

BRUNNSTROM'S APPROACH

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Objectives:

- Discuss the concepts and principles underlying the Brunnstrom's approach
 - Brunnstrom recovery stages
 - Treatment principles & techniques

History:

- ★ Brunnstrom's approach was developed by the physical therapist from Sweden in the early 1950's
- ★ Brunnstrom used motor control theory and observations of the patients
- ★ Procedure: in a "trial & error" fashion
- ★ Later modified: in light of neurophysiological knowledge

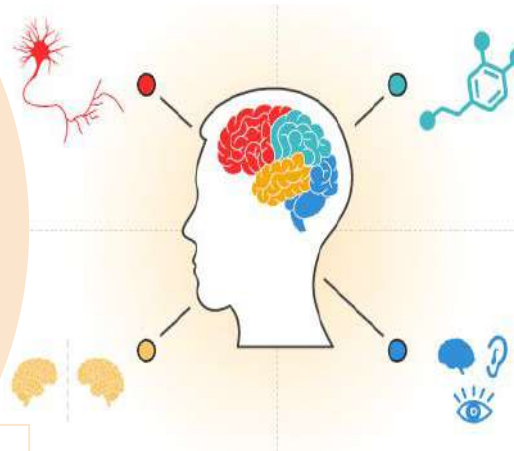
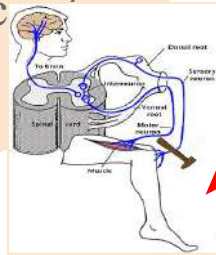
SIGNE BRUNNSTROM



Introduction:

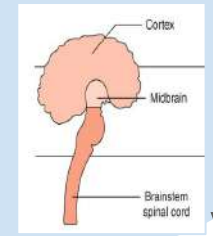
Reflex Theory

Movement is controlled by stimulus → response.
Reflexes are the basis for movement: reflexes are combined into actions that control behavior.



Hierarchical Theory

Characterized by a top-down structure, in which higher centers are always in charge of lower centers.

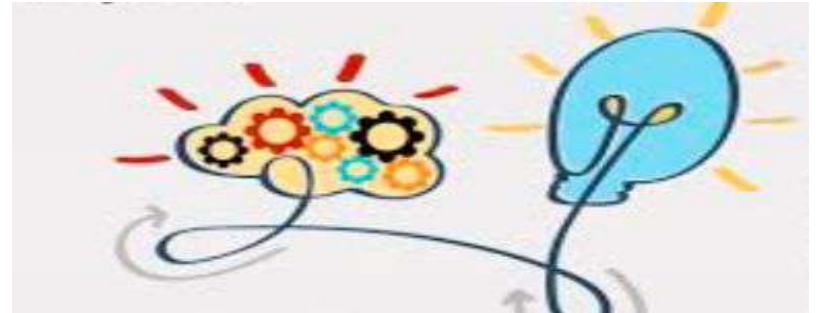


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- When the CNS is injured, as in cerebrovascular accident, an individual goes through an **“evolution in reverse”**.

Movement becomes primitive, reflexive and automatic.

- Changes in tone and the presence of reflexes considered as a normal process of recovery.



Cont'd:

- Movement recovery tends to be stereotypic.
- Patients exhibit only few stereotypic movement patterns: **Basic Limb Synergies**.
- Based on observations of recovery following a stroke, this approach makes use of associated reactions, tonic reflexes and the development of basic limb synergies to facilitate movements.
- Use of such procedure is temporary.



Basic Limb Synergies:

- Normal synergistic movements are purposeful movements with maximum precision and minimum waste of energy.
- Basic limb synergy (BLS) do not permit different combination of muscles.
- BLS are considered as primitive, automatic and reflexive due to loss of inhibitory control from higher centers.



Cont'd:

- Mass movement patterns in response to stimulus or voluntary effort both
 - Gross flexor movement (**Flexor Synergy**)
 - Gross extensor movement (**Extensor Synergy**)
 - Combination of the strongest component of the synergies (**Mixed Synergy**)
- Appear during the early spastic period of recovery

