UPM HSAAS Workshop 2025

EMPOWERING REHABILITATION WITH PNF (Lecture II)

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Content

Topic

1. ICF Model
2. Patient Treatment Scheme
3. Treatment Design
4. PNF Treatment
5. PNF Additional Techniques
6. Contraindication
7. References

1. ICF Model

(International Classification of Function and Activity and Participation, WHO 2001).

- **Body functions:**
  - physiological and psychological functions of body systems
- **Body structures:**
  - anatomical parts of the body such as organs, limbs, and their components.
- **Impairments:**
  - problems in body function or structure such as a significant deviation or loss.
- **Activity:**
  - the execution of a task or action by an individual.
- **Participation:**
  - is involvement in a life situation.
- **Activity limitations:**
  - difficulties an individual may have in executing activities.
- **Participation restrictions**
  - problems an individual may experience in their involvement in life situations.
- **Environmental factors:**
  - make up the physical, social, and attitudinal environment in which people live and conduct their lives

2. Patient Treatment Scheme

- Evaluation of areas of function (activities)
- Evaluation of impairments and activity limitations
- Hypothesis of the causal impairments
- Test for causal impairment and activity limitation
- Treatment goals
- Treatment planning
- Treatment design
- (Re)-assessment
- Re-test for causal impairment and activity limitation

* Before PNF, do for good side first, then affected side.

3. Treatment Design

1. **Direct or indirect treatment**
2. **Appropriate activities**
   - Movement or stability
   - What types of muscle contractions
3. **The best position for the patient.**
   Consider:
   - The patient's comfort and security
   - The effect of gravity
   - Reflex facilitation
   - The effect on two-joint muscles
   - Progression of treatment
   - Use of vision
   - Closed chain or open chain muscle work
   - Position to decrease spasticity
4. **Techniques and procedures**
5. **Patterns and combinations of patterns**
6. **Functional and goal oriented tasks**

affected → unaffected side.

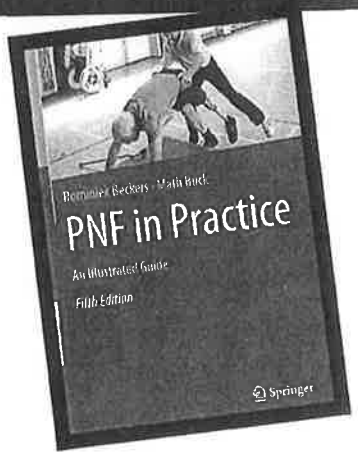
* do for core first, then UL or LL

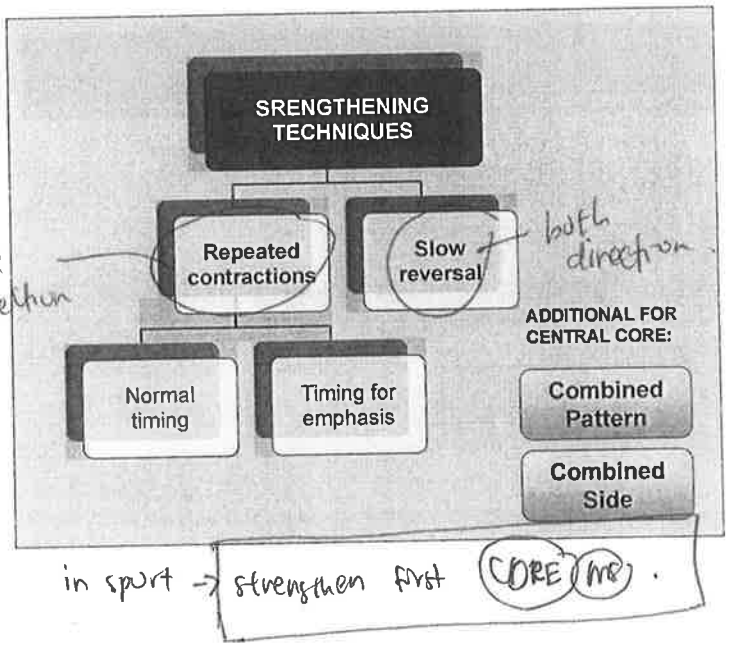
* before manual therapy, do traction to minimize friction in jt.

