Techniques

Introduction

The goal of the PNF techniques is to promote functional movement through facilitation, inhibition, strengthening, and relaxation of muscle groups. The techniques use concentric, eccentric, and static muscle contractions. These muscle contractions with properly graded resistance and suitable facilitatory procedures are combined and adjusted to fit the needs of each patient.

- To increase the range of motion and strengthen the muscles in the newly gained range of motion. Use a relaxation technique such as Contract-Relax to increase range of motion. Follow with a facilitatory technique such as Dynamic Reversals (Slow Reversals) or Combination of Isotonics to increase the strength and control in the newly gained range of motion.
- To relieve muscle fatigue during strengthening exercises. After using a strengthening technique such as Repeated Stretch (repeated stretch reflex), go immediately into Dynamic Reversals (Slow Reversals) to relieve fatigue in the exercised muscles. The repeated stretch reflex permits muscles to work longer without fatiguing. Alternating contractions of the antagonistic muscles relieves the fatigue that follows repeated exercise of one group of muscles.

We have grouped the PNF techniques so that those with similar functions or actions are together. Where new terminology is used, the name describes the activity or type of muscle contraction involved. When the terminology differs from that used by Knott and Voss (1968), both names are given.

For example, Reversal of Antagonists is a general class of techniques in which the patient first contracts the agonistic muscles then contracts their antagonists without pause or relaxation. Within that class, Dynamic Reversal of Antagonist is an isotonic technique where the patient first moves in one direction and then in the opposite without stopping. Rhythmic Stabilization involves isometric contractions of the antagonistic muscle groups. In this technique, motion is not intended by either the patient or the therapist. We use both reversal techniques to increase strength and range of motion. Rhythmic Stabilization works to increase the patient's ability to stabilize or hold a position as well.[1]

The techniques described are:

- Rhythmic Initiation
- Combination of Isotonics (G. Johnson and V. Saliba, unpublished handout 1988) (also called Reversal of Agonists; Sullivan et al. 1982)
- Reversal of Antagonists
  - Dynamic Reversal of Antagonists (incorporates Slow Reversal)
  - Stabilizing Reversal
  - Rhythmic Stabilization
- Repeated Stretch (Repeated Contraction)
  - Repeated Stretch from beginning of range
  - Repeated Stretch through range
- Contract-Relax
- Hold-Relax
- Replication

In presenting each technique we give a short characterization, the goals, uses, and any contraindications. Following are full descriptions of each technique, examples, and ways in which they may be modified.

3.1 Rhythmic Initiation

Characterization

Rhythmic motion of the limb or body through the desired range, starting with passive motion and progressing to active resisted movement.

Goals

- Aid in initiation of motion
- Improve coordination and sense of motion

1 G. Johnson and V. Saliba were the first to use the terms "stabilizing reversal of antagonists", "dynamic reversal of antagonist", "combination of isotonics", and "repeated stretch" in an unpublished course handout at the Institute of Physical Art (1979).

- Normalize the rate of motion, either increasing or decreasing it
- Teach the motion
- Help the patient to relax

Indications

- Difficulties in initiating motion
- Movement too slow or too fast
- Uncoordinated or dysrhythmic motion, i.e., ataxia and rigidity
- Regulate or normalize muscle tone
- General tension

Description

- The therapist starts by moving the patient passively through the range of motion, using the speed of the verbal command to set the rhythm.
- The patient is asked to begin working actively in the desired direction. The return motion is done by the therapist.
- The therapist resists the active movement, maintaining the rhythm with the verbal commands.
- To finish the patient should make the motion independently.

Example

Trunk extension in a sitting position:

- Move the patient passively from trunk flexion into extension and then back to the flexed position. "Let me move you up straight. Good, now let me move you back down and then up again."
- When the patient is relaxed and moving easily, ask for active assisted motion. "Help me a little coming up straight. Now relax and let me bring you forward."
- Then begin resisting the motion. "Push up straight. Let me bring you forward. Now push up straight again."
- Independent: "Now straighten up on your own."

Modifications

- The technique can be finished by using eccentric as well as concentric muscle contractions (Combination of Isotonics).
- The technique may be finished with active motion in both directions (Reversal of Antagonists).

Points to Remember

- Use the speed of the verbal command to set the rhythm.
- At the end the patient should make the motion independently.
- The technique may be combined with other techniques.