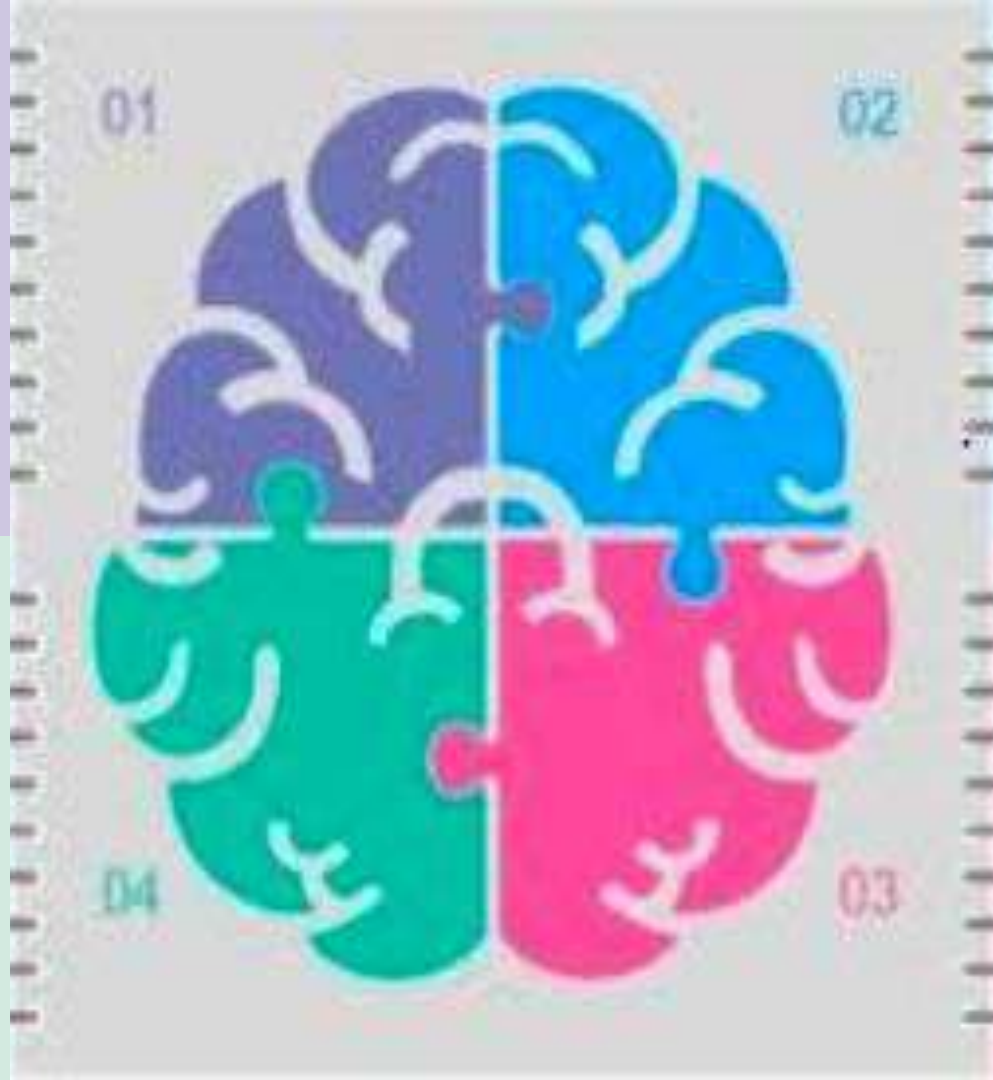


**Upper Limb Flexor
Synergy:**

Scapula: Retraction /
Elevation
Shoulder: Abduction and
External rotation
Elbow: Flexion
Forearm: Supination
Wrist and Finger: Flexion

**Lower Limb Extensor
Synergy:**

Pelvis: posterior tilt
Hip: Extension, Adduction
& Internal rotation
Knee: Extension
Ankle: Plantarflexion
Toes: Flexion

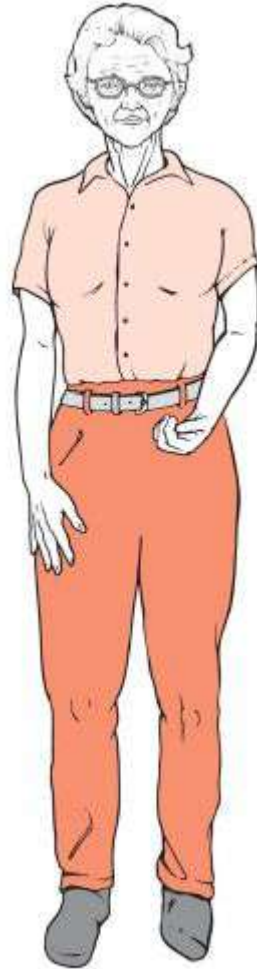


**Upper Limb Extensor
Synergy:**

Scapula: Protraction /
Depression
Shoulder: Adduction and
Internal rotation
Elbow: Extension
Forearm: Pronation
Wrist: Extension
Finger: Flexion

**Lower Limb Flexor
Synergy:**

Pelvis: anterior tilt
Hip: Flexion, Abduction &
External rotation
Knee: Flexion
Ankle: Dorsiflexion
Toes: Extension