e.g. two joint (MS)
→ hamstring
– biceps & triceps

PNF – OKC, CKC

4. PNF Treatment





same direction

both direction

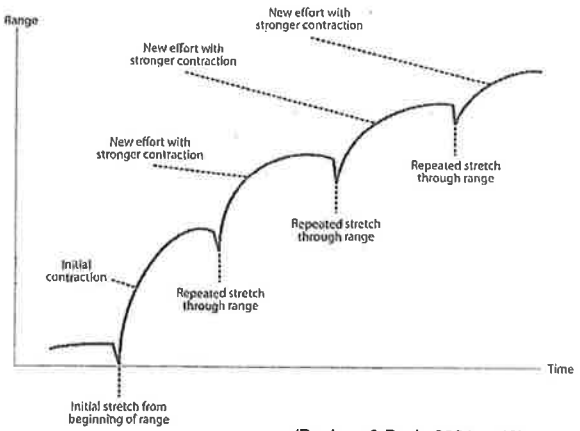
in sport → strengthen first CORE (MS).

* in sport → (MS) bulk for both side need same length

4.1 Repeated contraction

- Useful for treating weakness at differing points throughout the ROM
- Correct imbalances
- Movement against isotonic resistance until fatigue, followed by period of stretching
- Resistance and stretch must be modified for each patient or athlete
- Divided into:
  - **Normal timing**
  - **Timing for emphasis**

Normal Timing	Timing for Emphasis
• Involve lots of muscle groups	• For specific muscle group
• Utilise long leverage system	• Short leverage system → starting in short lever end in long lever
• Incorporate with extended elbow or knee	• Incorporate with flexed elbow or knee
• Require lots of effort and energy for both patient and therapist	• Less effort
• Complete ROM	• May not complete the range → only for target (MS).



(Beckers & Buck, 2021, p.49)

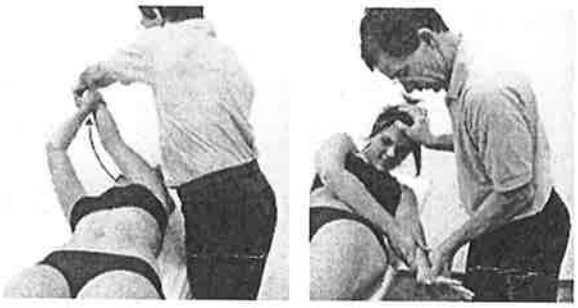
4.2 Slow Reversal

- Isotonic contraction of agonist followed by contraction of antagonist
- Initial contraction facilitates antagonist activity
- Used to develop contraction of agonist and reciprocal timing of antagonist – critical for coordination
- Extended or flexed knee (LL) or elbow (UL)
- Help improve muscle endurance
- Facilitate cardiorespiratory endurance(?)

H - head
Hd - hand
Hip - hip

4.3 Central core strengthening

- Most challenging techniques for strengthening
- Key in functional motion facilitation, balance and stability
- Divide into:
  - **Combined Pattern**
    - combining Left and Right but using or opposing 2 different pattern in a shot.
    - Eg. Left side using D1 flexion with Right side using D2 flexion pattern at the same time
  - **Combine Side**
    - combining Left and Right side but using or opposing the same pattern in a single shot

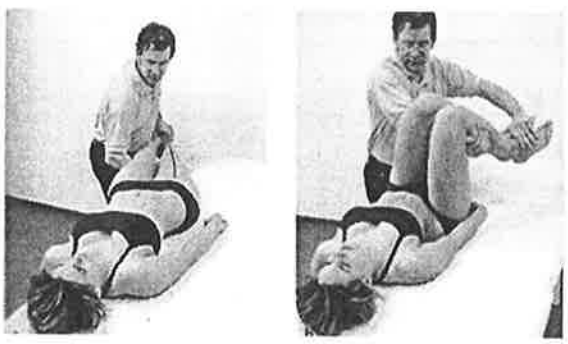


- Combine pattern in supine for upper limb

(Beckers & Buck, 2021, p.198)

- Combine pattern in high sitting for upper limb

(Beckers & Buck, 2021, p.198)



- Combine pattern in supine for lower limb

(Beckers & Buck, 2021, p.205)

-affected side must be on top of un-affected side.

