A. PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION:

A HISTORICAL PERSPECTIVE

Proprioceptive Neuromuscular Facilitation (PNF) is an approach to patient care which was originated in the mid 1940’s by Herman Kabat M.D. He was joined in his efforts to discover and define the approach by Margaret Knott in the late 1940’s. Once understood and defined, they began to teach PNF to graduate physical therapists from all over the world at the Kaiser Kabat Institute (later to become the Kaiser Rehabilitation Center in Vallejo). Dorothy Voss was one of the first students in this program and upon completion of the program, she joined Maggie on staff at Kaiser and together they wrote the first and second edition of the PNF book.

PNF was taught by Maggie Knott at Kaiser Rehabilitation Center for thirty years to physical therapists who came to study in three and six month courses. The impact Maggie had on our profession has been felt world-wide and continues through the programs still offered today.

Maggie died in December, 1978 but left a number of PNF enthusiasts who have continued the Kaiser program as well as others who continue to teach PNF in seminars world-wide. This course and syllabus are dedicated to the spirit and enthusiasm of Maggie Knott which infected all those who knew her and worked with her directly, as well as those influenced by the continued teaching of PNF.

The principles, philosophy and procedures of PNF were developed from and are based on the principles of human anatomy, physiology, growth and development, kinesiology, behavioral sciences and neurophysiology. To be effective in the application of the principles and procedures of PNF, one must understand efficient function and develop the skill to assess posture and movement. From this assessment, one determines the identified dysfunction through manual and observational means. The treatment that is determined by this assessment is a coordination of manual and verbal skills to facilitate improvement in the patient’s function. Finally one must develop intuitive and problem-solving abilities to be able to adapt treatment to each individual’s needs.
B. PNF: A DEFINITION

Proprioceptive:
1. Stimuli produced within an organism by movement of its tissues.
2. Sensory receptors which are stimulated by some aspect of muscle length or tension, joint angle, either stationary or moving, and by head position. In addition, this term actually refers to all sensory receptors including exteroceptors and interoceptors. A few examples are the muscle spindles, G.T.O.’s, joint connective tissue, skin receptors, eyes, ears, and the inner ear receptors.

Neuromuscular:

Pertaining to nerves and muscles, specifically the ability for the muscles to properly initiate, have appropriate initiation, strength and endurance.

Facilitation:
1. The promotion or hastening of any natural process, specifically the effect produced in nerve tissue by the passage of an impulse which lowers resistance to transmission so that a second stimuli or subsequent stimuli may more easily evoke a response (Dorland).
2. Increase ease of performance of any action, resulting from the lessening of nerve resistance by the continued successive application of the necessary stimulus (Webster).
3. To make easier.
4. Inhibition of abnormal tone and movement patterns are intricate components of facilitation.
CHAPTER TWO: THE BASIC PRINCIPLES AND PHILOSOPHY

The basic principles are the foundation from which all PNF evaluation and treatment techniques evolved. These principles allow for the therapist to create a standard of manual inter-reliability which enhances the assessment and treatment selection process.

While these principles serve as the foundation to the approach of PNF, they are easily integrated with the principles of other schools of manual therapy. The principles are meant to enhance one’s manual skills and create consistency, thus decrease the potential of error.

The underlying premise for the utilization of the basic principles is to enhance the postural response or movement patterns of the patient. The goal of treatment is to facilitate or “make easy” for the patient to achieve that movement or posture which has been identified to be in a state of dysfunction. The principles can be utilized with or without the patient’s cooperation as they are based on neuro-reflexive responses of the body.

The following principles are being presented in an order that logically guides the participant to understand the inter-relationship between the principles. In the classroom and clinic, you will go through a mental check list of the principles in the following order;

1. PATIENT’S POSITION
2. THERAPIST’S BODY POSITION
3. MANUAL CONTACT
4. ELONGATION, SPRING TEST, STRETCH STIMULUS
5. RESISTANCE
6. VERBAL COMMAND
7. USE OF VISUAL
8. EXECUTION OF PROPER PATTERN
9. FACILITATION OF OPTIMUM TIMING
I. MANUAL CONTACT

Motor responses are often influenced by the stimulation of skin and other receptors. Therefore, one can enhance the appropriate motor response through the proper use of manual contact. In addition, the patient’s level of confidence in a therapist is often influenced by the manner in which a therapist touches a patient. Therefore, at all times during a treatment, the therapist should be consistent and specific with the manual contact to allow for accurate assessment and treatment response.