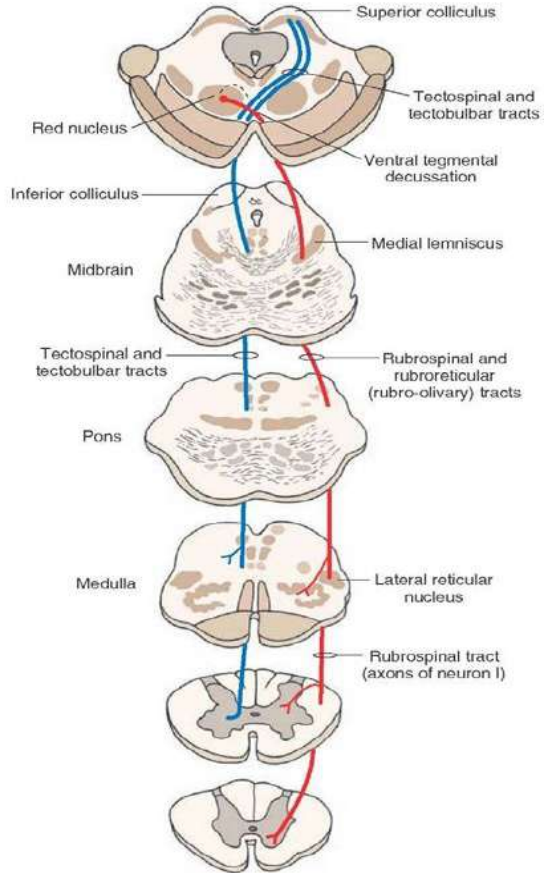
Upper Limb Mixed Synergy:
Scapula retraction
Shoulder add.+IR
Elbow flexion
Forearm pronation
Wrist & fingers flexion



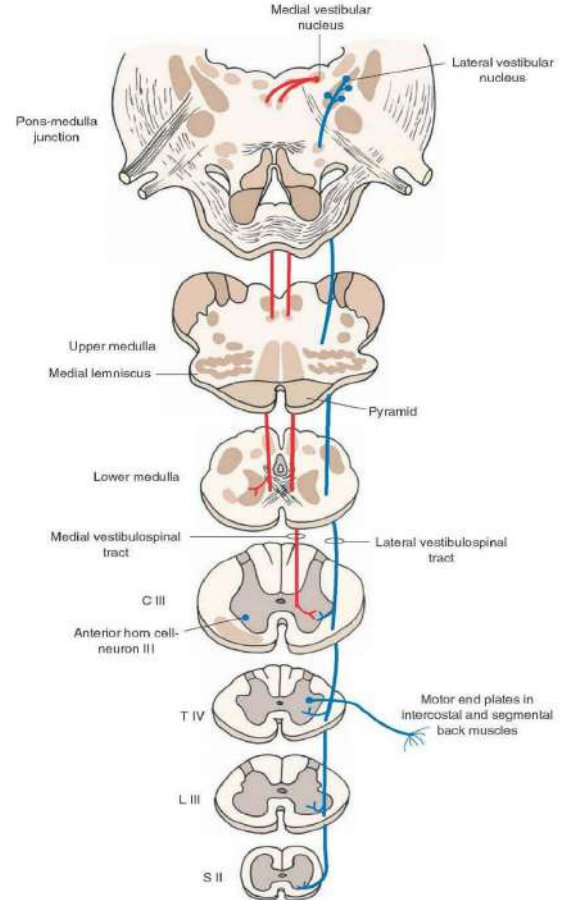
Lower Limb Mixed Synergy:
Pelvis post tilt
hip add.+IR
Knee extension
Ankle & toes plantarflexion



Rubrospinal tract



Vestibulospinal tract



Associated Reactions:

Voluntary forceful movement in other parts of the body readily elicit reflex tensing of muscles and involuntary movements of affected limbs known as **Associated reactions**.

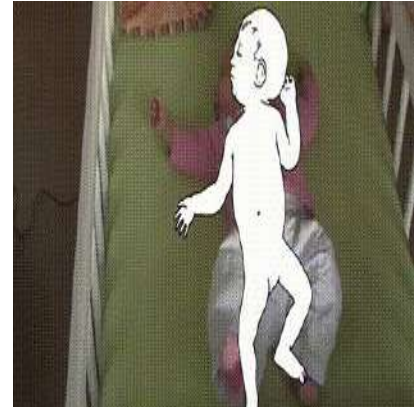
- Investigation by Simon (1923)
 - Position of the head has a marked influence on the outcome of the associated reactions
 - Limb reactions evoked closely resemble tonic neck reflexes
- Observations by Brunnstrom (1951 & 1952)
 - UE: movements employed elicited same reactions in the affected limb
 - LE: movements employed elicited opposite reactions in the affected limb

Cont'd:

- **Homolateral Limb Synkinesis:** the response of one extremity to stimulus will elicit the same reaction in it's ipsilateral extremity.
- **Raimiste's Phenomenon:** resisted abduction or adduction of the sound limb evokes a similar reaction in the affected limb.
- Associated reactions are also evoked by Yawning, Sneezing and Coughing.