- Combine pattern in high sitting for lower limb

(Beckers & Buck, 2021, p.205)

UL D1 Flexion pattern muscles involvement

JOINT	MOTION	PRIME MUSCLES
Scapula	ant. elev.	Serratus Anterior, Trapezius
Shoulder	flex., add., ext. rot.	Pectoralis Major, Anterior Deltoid, Biceps, Coracobrachialis
Elbow	ext.	Triceps, Anconeus
	w. flex.	Biceps, Brachialis
Forearm	supin.	Brachioradialis, Supinator
Wrist	Rad. dev.	Flexor Carpi Radialis
Fingers	flex., add.	Flexor Digitorums, Lumbricals, Interossei
Thumb	flex., add., opp.	Flexor Pollicis, Adductor Pollicis, Opponens Pollicis

UL D1 Extension pattern muscles involvement

JOINT	MOTION	PRIME MUSCLES
Scapula	Post. dep.	Rhomboids
Shoulder	ext., abd., int. rot.	Lattisimus Dorsi, Middle & Posterior Deltoid, Triceps, Teres Major, Subscapularis
Elbow	ext.	Triceps, Anconeus
Forearm	pron.	Brachioradialis, Pronators
Wrist	Ul. dev.	Flexor Carpi Ulnaris
Fingers	ext., abd.	Extensor Digitorum Longus, Lumbricals, Interossei
Thumb	ext., abd.	Abductor Pollicis Brevis, Adductor Pollicis, Extensor Pollicis

UL D2 Flexion pattern muscles involvement

JOINT	MOTION	PRIME MUSCLES
Scapula	post. elev.	Trapezius, Levator Scapulae, Serratus Anterior
Shoulder	flex., abd., ext. rot.	Anterior Deltoid, Biceps (long head), Coracobrachialis, Supraspinatus, Infraspinatus, Teres Minor
Elbow	ext.	Triceps, Anconeus
Forearm	supin.	Brachioradialis, Supinator
Wrist	Rad. dev.	Extensor Carpi Radialis
Fingers	ext., abd.	Extensor Digitorum Longus, Lumbricals, Interossei
Thumb	ext., abd.	Abductor Pollicis Brevis, Adductor Pollicis, Extensor Pollicis

UL D2 Extension pattern muscles involvement

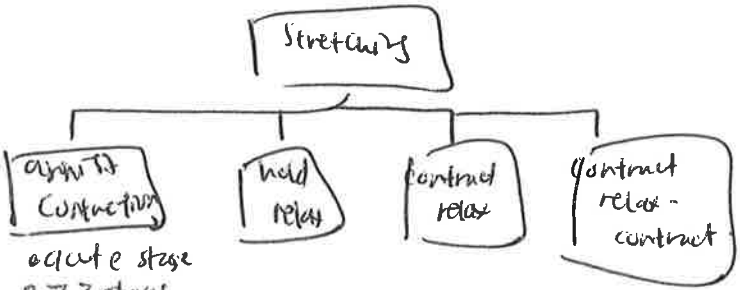
JOINT	MOTION	PRIME MUSCLES
Scapula	ant. dep.	Serratus Anterior, Pectoralis Minor, Rhomboids
Shoulder	ext., add., int. rot.	Pectoralis Major, Teres Major, Subscapularis
Elbow	ext.	Triceps, Anconeus
Forearm	pron.	Brachioradialis, Pronators
Wrist	Ul. dev.	Flexor Carpi Ulnaris
Fingers	Flexor Digitorums, Lumbricals, Interossei	Flexor Digitorums, Lumbricals, Interossei
Thumb	Flexor Pollicis, Adductor Pollicis, Opponens Pollicis	Flexor Pollicis, Adductor Pollicis, Opponens Pollicis

LL D1 Flexion pattern muscles involvement

JOINT	MOTION	PRIME MUSCLES
Hip	flex., add., ext. rot.	Psoas Major, Iliacus, Adductors, Sartorius, Pectineus, Rectus Femoris
Knee	ext.	Quadriceps
	w. flex.	Hamstrings, Gracilis, Gastrocnemius
Ankle/Foot	d. flex., inv.	Tibialis Anterior
Toes	ext.	Extensor Hallucis, Extensor Digitorum

