **moderate or high challenge** to balance in order to be effective

1) Reducing base of support
2) Movement of the center of gravity – control of body position while standing
3) Reducing need for upper limb support with exercises in standing or decrease reliance on arms.

Exercise Training

Comprehensive program includes:

1. Flexibility*
2. Muscle Strength/Endurance*
3. Walking Pattern/Variation**
4. Postural Training**
5. Multisensory Training**
6. Center of Gravity Control Training**



*exercises included in lecture

**a few exercises included but mostly physical therapy treatment

General Exercises to Improve Balance (flexibility/strength)

- Knee Extension/Flexion—Sit/Stand
- Toe/Heel Raises/Circle—Sit/Stand
- Lower Leg Stretch--Stand
- Hamstring Stretch--Sitting
- March in Place—Sit/Stand
- Hip Out/Together—Sitting
- Hip Pendulum--Stand
- Draw In (10x10sec) & Butt Squeeze (10x10sec)—Sit/Stand
- Sit to Stand--Sitting
- Wall Squats--Standing
- Wall Push Up—Standing
- Chair Push Up--Sitting
- Seated Sit-ups—Sitting
- Curl Ups—floor/bed
- Front/Side Lunges--Standing
- Head/Neck Flexibility—Sit/Stand
- Upper Body Flexibility—Sit/Stand

General Exercises to Improve Balance

- Do not bounce when stretching
- Hold stretch for 10-30sec (can go up to 60sec), to point of tightness, minimum of 2-3 days/week but most effective 6-7 days/week.
- Non stretching exercises should be performed 10-20 times each, minimum of 2-3 days/week but most effective 3-5 days/week.
- Make sure to exercise both arms/legs.
- Can provide resistance--hand, theraband, stability ball, cuff weights to make exercise more challenging.

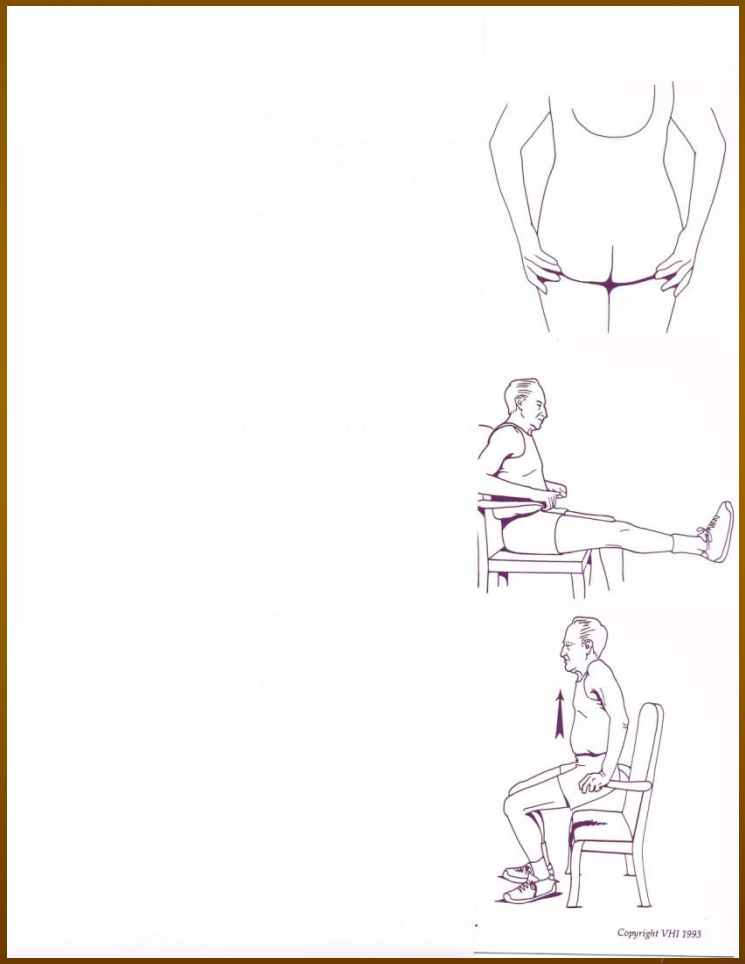
Exercise Training—Physical Therapy or Balance Programs

