

Brunnstrom Approach

Learning Objectives:

By the end of this lab, the student will be able to:

1. Demonstrate different reflexes including stimulus and muscle tone response.
2. Demonstrate how to evoke associated reactions in both upper and lower extremities.
3. Perform sensory evaluation according to Brunnstrom technique.
4. Describe the characteristics of each motor stage.
5. Apply speed test.
6. Evaluate practically basic limb synergies.
7. Describe practically different exercises based on treatment principles of Brunnstrom.

Brunnstrom, a physical therapist, was particularly concerned with the problems of patients with hemiplegia. The basic premises of this approach are: In normal persons, spinal cord and brain stem reflexes become modified during development and their components rearranged into purposeful movement by the influence of higher centers. Since reflexes represent normal stages of development, they can be used when the CNS has reverted to an earlier developmental stage as in hemiplegia.

Also, she believed that no reasonable training method should be left untried. Moreover, the sub-cortical motion synergy, which can be elicited on a reflex basis, may serve as a wedge by which the limited willed movement may be learned. **Therefore:**

- (1) Reflexes should be used to elicit movement when none exists (normal developmental sequence).
- (2) Proprioceptive and exteroceptive stimuli also can be used therapeutically to evoke desired motion or tonal changes.

Evaluation:

1. Tonic reflexes (STNR, ATNR, tonic labyrinthine "supine & prone", tonic lumbar reflex, tonic thumb reflex, +ve supporting reaction, -ve local static reaction, tonic thumb reflex and flexor withdrawal reflex).

Influence of reflexes:

Varying degrees of influence of the postural reflexes may be noted, and are often associated with spasticity and synergy involvement.

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.

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.

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.

Tonic Lumbar Reflex:

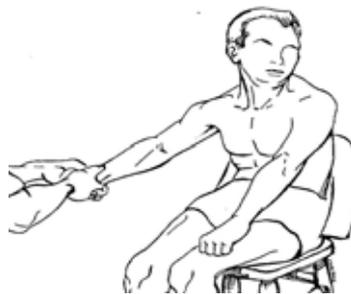
This is initiated by a change in the position of the upper trunk with respect to the pelvis. Rotation of the trunk to the right results in flexion of the right upper extremity and extension of the right lower extremity; rotation of the trunk to the left results in extension of the right upper extremity and flexion of the right lower extremity.

Tonic Thumb Reflex:

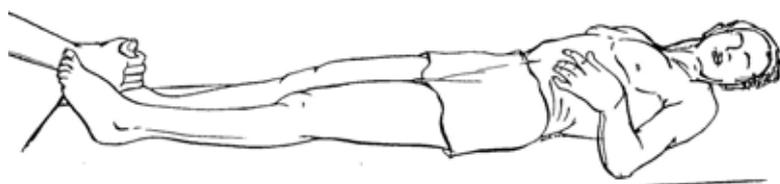
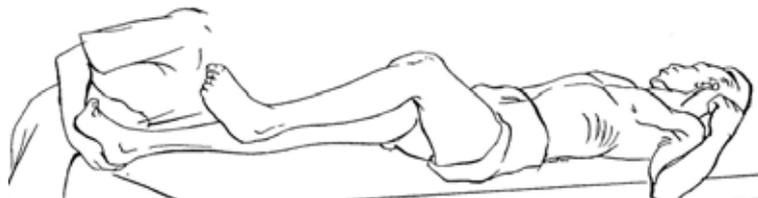
When the affected upper extremity is elevated above the horizontal with forearm supination, thumb extension is facilitated (pronation is facilitatory to finger extension).

2. Associated reactions:

Associated reactions are automatic responses of the involved limb resulting from action occurring in some other part of the body, either by voluntary or reflex stimulation (e.g., resistance or ATNR). They are commonly elicited when some degree of spasticity is present and are infrequently seen in a limb exhibiting minimal muscle tone. Generally speaking, although not true in every case, associated reactions elicit the same direction of movement (i.e., flexion evokes flexion) and the opposite direction (i.e., flexion evokes extension) in the lower extremity.



Associated reactions in the upper extremity



Associated reactions in the lower extremity

Souques' Phenomenon:

Elevation of the affected arm above the horizontal evokes an extension and abduction response of the fingers.



Souques' Phenomenon

Raimiste's Phenomenon:

Resistance applied to abduction or adduction of the nonaffected lower extremity evokes a similar reaction in the affected limb.