LL D1 Extension pattern muscles involvement

JOINT	MOTION	PRIME MUSCLES
Hip	ext., abd., int. rot.	Gluteus Medius, Glutesu Maximus, Hamstrings
Knee	ext.	Quadriceps
	w. flex.	Hamstrings, Gracilis,
Ankle/Foot	pl. flex., ev.	Gastrocnemius, Soleus, Peroneus Longus and Brevis
Toes	flex.	Flexor Hallucis, Flexor Digitorum



acute stage
• > 3 days
• when still inflamation still there
• type of (ms) contraction → isotonic contraction

LL D2 Extension pattern muscles involvement

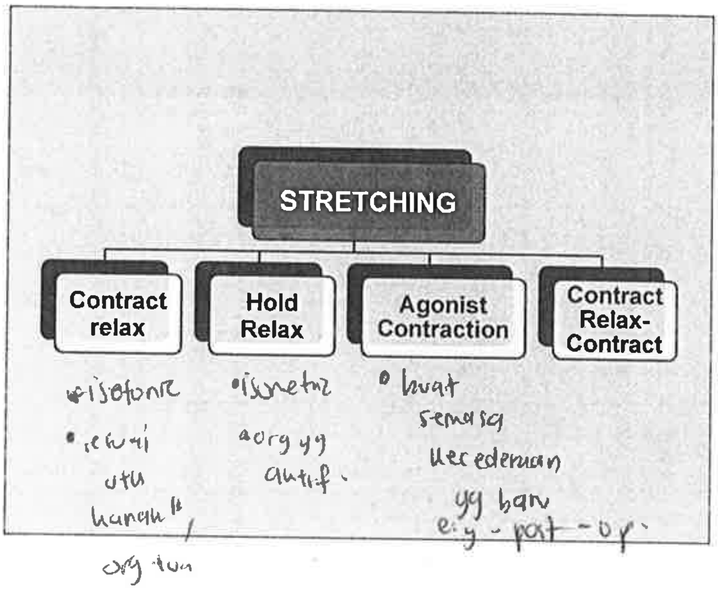
JOINT	MOTION	PRIME MUSCLES
Hip	ext., dd., ext. rot.	Adductor Magnus, Gluteus Maximus, Hamstrings, Piriformis, Sartorius, Obturators
Knee	ext.	Quadriceps
	w. flex.	Hamstrings, Gracilis,
Ankle/Foot	pl. flex., ev.	Gastrocnemius, Soleus, Tibialis Posterior
Toes	flex.	Flexor Hallucis, Flexor Digitorum

(ms) - within 24 h x guna boleh tisu.
(ms) lebih cepat tight compared to ~~jt~~ capsule;

LL D2 Flexion pattern muscles involvement

JOINT	MOTION	PRIME MUSCLES
Hip	flex., abd., int. rot.	TFL, Rectus femoris, Gluteus Medius, Gluteus Minimus
Knee	ext.	Quadriceps
	w. flex.	Hamstrings, Gracilis, Gastrocnemius
Ankle/Foot	d. flex., ev.	Peroneus Tertius
Toes	ext.	Extensor Hallucis, Extensor Digitorum

* problem is always /ONLY in the antagonist (ms).



4.4 Contract relax

- Moves body part passively into agonist pattern
- Contract antagonist against isotonic resistance (muscle to be stretched)
- Once patient fatigued, therapist takes muscle through as much range as possible
- Useful when range of motion is limited by muscle tightness
- Chronic cases
- Children and elders

4.5 Hold relax

- Isometric contraction against tight antagonist until the muscle is fully fatigue and followed by passive maximal stretch.
- Chronic cases
- Suitable for athlete, sportsmen and active people
- Minimize repetition to prevent injury to the muscle
- May use other mechanical external force as load as assistance