3.2 Combination of Isotonics (described by Gregg Johnson and Vicky Saliba)

Characterization

Combined concentric, eccentric, and stabilizing contractions of one group of muscles (agonists) without relaxation. For treatment, start where the patient has the most strength or best coordination.

Goals

- Active control of motion
- Coordination
- Increase the active range of motion
- Strengthen
- Functional training in eccentric control of movement

Indications

- Decreased eccentric control
- Lack of coordination or ability to move in a desired direction
- Decreased active range of motion
- Lack of active motion within the range of motion

Description

- The therapist resists the patient's moving actively through a desired range of motion (concentric contraction).
- At the end of motion the therapist tells the patient to stay in that position (stabilizing contraction).
- When stability is attained the therapist tells the patient to allow the part to be moved slowly back to the starting position (eccentric contraction).
- There is no relaxation between the different types of muscle activities and the therapist's hands remain on the same surface.

Note

The eccentric or stabilizing muscle contraction may come before the concentric contraction.

Example

Trunk extension in a sitting position (Fig. 3.1 a, b):

- Resist the patient's concentric contraction into trunk extension. "Push back away from me."
- At the end of the patient's active range of motion, tell the patient to stabilize in that position. "Stop, stay there, don't let me pull you forward."
- After the patient is stable, move the patient back to the original position while he or she maintains control with an eccentric contraction of the trunk extensor muscles. "Now let me pull you forward, but slowly."

Modifications

- The technique may be combined with Reversal of Antagonists.

a b

Fig. 3.1a, b. Combination of Isotonics: coming forward with eccentric contraction of trunk extensor muscles

Example
Trunk flexion combined with trunk extension:
- After repeating the above exercise a number of times, tell the patient to move actively with concentric contractions into trunk flexion.
- Then you may repeat the exercise with trunk flexion, using Combination of Isotonics, or continue with Reversal of Antagonists for trunk flexion and extension.

Modification

- The technique can start at the end of the range of motion and begin with eccentric contractions.

Example
Eccentric trunk extension in a sitting position (Fig. 3.1 a, b):
- Start the exercise with the patient in trunk extension.
- Move the patient from extension back to trunk flexion while he or she maintains control with an eccentric contraction of the trunk extension muscles. "Now let me pull you forward, but slowly."

Modifications

- One type of muscle contraction can be changed to another before completing the full range of motion.
- A change can be made from the concentric to the eccentric muscle contraction without stopping or stabilizing.

Example
Trunk flexion in a sitting position:
- Resist the patient's concentric contraction into trunk flexion. "Push forward toward me."
- After the patient reaches the desired degree of trunk flexion, move the patient back to the original position while he or she maintains control with an eccentric contraction of the trunk flexor muscles. "Now let me push you back, but slowly."

Points to Remember

- Start where the patient has the most strength or best coordination
- The stabilizing or eccentric muscle contraction may come first
- To emphasize the end of the range, start there with eccentric contractions

3.3 Reversal of Antagonists

These techniques are based on Sherrington's principle of successive induction (Sherrington 1961).

3.3.1 Dynamic Reversals (Incorporates Slow Reversal)

Characterization

Active motion changing from one direction (agonist) to the opposite (antagonist) without pause or relaxation. In normal life we often see this kind of muscle activity: throwing a ball, bicycling, walking etc.

Goals

- Increase active range of motion
- Increase strength
- Develop coordination (smooth reversal of motion)
- Prevent or reduce fatigue
- Increase endurance
- Decrease muscle tone

Indications

- Decreased active range of motion
- Weakness of the agonistic muscles
- Decreased ability to change direction of motion
- Exercised muscles begin to fatigue
- Relaxation of hypertonic muscle groups

Description

- The therapist resists the patient's moving in one direction, usually the stronger or better direction (Fig. 3.2 a).
- As the end of the desired range of motion approaches the therapist reverses the grip on the distal portion of the moving segment and gives a command to prepare for the change of direction.
- At the end of the desired movement the therapist gives the action command to reverse direction, without relaxation, and gives resistance to the new motion starting with the distal part (Fig. 3.2 b).
- When the patient begins moving in the opposite direction the therapist reverses the proximal grip so all resistance opposes the new direction.
- The reversals may be done as often as necessary.