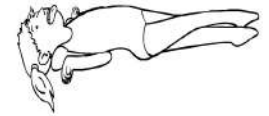
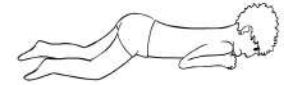
Postural Reactions:

- **Asymmetric Tonic Neck Reflex (ATNR):** Head rotation to the left causes extension of left arm and leg and flexion of right arm and leg; head rotation to the right causes extension of right arm and leg and flexion of left arm and leg.
- **Symmetric Tonic Neck Reflex (STNR):** Flexion of the neck results in flexion of the arms and extension of the legs; extension of the neck results in extension of the arms and flexion of the legs.



Cont'd:

- **Tonic Labyrinthine Reflex (TLR):** Prone lying position facilitates flexion; the supine position facilitates extension. The reflex can also be thought of as inhibition of extensor tone in the prone position



Brunnstrom Recovery Stages:

- Brunnstrom stereotyped sequence of events takes place during recovery.
- Initially classified into six stages later on modified into seven recovery stages.
- Depending on the severity of the insult and the degree of the sensory motor involvement, recovery may get arrested at any stage in the process.
- Stages cannot be skipped.
- In some cases, specially when insult is minor, the recovery may proceed rapidly with no distinct observable stages.
- Believes that the stages of recovery resemble the normal infantile motor development.



BRUNNSTROM



v/s

BOBATH

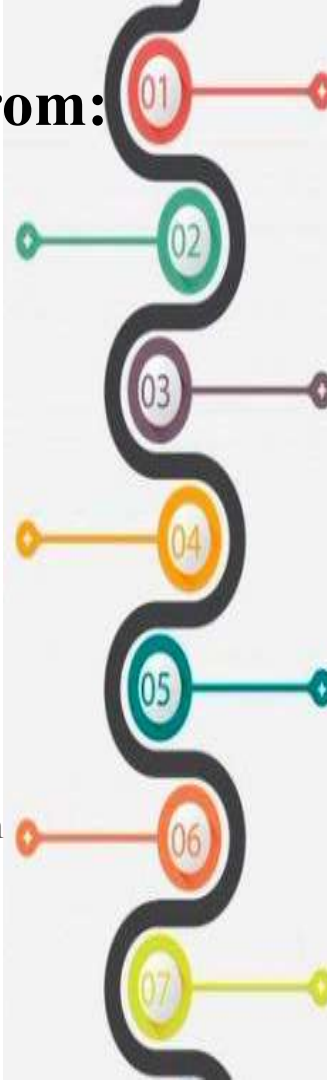


Recovery Stages of Brunnstrom:

As recovery begins, BLS or some of their components appears as associated reactions, or minimal voluntary responses may be present. Spasticity begin to develop and may be particularly evident in muscle groups that dominate synergy movement (e.g. elbow flexors and knee extensors).

Some movement combinations that do not follow the paths of BLS are mastered, first with difficulty and then with ease; spasticity begins to decline; the influence of spasticity on non-synergistic movements is readily observable.

Individual joint movements possible; coordination reaching normally, absence of spasticity.