Raimiste's Phenomenon (abduction)

Homolateral Limb Synkineses:

It has been noted that a dependency exists between the synergies of the involved upper and lower extremities. Thus, flexion of the involved upper extremity will elicit flexion of the involved lower extremity.



Homolateral Limb Synkineses

3. Sensory evaluation:

Joint sense: With the patient seated and is blindfolded; the affected upper limb is supported by the examiner and moved to different positions asking the patient to perform identical position with the unaffected extremity.



Examination of joint sense

Touch sensation: The palmer aspect of the finger tips are touched with a rubber end of a pencil and the patient is asked to determine without looking which fingertip is touched.

Sole sensation: the patient, without looking, is asked to determine if an object is touching and pressing against his sole of the foot or not and where.

4. Stages of motor recovery:

Brunnstrom classified stages of recovery into six stages:

Stage 1: The patient is completely flaccid, no voluntary movement, and patient is confined to bed.

Stage 2: Basic limb synergy develops, no voluntary movement, can be done as spasticity appears but is not marked.

Stage 3: Basic limb synergy develops voluntarily and is marked, spasticity is marked. (This is the stage of maximal spasticity).

Stage 4: Spasticity begins to decrease, four movement combinations deviate from basic limb synergies and become available, which are:

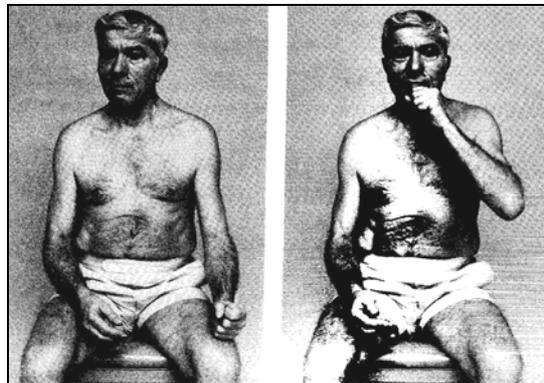
Placing the hand behind the body, alternative pronation- supination with the elbow at 90° flexion and elevation of the arm to a forward horizontal position).

Stage 5: There is relative independence of the basic limb synergies. Spasticity is wanning, and movements can be performed as arm raising to a side horizontal position, alternative pronation- supination with the elbow extended and bringing hand over the head.

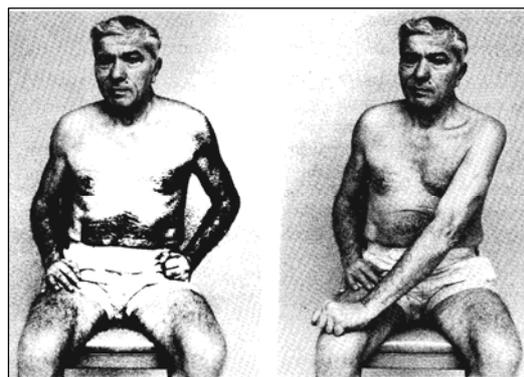
Stage 6: There are isolated joint movements.

5- Speed test

It can be used to assess spasticity during anyone of the recovery stages, provided that the patient has sufficient active ROM. The patient is seated on a chair without armrest leaning against chair back and keeping the head erect. The two movements studied are: (1) The hand is moved from lap to chin, requiring complete range of elbow flexion.



(2) The hand is moved from lap to opposite knee, requiring full range of elbow extension.



A stopwatch is used and the number of full strokes completed in 5 seconds is recorded, first on the unaffected then on the affected side.

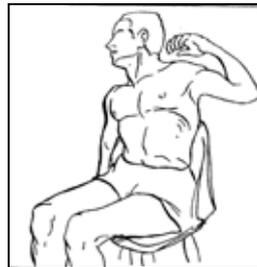
6- Assessment of basic limb synergies:

- Synergy means: stereotype whole limb movement.
- There are two synergies for U.L. and two synergies for L.L.: flexor & extensor.

1. Flexor synergy of U.L:

It consists of Scapula: retraction & depression, Shoulder: flexion, abduction, external, and rotation, Elbow: flexion to acute angle, Forearm: supination, Wrist & fingers: variable. Most commonly flexed

- The strongest component: elbow flexion
- The weakest component: shoulder abduction & external rotation.



Flexor synergy of left upper extremity

2. Extensor synergy of U.L:

It consists of Scapula: protraction, Shoulder: extension, adduction, and internal rotation, Elbow: extension, Forearm: pronation and Wrist & fingers: variable. Most commonly flexed

- The strongest components: adduction (pectoralis major) and pronation.
- The weakest component: elbow extension.

