

## ***Proprioceptive Neuromuscular Facilitation (PNF)***

### ***Definition:***

It is a method of promoting or hastening the response of the neuromuscular mechanism through stimulation of the proprioceptors. In addition, it uses exteroceptive, visual and auditory inputs.

### ***Philosophy of treatment:***

The philosophy is based upon the ideas that:

- 1) All human beings respond in accordance with demand.
- 2) Existing potentials may develop more fully.
- 3) Movement must be specific and directed toward a goal.
- 4) Activity is necessary to the best development of coordination, strength and endurance.
- 5) The stronger body parts strengthen the weaker parts through cooperation directed toward a goal of optimum function.

### ***Neurophysiological basis:***

The brain recognizes only gross joint movement and not individual muscle action. Moreover, the strength of a muscle contraction is directly proportional to the activated motor units. Therefore, to strengthen a muscle, the maximum number of motor units should be stimulated. This can be obtained by maximum resistance, which is called the "irradiation or overflow principle". Maximal resistance causes recruitment with irradiation or spread of excessive impulses from stronger muscle group to weaker one, within the same pattern or from stronger patterns to weaker ones.

***Basic principles:***

- *Patterns of movement:* Functional mass movements that resemble activities of daily living (ADL).
- *Characteristics of the patterns:* Spiral and diagonal regarding the line of movement. This provides an optimal contraction of all muscle(s) fibers because of their topographical alignment upon the skeletal system.
- *Diagonals:* Two diagonals for each body part (head and neck, upper trunk, lower trunk, upper limb and lower limb). Each diagonal is made up to two patterns that are antagonistic to each other. Two flexion and extension patterns are present for each body part.
- *Motion components:* Each pattern has three components of motion, named according to the proximal joint (shoulder in the upper limb and hip in the lower limb) including flexion or extension, abduction or adduction and internal or external rotation. The patterns of head, neck and trunk include components of flexion or extension with rotation to the right or the left side.
- *Relation between motion components of different joints (pivots):*

Specific movements occur with each others during performance of patterns:

*Upper limb:* “Shoulder flexion + external rotation + radioulnar supination + radial deviation”. “Shoulder abduction + scapular adduction + wrist extension + fingers extension and abduction and vice versa”.

*Lower limb:* “Hip flexion + ankle dorsiflexion”. “Hip abduction + internal rotation + eversion and vice versa”.

***N.B.*** The intermediate joint (the elbow or the knee are variable and should be mentioned within the pattern's name).

- Muscle component: Those are the muscles responsible for movement in all pivots.
- Indications: PNF patterns can be used for strengthening, coordination, initiation of movement, relaxation and proximal stability. The pattern may be performed as passive, active assisted, active resisted or active free (active free is the optimum goal of performance because the patterns resemble ADL).
- When learning the patterns, the patient is often helped by looking at the moving limb. This “visual stimulus” provides feedback for directional and positional control.
- Proper mechanics and body positioning of the therapist are essential in applying pressure and resistance.
- Patterns are named according to the direction of movement i.e. “the end position”.

***Basic procedures:***

1. Manual contact: The pressure of the different grasps must be applied only on the muscles responsible for the production of patterns. One hand applies resistance on the stronger component, while the other guides the movement and stimulates the exteroceptors of the weaker component.

2. Command: Two types of commands must be considered.

a) Preparatory command: Explanatory and includes details of the desired movement and pattern demonstration.

b) Action command: It should be simple, short, sharp and precise.

3. Stretch: The starting position of any pattern of PNF is an important mean of facilitation as it stimulates muscle spindles.

4. Traction and approximation: They are used to stimulate joint receptors (traction is provided with anti-gravity patterns, while approximation is provided with pro-gravity patterns).

5. Maximal resistance: It permits an optimal muscle contraction and slow & non jerky movement.

6. Normal timing: The movement occurs from distal to proximal during pattern performance. The first motion should be the rotatory component because maximal contraction is impossible without it.

7. Reinforcement: Techniques of PNF employ reinforcement as a means of increasing the strength of a response. This can be achieved by:

a) *Timing for emphasis:* It means that certain muscles (weak) are emphasized by allowing other strong muscles to contract maximally against resistance i.e. “isometric contraction while allowing movement to occur only at the joint upon which weak muscles act”. Movement may be also allowed from proximal to distal.

b) *Combining patterns that are under stress:* Irradiation or spread of muscle activity occurs automatically in other body parts to support the desired movement. This irradiation can occur from upper limbs and head & neck to upper trunk or from lower limbs to lower trunk and vice versa.

c) *Vision:* It is important to perception and performance of a motor act.

N.B. PNF patterns can be performed from any position that allows movement through full ROM.