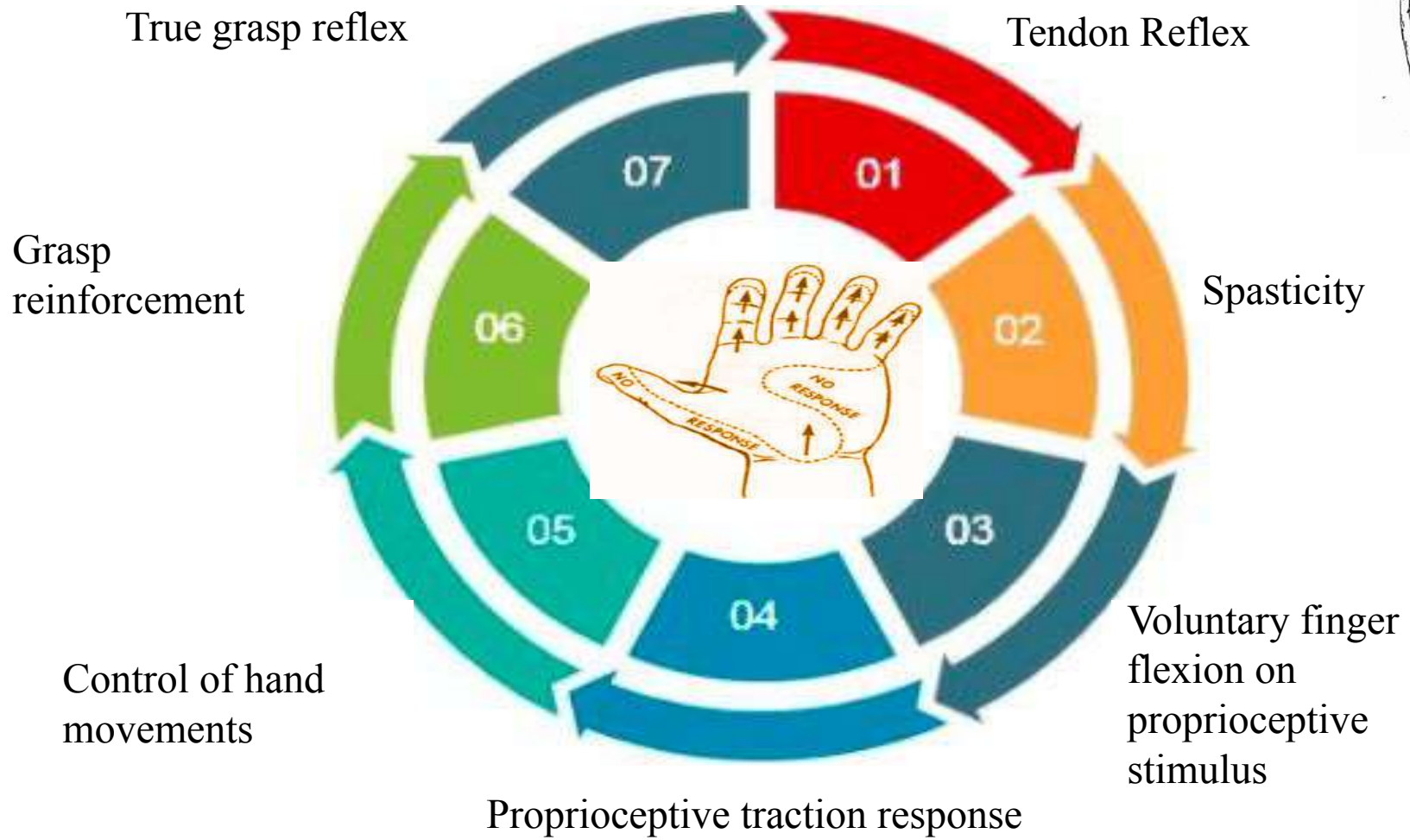


Seen soon after the acute episode, affected limbs are essentially flaccid, no voluntary or reflexive movements possible.

The patient gains voluntary control on BLS, full range of all synergy components is not mandatory, spasticity reaches its peak: consider as the semi-voluntary stage.

As recovery continues, more difficult movement combinations away from the path of BLS are mastered; dominance of BLS over motor control reducing; spasticity continues to decline.

Normal motor functions restored.



Brunnstrom Recovery Stages for Lower limb:

Minimal voluntary movements of the lower limb

Sitting knee flexion beyond 90 degrees with foot sliding backward on the floor, voluntary ankle dorsiflexion without lifting foot from the ground

Standing hip abduction with pelvis elevation, knee inner and outer rotation, combined with ankle inversion and eversion



Flaccidity

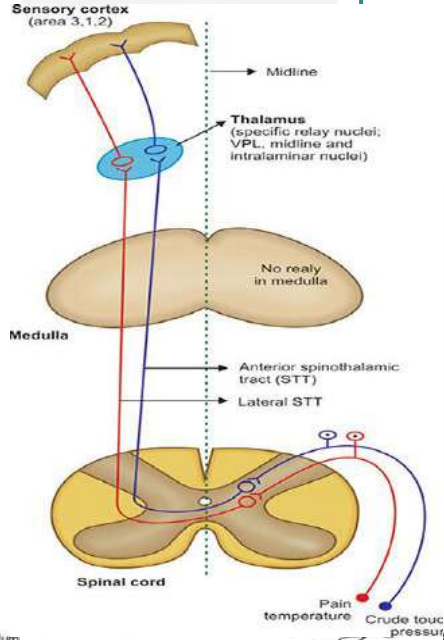
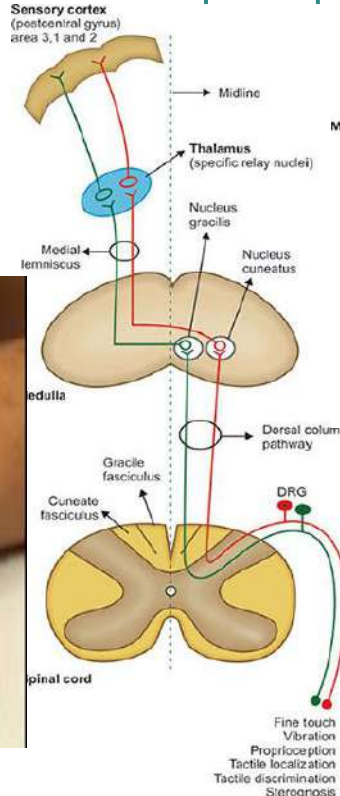
Hip - Knee - Ankle flexion in sitting and standing