3. Flexor Synergy of L.L:

It consists of Hip: flexion, abduction, external rotation, Knee: flexion to about 90°, Ankle: dorsiflexion and inversion, Toes: dorsiflexion.

- Strongest component: hip flexion.
- Weakest component: hip abduction, external, rotation.

4. Extensor synergy of L.L:

It consists of Hip: extension, adduction, internal rotation, Knee: extension, Ankle: planter flexion, inversion, Toes: plantarflexion.

- Strongest components: Hip adduction and Knee: extension.
- Weakest component: hip internal rotation.

Treatment principles:

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

(2) The responses of the patient from such facilitation combine with the patient's voluntary effort to produces semivoluntary movement.

(3) Proprioceptive and exteroceptive stimuli assist in eliciting the synergies.

(4) When voluntary effort appears:

a) The patient is asked to hold (isometric) the contraction.

b) If successful, he is asked for an eccentric (controlled lengthening) contraction.

c) Finally, a concentric (shortening) contraction.

d) Reversal of the movement between the agonist and antagonist.

(5) Facilitation is reduced or dropped out as quickly as the patient shows voluntary control (primitive reflexes & associated reactions).

(6) Correct movement is repeated.

(7) Practice in the form of ADL.

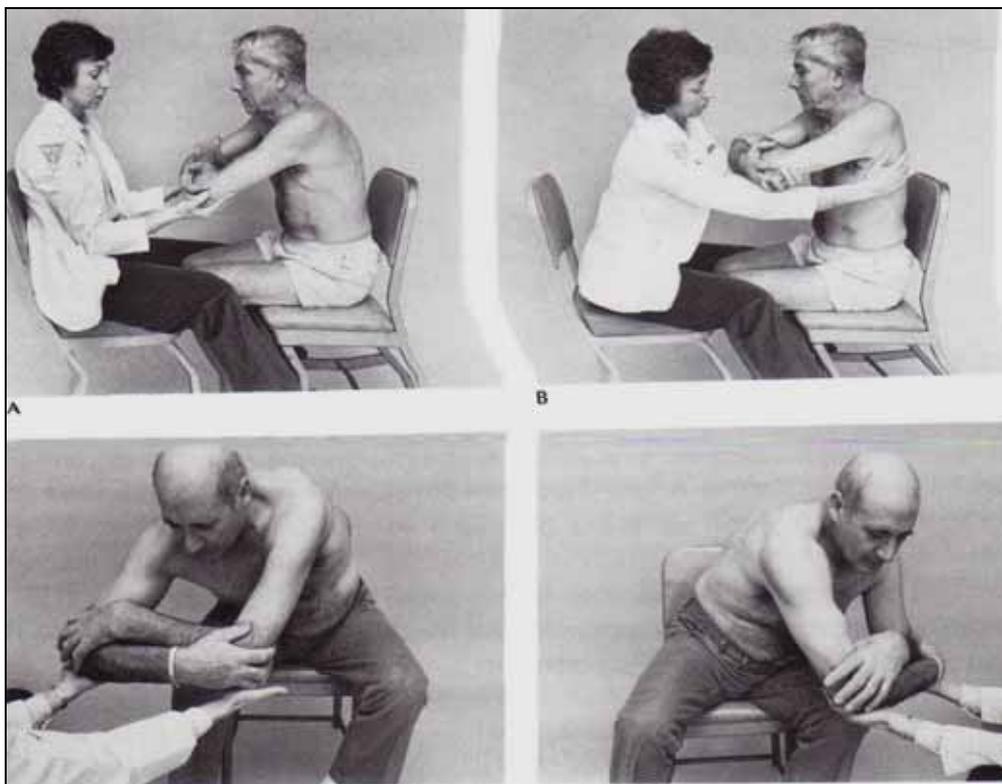
N.B. All pathological and physiological methods of facilitation are indicated during the first three motor stages. While, only the

physiological methods of facilitation are indicated during the recovery stages (stages 4, 5, 6).

Example of exercise:

Trunk balance in sitting

The patient is asked to assume sitting position, lifting the affected upper extremity by the unaffected one and do actively trunk movements in all directions.



Trunk control

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1. *Pedretti L and Early M: Occupational Therapy: Practice skills for physical dysfunction. 5th ed., Mosby, London, 2001.*
 2. *Sawner K and La Vigne J: Brunnstrom's Movement Therapy in Hemiplegia: A neurophysiological approach. 2nd ed., J.B.Lippincott Company, Philadelphia, 1992.*