Normally we start with contraction of the stronger pattern and finish with contraction of the weaker pattern. However, don't leave the patient with a limb "in the air".

Example

Reversing lower extremity motion from flexion to extension:

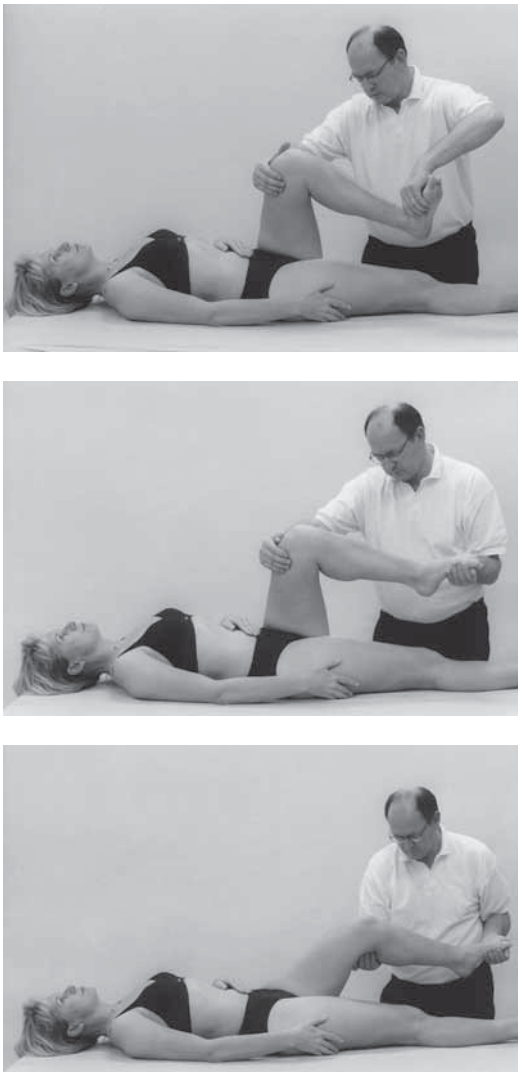
- Resist the desired (stronger) pattern of lower extremity flexion. "Foot up and lift your leg up." (Fig. 3.3 a)
- As the patient's leg approaches the end of the range, give a verbal cue (preparatory command) to get the patient's attention while you slide the hand that was resisting on the dorsum of the foot to the plantar surface (the dorsiflexor muscles are still active by irradiation from the proximal grip) to resist the patient's foot during the reverse motion.
- When you are ready for the patient to move in the new direction give the action command "Now push your foot down and kick your leg down." (Fig. 3.3 b)
- As the patient starts to move in the new direction, move your proximal hand so that it also resists the new direction of motion (Fig. 3.3 c).

a b

Fig. 3.2. Dynamic Reversal of the arm diagonal flexion-abduction into extensionadduction. **a** Reaching the end of flexion-abduction. **b** After changing the hands, resisting the movement into extension-adduction

Modifications

- Instead of moving through the full range, the change of direction can be used to emphasize a particular range of the motion.
  - Start the reversal from flexion to extension before reaching the end of the flexion motion. You may reverse again before reaching the end of the extension motion:



a

b

c

Fig. 3.3. Dynamic Reversal of the leg diagonal: flexion-adduction with knee flexion into extension-abduction with knee extension. **a** Resisting flexion adduction. **b** Distal grip changed and motion into extension-abduction started. **c** Resisting extension abduction

- The speed used in one or both directions can be varied.
- The technique can begin with small motions in each direction, increasing the range of motion as the patient's skill increases.
- The range of motion can be decreased in each direction until the patient is stabilized in both directions.
- The patient can be instructed to hold his or her position or stabilize at any point in the range of motion or at the end of the range. This can be done before and after reversing direction.

Example

Reversing lower extremity motion with stabilization before the reversal.

- When the patient reaches the end of the flexion motion give a stabilizing command ("keep your leg up there").
- After the leg is stabilized change the distal hand and ask for the next motion ("kick down").

Example

Reversing lower extremity motion with stabilization after the reversal.

- After changing the distal hand to the plantar surface of the foot give a stabilizing command ("keep your leg there, don't let me push it up any further").
- When the leg is stabilized, give a motion command to continue to exercise ("now kick down").