- Walking Pattern/Variation—directional change, start/stop, gait pattern variations, obstacle avoidance.
- Postural Training—working on ankle, hip & step strategies for postural control.
- Multisensory Training—eyes closed/alter support surface/alter base of support.
- Center of Gravity Control Training—manipulating seated support surface or standing surface—stability ball, dyna-disc

In Conclusion

Balance & mobility CAN BE IMPROVED through balance training to reduce the risk of falls.

Exercise Pictures



- Butt Squeeze
- Knee Extension/Flexion
- Chair Push Up

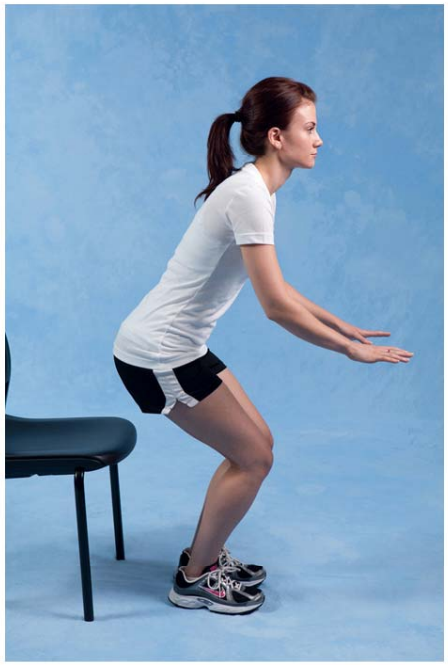
Exercise Pictures

Lower Leg Stretch

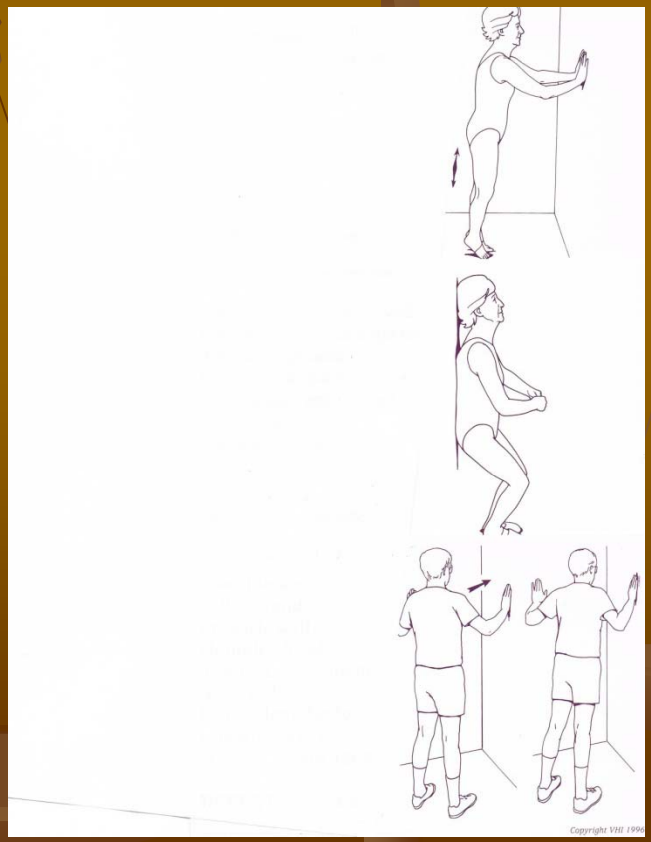
Hamstring Stretches

Exercise Pictures

Sit To Stand



Toe Raises, Wall Squats & Wall Push Ups



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