A. MOTOR RESPONSES AFFECTED BY MANUAL CONTACT

1. STRENGTH OR POWER: When the therapist applies the proper contact to the segment being facilitated, the patient often demonstrates an increased strength of contraction. The proper placement should be specific to either
   a. the surface which corresponds to the direction of movement (indirect) facilitation or
   b. the skin surface over the actual muscle of which a stronger contraction is desired (direct).

2. DIRECTION OF MOVEMENT: The patient’s active or resistive contraction of a segment or body part in a specific direction is enhanced by specific manual contact. By decreasing conflicting sensory input created by multiple contacts or commonly used wrap-around grips, the patient’s response is easier and more precise.

B. APPLICATION OF APPROPRIATE MANUAL CONTACT

1. LUMBRICAL GRIP: The utilization of a lumbrical grip for manual contact on the proper surface provides efficient facilitation while imparting a feeling of security. The lumbrical grip utilizes the intrinsic muscles of the hand which decreases the potential for grabbing the patient or touching too many surfaces. The contact surfaces should be the palm, especially the thenar and hypothenar eminences and the finger pads, not finger tips. The amount of contact depends on the body part being resisted and the size of the patient. The grip should be comfortable, not painful, as pain inhibits appropriate response.

2. IDENTIFY SPECIFIC LOCATION FOR CONTACT: The point of manual contact may vary from patient to patient for many of the patterns. The correct contact is that specific point which facilitates the appropriate contraction in the correct direction. A general guideline is to choose a surface which faces directly into the line of movement desired.

3. MC should follow three “C’s” of appropriate touch. (Saliba, 2011)
   1) Confidence
   2) Control
   3) Compassion

   Learn to be invited in by the patient to the appropriate depth.
The purpose of proper manual contact is to allow resistance to be applied in an appropriate manner. Proper contact alone does not ensure appropriate translation of resistance. The principles of manual contact and appropriate resistance can only compliment one another if the therapist’s body position is correct and proper body mechanics are utilized.

A. **BODY POSITION:** The therapist’s body should be positioned at either end of the desired movement, with the therapist’s shoulders and hips facing in the direction of that movement. In the correct position, an imaginary line can be drawn through the movement desired into the therapist’s mid-line and center of gravity. The slightest deviation from this position can alter the desired effect of the manual contact and resistance. Think of headlights on your ASIS and light up the direction of movement.

In addition, the therapist’s forearms should always be pointed in the direction of the movement desired. During certain complex patterns, the body may not be in the exact diagonal, but the forearms must always be positioned in the diagonal of motion. This principle changes slightly with resistance to the pelvis when the elbow is fixed. In that case the ARM must be in the line of the diagonal.

B. **BODY MECHANICS:** How the therapist moves directly influences how the patient moves. The movement of the therapist must be a mirror image of the patient’s movement. The following are guidelines for proper body mechanics:

1. Therapist should position spine in neutral and maintain the neutral position throughout movement, with movement occurring from the legs, hips, and upper extremities.
2. Weight shift or movement by the therapist should always be in the direction you desire the patient to move.
3. Weight shift or movement by the therapist should be in direct proportion to patient’s movement.
4. Movement of the therapist’s body parts is directly related to the arc of motion being performed by the patient to ensure proper direction and strength of resistance throughout entire ROM.
5. The therapist’s body position should always allow for the resistance to come from the therapist’s trunk, pelvis, and legs, not the therapist’s arms.
Through the application of appropriate and variable resistance, one can evaluate a patient’s motor response and facilitate the desired or appropriate smooth and coordinated contraction. The term maximal resistance was previously used to indicate that amount of resistance necessary to facilitate the maximum contraction available for the desired motor response. This was not intended to indicate that amount of resistance which would facilitate the most force on the patient’s part; however, the clinical application often manifested this concept. Therefore, the term maximum was changed by Johnson and Johnson in 1982 to appropriate to encourage the therapist to consider the appropriate response desired, and facilitate “fiber specific”, efficient neuromuscular and motor control.