Standing isolated knee flexion beyond with hip extension, isolated ankle dorsiflexion with knee extension, heel forward in a position of short step

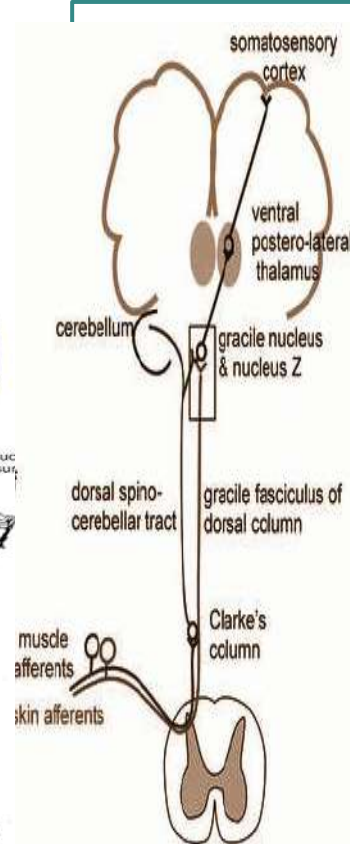
Sensory Examination



Tactile Localization

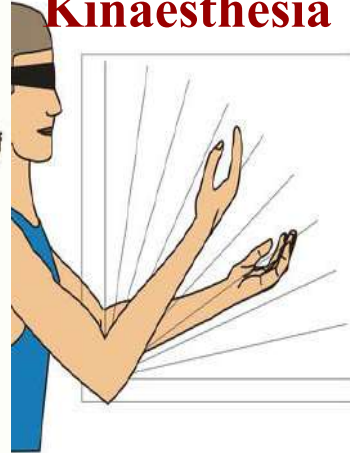


Pressure



Test of position sense

Kinaesthesia



Treatment Principles:

1. Treatment progress developmentally, so facilitate the patient's progress throughout the recovery stages.

2. When no motion exists, movement is facilitated using reflexes, associated reactions, proprioceptive facilitation/exteroceptive facilitation to develop muscle tension in preparation for voluntary movement.

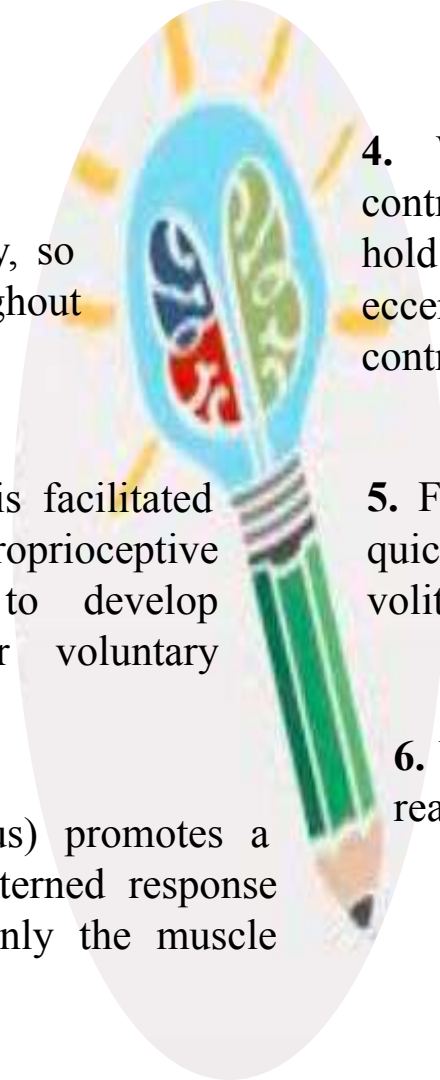
3. Resistance (proprioceptive stimulus) promotes a spread of impulses to produce a patterned response while tactile stimulation facilitates only the muscle related to stimulated area.

4. When voluntary effort produces or contribute to a response, patient is asked to hold the isometric contraction. If successful eccentric is performed and finally a concentric contraction is done.

5. Facilitation is reduced or dropped out as quickly as the patient shows evidence of volitional control.

6. No primitive reflexes, including associated reactions, are used beyond stage 3.

7. Correct movement once elicited is repeated.



Bad Posture and Bed Exercises

- During flaccid condition, the positioning of the limbs on the bed most favorable way without interference of spastic muscles.
- In supine position: lower limb has a tendency to produce extensor posture with hip abduction and external rotation: slight hip and knee flexion is recommended with small pillow under the knee and lateral support to the knee to protect hip abduction and external rotation.
- The affected upper limb is supported on a pillow in a position that is comfortable for the patient.

