BALANCE

- It is defined as the ability to align body segment against gravity to maintain or move the body within the available base of support without falling.

- **Types of balance:**
- **1. Static balance:**
- It is the balance which is maintained when the body is still.
- **2. Dynamic balance:**
- It is the balance which is maintained during activity like walking, running, jumping etc.

Balance control mechanism

- Balance control requires the interaction of nervous system, muscular system and contextual effects.

- **A. Nervous system:**
- It includes sensory or motor system
- **1. Sensory system:**
- Perception of one's body position and movement in space require a combination of information from peripheral receptors in multiple sensory systems. This includes;

- **Visual system:**
- Visual sensation records any alteration in position of the body with regards to its surrounding and the eyes form one of the receptor for the righting reflexes which enable the head and body to restore themselves in balanced position.
- **Vestibular system:**
- Stimulation of receptors of the vestibular nerve results from movement of fluid present in semicircular canal of internal ear . Any movement of head disturb the fluid & thus knowledge of movement & direction in which it takes place are recorded.

- **Somatosensory system :** It consist of,
- **1.Proprioceptor:**
- Information from muscle proprioceptors including muscle spindles and golgi tendon organs record changing tension within the muscle. Increased tension causes stimulation & results in a reflex contraction of the muscle. This is called myotatic or stretch reflex.

  2. Joint receptors:
- In the weight bearing position approximation of bones stimulates the receptors in joint structure & elicit reflex reaction to maintain the position.

- **3. Cutaneous receptors:**
- The skin mechanoreceptors sensitive to vibration, light touch, deep pressure & skin stretch also give sensory input for maintaining the balance & coordination.

- **2. Motor system:**
- The chief center involved are cerebral cortex, the cerebellum, the red nucleus & the vestibular nucleus. Sensory input from all the nucleus are conveyed & coordinated in these centers & give efferent impulses for planning, programming & executing the balance responses by delicate adjustment & harmonious interaction of various groups of muscles.

- **C. Musculoskeletal contribution:**
- This includes postural alignment, musculoskeletal flexibility such as ROM, joint integrity, muscle performance (muscle strength, power & endurance) & sensation (touch, pressure, vibration & kinesthesia)

- **D. contextual effects:** That interact with two systems these are,
- These are environment whether it is closed (predictable with no distraction) or open (unpredictable with distraction),

- The support surface i.e. firm vs slippery, stable vs unstable, types of shoes.
- The amount of lighting, effects of gravity.

- **Impaired balance:**
- Impaired balance can be caused by injuries or diseases to any structures responsible for maintaining the balance like deficits in sensory motor system, musculoskeletal system etc.

Causes of balance impairment

- **1. Sensory input impairment:**
- **a)** Proprioceptive deficits following lower extremities & trunk injuries or pathologies causes balance impairments such as;
- - Decreased joint position sense incase of recurrent ankle sprains, knee ligamentous injuries, degenerative joint diseases & low back pain.
- **b)** Somatosensory, visual and vestibular deficits may impair balance & mobility;
- -Reduced somatosensation in lower extremity caused by peripheral neuropathies in aged & in individual with diabetes mellitus are associated with balance deficits.

- -Visual loss caused by disease, trauma or aging can impair balance & lead to fall.
- -Damage to vestibular system due to visual infection, traumatic brain injury (TBI) or aging may impair balance & mobility.

- **2. Motor deficits**:
- Damage to the basal ganglia, cerebellum or supplementary motor area impair the processing of incoming sensory information resulting in difficulty adapting sensory information in response to environmental changes that affects the balance.

- **Other causes:**
- Deficits in the balance control can be caused by musculoskeletal impairment such as poor posture, joint ROM limitation, decreased muscle performance and neuromuscular impairments such as impaired motor coordination and pain.

- **Balance training:**
- Balance training is given in both static and dynamic position.
- **1. Static balance control**: Activities to promote static balance control are;

- Ask the patient to maintain balance in sitting, half kneeling, tall kneeling & standing on a firm surface.
- Progress these activities to tandem & single leg stance, lunges & squat position.
- Again progress these activities by working on a soft surfaces (foam, sand etc), narrowing the base of support, moving the arms or closing the eyes.
- Add a secondary task to further increase the level of difficulty like balance while standing & catching a ball.

- **2. Dynamic balance control:** Activities to promote dynamic balance control are;
- Have the patient maintain equal weight distribution & upright trunk postural alignment while moving on surfaces such as sitting on a therapeutic ball, standing on wobble board.
- Progress the activities by adding movement such as shifting the body weight, rotating the trunk, moving the head & arm on moving surfaces.
- Vary the position of the arms from out to the side to above the head while standing on the wobble board.

- Practice stepping exercises starting with small steps then mini lunges to full lunges.
- Progress the exercises to hopping, skipping ropes, jumping.
- Have the patient perform arm and leg exercises while standing with normal stance and single leg stance.