A. RESISTANCE is used to evaluate and facilitate two different types of muscular contractions, isotonic and isometric.

1. ISOTONIC CONTRACTION: This contraction is typically defined as a contraction in which the internal force overcomes the external force allowing movement. Functionally, this contraction is defined as one in which the intention is movement. It is usually associated with joint motion or a change of position.

   a. Concentric: shortening contraction; resistance is applied throughout the desired or available active ROM. Movement occurs in an arc of motion and resistance varies throughout the arc according to the strength and coordination of the patient.

      Command: “push”, “pull”

   b. Eccentric: controlled lengthening contraction. Resistance can be applied throughout any part of the ROM. Used to promote kinesthetic awareness and increase strength and ROM.

      Command; “let go slowly or slowly let go”

   c. Maintained Isotonic (MI) (Johnson 1979): a concentric contraction in which the resistance applied by the therapist allows minimal to no motion to occur. This contraction is used to facilitate appropriate strength, endurance, and irradiation. An efficient MI initiates with appropriate core, immediately followed by the global response. This allows for irradiation to the localized core muscles or to other phasic or global groups. Therapist must be attentive to the motor recruitment pattern to ensure appropriate facilitation of temporal and spacial summation for irradiation.

   In a MI, the intention of the patient is movement, and even when no movement is allowed, global muscles are facilitated with an efficient “CoreFirst™” motor strategy.

      Command: “Keep it there”, “Don’t let me move you”
2. ISOMETRIC CONTRACTION: Typically this contraction is defined as a contraction in which no movement is allowed. Functionally, an isometric contraction is defined as one in which the intention is a stabilizing contraction in which minimal or no joint motion occurs. The patient’s intention is to maintain a position in space against external resistance. The contraction is built and released slowly, with the therapist at all times attempting to match the force being generated by the patient. This type of contraction more closely resembles the true stabilization contraction observed during functional postures and activities. This contraction is most effective for facilitating and training the core muscle contractions throughout the body. Used to facilitate a fiber specific response.

RESISTANCE: Slow and low

Command: “Hold it, don’t let me move you. Don’t push”.

Isometric resistance utilizes temporal summation to increase the local response and slowly builds to facilitate an appropriate “CoreFirst™” motor strategy. Irradiation is effective to facilitate a spreading of the controlled contraction (Tonic Spread: Saliba 2008).

When applying resistance to promote an isometric contraction, one should give careful consideration to the overflow or irradiation which occurs during the course of the contraction. An analysis of this overflow contraction can give valuable input about the functional or structural integrity of the patient’s body.

B. RESISTANCE is varied by the therapist to facilitate the appropriate response of the desired contraction depending on the functional component being treated. Treatment can be directed toward the improvement of:

1. COORDINATION - less effort, more controlled
2. ROM - resistance is varied throughout range
3. STRENGTH - resistance is gradually increased
4. INITIATION - resistance gradually increases at beginning of range
5. STABILIZATION - resistance is slowly applied
6. RELAXATION - light resistance, emphasis on letting go

Each of these components may be affected by the
1) patient’s position,
2) gravity,
3) existing reflexes,
4) the diagonal pattern and
5) the position of the distal component.
C. **RESISTED VS. PASSIVE ROM EXERCISES:** resisted exercise stimulates the muscle spindle, joint receptors and the patient’s awareness. While the mid-range of a movement may not be worked extensively, the full ROM can be both achieved and reinforced.

D. **MANUAL VS. NON-MANUAL RESISTANCE:** When using manual resistance, the therapist has the ability to identify and retrain compensatory motor responses, not always visible.

E. **BREATHING** is an important component of efficient movement, therefore, breathing is emphasized during resisted movements to avoid fatigue or an abnormal response and facilitate efficient movement.
IV. TRACTION & APPROXIMATION

The use of traction and approximation adds an additional force vector to the directional resistance. Therefore, the therapist must be aware of the resultant force created by both the resistance and traction or approximation to ensure smooth and appropriate resistance. The therapist must be sure to avoid using traction or approximation to assist the movement rather than enhance the resistance.

A. Traction is the elongation of a segment to increase muscular response of the segment’s core muscles and promotes a “CoreFirst™” movement strategy. When dealing with painful joints, carefully applied traction may be effective in reducing pain. The direction of traction is always applied away from the apex of the arc of motion and is consistent in force. Resistance must be graduated to balance the force of the traction. THINK OVER THE BOWL!!

![Diagram](image)

When applying traction, the fingers of the therapist should be extended. This enhances the traction.