- The technique can begin with the stronger direction to gain irradiation into the weaker muscles after reversing.
- A reversal should be done whenever the agonistic muscles begin to fatigue.
- If increasing strength is the goal the resistance increases with each change and the command asks for more power.

Points to Remember

- Only use an initial stretch reflex. Do not re-stretch when changing the direction because the antagonist muscles are not yet under tension
- Resist, don't assist the patient when changing the direction of motion
- Change the direction to emphasize a particular range of the motion

3.3.2 Stabilizing Reversals

Characterization

Alternating isotonic contractions opposed by enough resistance to prevent motion. The command is a dynamic command ("push against my hands", or "don't let me push you") and the therapist allows only a very small movement.

Goals

- Increase stability and balance
- Increase muscle strength
- Increase coordination between agonist and antagonist

Indications

- Decreased stability
- Weakness
- Patient is unable to contract muscle isometrically and still needs resistance in a one-way direction

Description

- The therapist gives resistance to the patient, starting in the strongest direction, while asking the patient to oppose the force. Very little motion is allowed. Approximation or traction should be used to increase stability.
- When the patient is fully resisting the force the therapist moves one hand and begins to give resistance in another direction.
- After the patient responds to the new resistance the therapist moves the other hand to resist the new direction.

Example

Trunk stability (Fig. 3.4 a):

- Combine traction with resistance to the patient's trunk flexor muscles. "Don't let me push you backward."
- When the patient is contracting his or her trunk flexor muscles, maintain the traction and resistance with one hand while moving your other hand to approximate and resist the patient's trunk extension. "Now don't let me pull you forward."
- As the patient responds to the new resistance, move the hand that was still resisting trunk flexion to resist trunk extension.
- Reverse directions as often as needed to be sure the patient is stable. "Now don't let me push you. Don't let me pull you."

Modifications

- The technique can begin with slow reversals and progress to smaller ranges until the patient is stabilizing.
- The stabilization can start with the stronger muscle groups to facilitate the weaker muscles.
- The resistance may be moved around the patient so that all muscle groups work (Fig. 3.4 b).

Example

Trunk and neck stability:

- After the upper trunk is stable, you may give resistance at the pelvis to stabilize the lower trunk.
- Next you may move one hand to resist neck extension.

Note

The speed of the reversal may be increased or decreased.

a b

Fig. 3.4. Stabilizing Reversal for the trunk. **a** Stabilizing the upper trunk. **b** One hand continues resisting the upper trunk, the therapist's other hand changes to resist at the pelvis

Points to Remember

- Starting working in the strongest direction
- You can begin with slow reversals and decrease the range until the patient is stabilizing

3.3.3 Rhythmic Stabilization

Characterization

Alternating isometric contractions against resistance, no motion intended.[2]

Goals

- Increase active and passive range of motion
- Increase strength
- Increase stability and balance
- Decrease pain

Indications and contraindications

Indications

- Limited range of motion
- Pain, particularly when motion is attempted
- Joint instability
- Weakness in the antagonistic muscle group
- Decreased balance

Contraindications

- Rhythmic stabilization may be too difficult for patients with cerebellar involvement (Kabat 1950)
- The patient is unable to follow instructions due to age, language difficulty, cerebral dysfunction

2 In the first and second editions of Proprioceptive neuromuscular facilitation, Knott and Voss describe this technique as resisting alternately the agonistic and antagonistic patterns without relaxation. In the third edition (1985), Voss et al. describe resisting the agonistic pattern distally and the antagonistic pattern proximally.

Description

- The therapist resists an isometric contraction of the agonistic muscle group. The patient maintains the position of the part without trying to move.
- The resistance is increased slowly as the patient builds a matching force.
- When the patient is responding fully, the therapist moves one hand to begin resisting the antagonistic motion at the distal part. Neither the therapist nor the patient relaxes as the resistance changes (Fig. 3.5).
- The new resistance is built up slowly. As the patient responds the therapist moves the other hand to resist the antagonistic motion also.
- Use traction or approximation as indicated by the patient's condition.
- The reversals are repeated as often as needed.
- Use a static command. "Stay there." "Don't try to move."

Example

Trunk stability:

- Resist an isometric contraction of the patient's trunk flexor muscles. "Stay still, match my resistance in front."
- Next, take all the anterior resistance with your left hand and move your right hand to resist trunk extension. "Now start matching me in back, hold it."
- As the patient responds to the new resistance, move your left hand to resist trunk extension. "Stay still, match me in back."
- The direction of contraction may be reversed as often as necessary to reach the chosen goal. "Now hold in front again. Stay still. Now start matching me in the back."