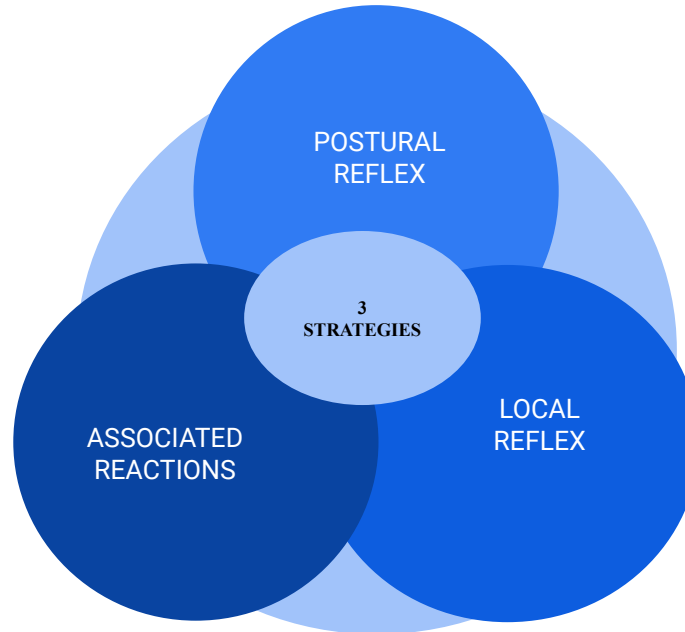
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- To avoid inferior subluxation of glenohumeral joint, advise has to be given not to keep the shoulder in the abduction in relation to the scapula.
- Avoid traction on the side of the affected arm and should be instructed to support his arm with his normal hand.
- During flaccidity, passive motions of the limbs are first carried out and then developed into the active assisted motions.



Brunnstrom exercise in flaccid stage of hemiplegia:

- It includes 3 strategies:

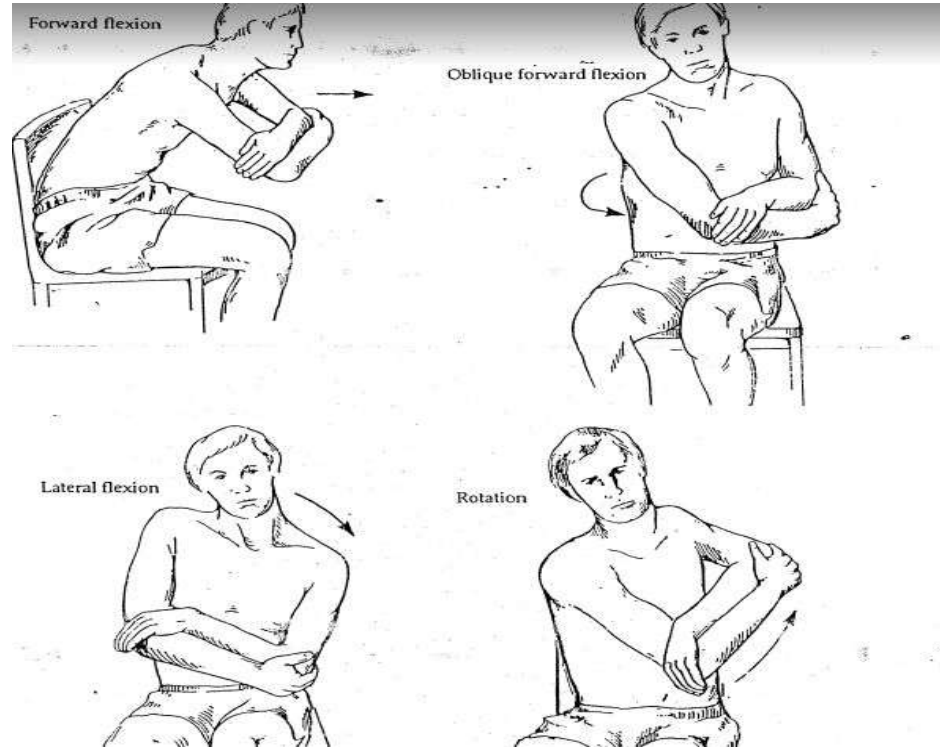


Treatment of Shoulder Pain:

- Adequate handling
- Prevent any shoulder motion above 90 degrees
- Maintain scapulo-humeral rhythm
- Avoid vigorous passive fast movements
- Utilize scaption plane during exercise
- Use indirect method of mobilization in times of patient does not allow a\exercise during severe shoulder pain



Treatment of Trunk Control:



Bilateral Rowing Exercise:



Breaking Synergy:

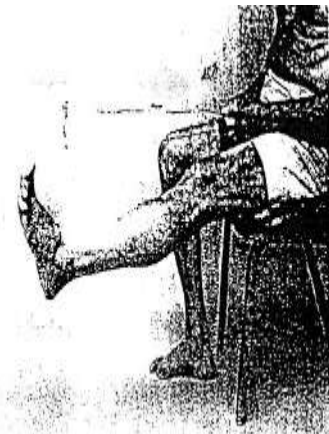


Hand Manipulation Exercise:



Extension and abduction of thumb while fully supinating the forearm

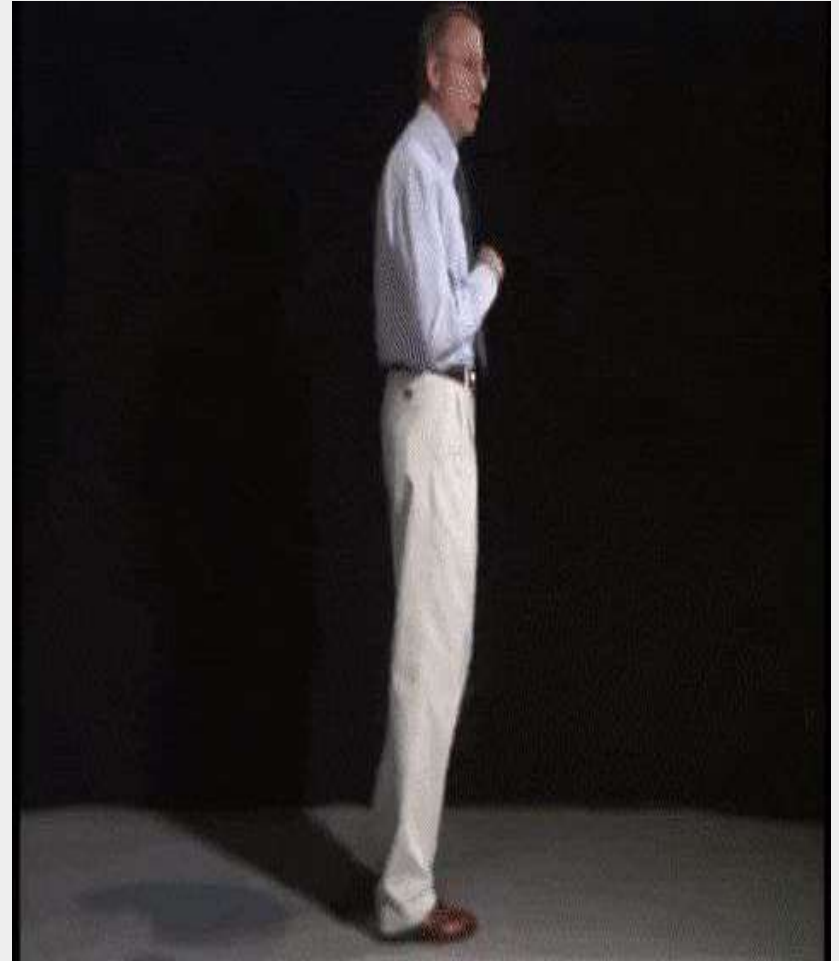
Treatment of Lower limb in sitting:



Treatment of Lower Limb Standing:



Hemiplegic Gait Training



Evidence related to Brunnstrom Approach:



S. Pandian et al. did a RCT (2012) to investigate the effectiveness of Brunnstrom hand manipulation and motor relearning program on motor recovery of hand with a group of post-stroke patients. Post-stroke subjects were randomly assigned into two equal groups (Group A and Group B), Outcome Measures: Brunnstrom recovery stages of hand (BRS-H), Fugl–Meyer assessment: wrist and hand (FMA-WH). Group A received Brunnstrom hand manipulation (BHM). Group B received the Motor Relearning Program (MRP) based hand protocol. Both the therapy protocols were effective in rehabilitation of the hand. However, the results were statistically significant in favor of group A undergoing BHM for FMA-WH and FMA item VIII (hand motor recovery).

Wagenaar et al. did a comparative study (1990) to check the efficacy of NDT versus Bobath treatment for functional recovery of stroke patients and suggested that time series analysis indicated that for one patient only, walking speed progressed more during the Brunnstrom phases than the N.D.T. phases. This result did not generalize towards other parameters or patients studied. For upper extremity function and maximum walking speed, a high correlation was found between the week post stroke in which the patient showed the first signs of recovery and the end condition after 20 weeks.



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Pandian, S., Arya, K. N., & Davidson, E. (2012). Comparison of Brunnstrom movement therapy and Motor Relearning Program in rehabilitation of post-stroke hemiparetic hand: a randomized trial. *Journal of bodywork and movement therapies*, 16(3), 330–337.
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Santello, M., & Lang, C. E. (2015). Are movement disorders and sensorimotor injuries pathologic synergies? When normal multi-joint movement synergies become pathologic. *Frontiers in human neuroscience*, 8, 1050. <https://doi.org/10.3389/fnhum.2014.01050>



THANK YOU