B. Approximation is the compression of a segment to promote stability. It is more likely to be used when facilitating weight bearing postures or positions. The desired response can be initiated or reinforced by a reflex-producing quick approximation followed immediately by maintained approximation-pressure. Care must be used to avoid pain and to consider underlying pathology when applying approximation.
V. QUICK STRETCH

A. DEFINITIONS

1. **Stretch stimulus:** elongation of a muscle increases its responsiveness to cortical stimulation (Gelhorn)

2. **Stretch reflex:** a spinal reflex used in conjunction with the techniques and procedures of PNF to facilitate a reflex contraction.

B. TECHNIQUE

The stretch reflex is best facilitated through the application of a quick stretch. This is accomplished by elongating a group of muscles in pattern to their lengthened or slightly taut range, applying traction and quickly, but gently, elongating the muscle further into the direction of the pattern.

**CAUTION:** Do not jerk the segment which you are elongating or stretching out of the pattern of movement. Always spring test first! Be sure to stay in the spring (purple) zone. (Note: the use of the descriptive “purple” zone is new since the video production)

<table>
<thead>
<tr>
<th>red</th>
<th>purple</th>
<th>blue</th>
<th>green</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimal Recoil</td>
<td>Spring Zone</td>
<td>Good Recoil</td>
<td>Little to no Recoil</td>
</tr>
</tbody>
</table>

Always spring test before applying a stretch stimulus.

The reflex is synchronized with a verbal command to stimulate a volitional effort by the patient when possible.

The reflex response is reinforced by the immediate application of appropriate resistance. This resistance must occur within the first few degrees of movement by the patient or the effects of the stretch reflex will be diminished as the proper core response will not be facilitated and resisted.

**CAUTION:** Do not bounce off the quick stretch and lose control of the contraction!

C. **THE STRETCH STIMULUS** can be superimposed on an existing contraction, if tension is maintained. If there is no recoil, then you cannot apply a stretch stimulus. You must begin with an isometric to generate the tension from a contraction.

D. **THE STRETCH REFLEX** is used to achieve and enhance normal movement by:

1. Facilitating initiation of motion
2. Increasing strength of muscle contraction
3. Increasing endurance by decreasing muscle fatigue and decreasing effort needed to produce movement.
4. Influencing the direction of movement

E. **CONTRAINDICATIONS** for the use of quick stretch are:

1. Hyperactive stretch reflex not under voluntary control
2. Pain.

VI. VERBAL STIMULI

Verbal commands, coupled with manual contact, provides the therapist with one of the primary tools for establishing communication and cooperation. Verbal commands should be simple, concise, audible and specific to the contraction desired. The quality of the verbal command significantly influences the appropriateness of a person’s response.

VERBAL COMMANDS ARE USED TO:

- Coordinate volitional effort with reflex response
- Define the type of muscular contraction desired
- Define direction of motion
- Signal timing of relaxation of contraction
- Facilitate increased arousal and responsiveness
- Stimulate generalized relaxation

VII. VISUAL STIMULI

Vision is important in the normal development and coordinated use of the body. During treatment, properly directed use of vision assists in:

A. Initial learning of activities
B. Identifying direction of motion
C. Identifying position in space
D. Directing the motion of the head, trunk and extremities across midline and on the same side
E. Increasing ROM
The patterns of facilitation were developed by Dr. Kabat and Maggie in the final stages of the development of PNF. It was through the utilization of all the previous principles that they began to understand and recognize the normal patterns of movement which existed in functional activities. Dr. Kabat’s and Maggie’s observations revealed that:

A. Normal coordinated activities are accomplished by the extremities and trunk moving in diagonal directions with spiral components.

B. The stretch reflex is most effectively elicited when the segment to be stretched is elongated in a specific diagonal.

C. The muscular response is more coordinated and forceful when resistance is applied within a specific diagonal pattern.

D. Each pattern consists of three components:

<table>
<thead>
<tr>
<th>Extremity</th>
<th>Trunk/Scapula-Pelvis</th>
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<tbody>
<tr>
<td>Flexion or extension</td>
<td>Flexion or extension / Elevation or depression</td>
</tr>
<tr>
<td>Abduction or adduction</td>
<td>Lateral or medial movement</td>
</tr>
<tr>
<td>Rotation</td>
<td>Rotation / upward or downward rotation</td>
</tr>
</tbody>
</table>

These three components are equally blended throughout the complete ROM.