Modifications

- The technique can begin with the stronger group of muscles for facilitation of the weaker muscle group (successive induction).
- The stabilizing activity can be followed by a strengthening technique for the weak muscles.

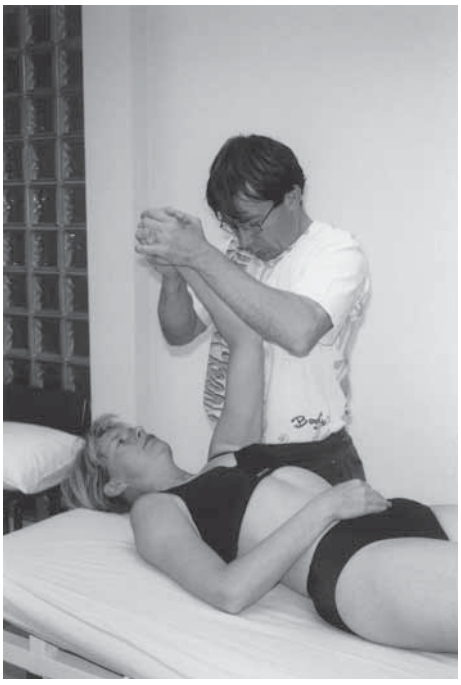


Fig.3.5. Rhythmic Stabilization of the shoulder in the diagonal of flexion-abduction/extension-adduction

- To increase the range of motion the stabilization may be followed by asking the patient to move farther into the restricted range.
- For relaxation the patient may be asked to relax all muscles at the end of the technique.
- To gain relaxation without pain the technique may be done with muscles distant from the painful area.

Example

Trunk stability and strengthening:

- Resist alternate trunk flexion and extension until the patient is stabile.
- When the trunk is stabile, give increased stabilizing resistance to the stronger direction ("Match me in back" for extension).
- Then ask for motion into the direction to be strengthened ("Now push me forward as hard as you can" to strengthen flexion).

Table 3.1. Differences Between Stabilizing Reversals and Rhythmic Stabilization

Stabilizing Reversals	Rhythmic Stabilization
Isotonic muscle action	Isometric muscle co-contraction, no movement allowed Rhythmic stabilization requires concentration and may be easier in a closed muscle chain
Intention to move	No intention to move
Command: »Stay here, against me«	Static command: "Stay still, don't try to move"
Hand grip: changes with each change in direction. Change from one part of the body to another part is allowed	Hand grip: May grip on both sides and change direction of resistance slowly
Muscle activity: From agonist to antagonist to agonist to antagonist	Muscle activity: Agonistic and antagonistic activity together (possible co-contraction)
Patient needs one direction; to control both directions together is too difficult	Patient is still able to control both directions

Points to Remember

- Use static commands because no motion intended
- The stabilization may be done with muscles distant from a painful area
- Stabilization can be followed by a strengthening technique

3.4 Repeated Stretch (Repeated Contractions)

3.4.1 Repeated Stretch from Beginning of Range

Characterization

The stretch reflex elicited from muscles under the tension of elongation.

Note
Only muscles should be under tension; take care not to stretch the joint structures.

Goals

- Facilitate initiation of motion
- Increase active range of motion
- Increase strength
- Prevent or reduce fatigue
- Guide motion in the desired direction

Indications and Contraindications

Indications

- Weakness
- Inability to initiate motion due to weakness or rigidity
- Fatigue
- Decreased awareness of motion

Contraindications

- Joint instability
- Pain
- Unstable bones due to fracture or osteoporosis
- Damaged muscle or tendon

Description

- Lengthened muscle tension = stretch stimulus
- Lengthened muscle tension + tap = stretch reflex
  - The therapist gives a preparatory command while fully elongating the muscles in the pattern. Pay particular attention to the rotation.
  - Give a quick "tap" to lengthen (stretch) the muscles further and evoke the stretch reflex.

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PNF in Practice
An Illustrated Guide
Adler, S.; Beckers, D.; Buck, M.
2008, X, 300 p. 215 illus., Softcover
ISBN: 978-3-540-73901-2