E. The patterns are effective tools for evaluating the quality of a muscular contraction and the range of motion. When dysfunctions are identified, specific techniques are applied to facilitate improvement.

F. The patterns are narrow diagonals and can be identified by placing the group of muscles or segment in an elongated position where all muscles feel equally on stretch. In addition, the muscles of the pattern each work together with more power and efficiency when in the pattern. (Figures 1, 2)

G. Working patients in pattern is a means to the end, not the end of the means.

Success in the application of the principles to effect a desired response is dependant upon the position of the patient. When considering the patient position, one should consider such factors as support, influence of tone, comfort, and desired neuromuscular response.
IX.  TIMING: “CoreFirst™” MOTOR STRATEGIES – Saliba, 2009

Normal timing is used to refer to the sequencing of motor recruitment which takes place in a normal functional activity or movement. It is important for the therapist to recognize the normal timing of an activity and adjust the resistance and or verbal commands to facilitate the reinforcement or relearning of this timing. Normal timing is proximal stability – distal mobility, or core stabilizers – prime movers.

Normal timing allows for dynamic stability with controlled mobility.
The normal timing of a response can be altered to emphasize an individual component. This utilization of timing is referred to as “timing for emphasis” and is often used to make the other techniques more effective and to ensure the appropriate motor recruitment.

X.  POSITIONING FOR SUCCESS

The position of the patient is the most fundamental and critical principle in PNF. Because alignment has a direct influence on the neuromuscular response, which is essential for appropriate motor control, the therapist must make every effort to appropriately position the patient with proper supports and alignment.

Positioning not only refers to the issue of support and mid-range alignment, but also to the IPA’s unique concept of “setting” a segment prior to elongating and finding the pattern.

In PNF I, the therapist will be expected to always position the patient is an alignment which allows the segment being facilitated to be in an appropriate relationship to a designated mid-line or functional plane. An example is the scapula pattern. This pattern is performed in relation to the mid-frontal plane.

Finally, the therapist is expected to note how the positioning of associated body parts can affect the mechanical and neuromuscular responses of the patient. For example, when elongating the scapula into posterior depression, if the neck is in extension, an inappropriate strain will be placed on the cervical spine and the full excursion of the scapula into PD will be affected.

The above principles are utilized to facilitate motor learning by taking a reflex or volitional (cognitive) motor response and progressing the patient toward an associate and automatic appropriate motor response.
XI. PNF - THE BASIC PHILOSOPHY

I. The basic philosophy of Proprioceptive Neuromuscular Facilitation (PNF) developed from the premise that all human beings, including those with disabilities, have untapped existing potential.

A. The effectiveness of any treatment program is dependent upon both the therapist and patient having well-defined goals and the intention that those goals will be achieved.

B. Treatment is directed towards patient education and the improvement of the patient’s performance of functional activities.

C. The treatment approach is always positive, reinforcing and utilizing that which the patient can do on a physical and emotional level.

D. The ability to learn is an individual characteristic. Therefore, treatment is tailored to the individual with his ability to cooperate and learn considered.

E. When treating a patient the therapist must remember that all problems, neurological and orthopedic, affect the system as a whole. Therefore, the approach should be integrated, addressing sensory, musculoskeletal, and psychological elements to ensure that each treatment is directed at a total human being not a specific problem.

II. The purpose of treatment is to assist the patient to attain the highest level of function possible through the development of the most efficient neuromuscular system

A. The process of evaluation which is essential for the selection of appropriate techniques, is a continuing process throughout the entire treatment.

B. Appropriate techniques are used to facilitate normal spinal and subcortical reflexes in conjunction with voluntary activity to enhance the development of efficient posture and movement.

C. To achieve optimal functions:
   1. Complex skills are broken into their individual components
   2. The interaction of stability and mobility is taken into account
   3. The ability to perform the whole skill is facilitated through the learning sequence.

D. Abnormal tone, posture and movement are treated by direct or indirect inhibition. The emphasis is on training reciprocal motion.

E. Tapping a maximal response is the most effective means of increasing awareness, strength, and endurance. Repetition of the response is used to promote retention of motor learning.

F. Continued activity is essential to improve and maintain the strength, endurance, and coordination of the neuromuscular system. Therefore, an intense program provides for the greatest improvement.