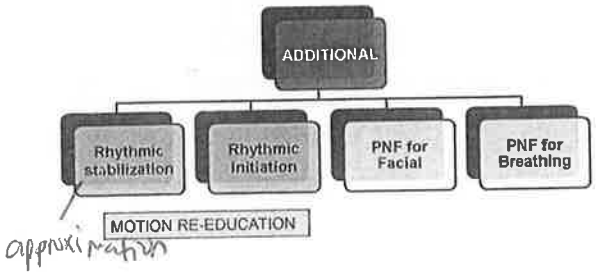
4.6 Agonist contraction

- Patient actively and concentrically contracts the muscle opposite the range limiting muscle (antagonist)
- Hold the end range position for several seconds
- When the agonist contract, the antagonist (tight muscle) will reciprocally inhibited to allow relaxation and lengthening
- Acute painful muscle conditions

4.7 Contract-relax-contract

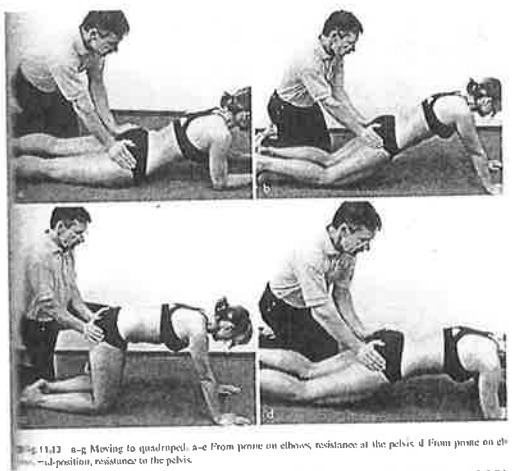
- Subacute stage
- Presence of mild pain and very slight tightness of muscles
- Combination of Agonist Contraction with Hold or Contract Relax depends on patient suitability

5. PNF Additional Techniques

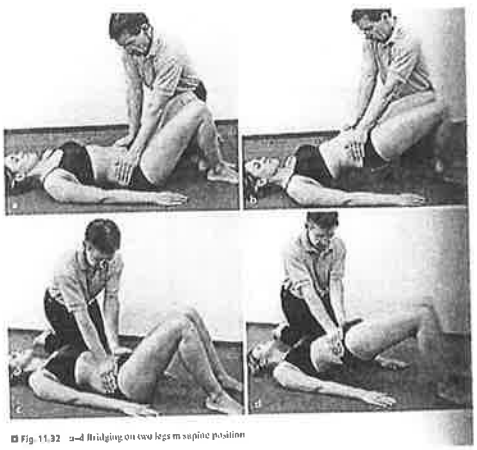


5.1 Rhythmic Stabilization

- Co-contraction or simultaneous isometric contraction of agonist and antagonist to resist/controlling motion
- Maintain "hold" position" while movement in applied in multiple directions
- Improving stability, balance and coordination and stability
- Help in relaxation and strength
- Mat activities
- Static balance training



(Beckers & Buck, 2021, p.233)



(Beckers & Buck, 2021, p.250)

5.2 Rhythmic Initiation

- Unidirectional motion of the limb or body through a desired range or task.
- For patient with difficulty to initiate motion, uncoordinated or dysrhythmic (eg. Parkinsonism, ataxia, rigidity)
- Progress from passive to assisted active, free active and finally resisted active motion
- Repeated until good motion rhythm and speed is established
- Can use visualization techniques (imagery) using digital image videos

• Guna video utk initiate movement.
• e.g. - video goson ...

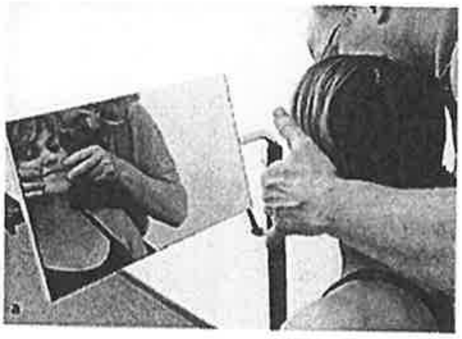
Fig. 12.7 a–f Managing the wheelchair. a, b Wheeling forward

(Beckers & Buck, 2021, p.270)

5.3 PNF Facial

- Using stretch reflex and resistance to promote muscle activity, increase strength and improve coordination
- Hand grip and pressure to guide and facilitate motion
- May use ice as additional facilitation for hypotonic or flaccid paresis
- Muscle contraction of the stronger side will facilitate and reinforce the action of the affected side
- Timing for emphasis
- Rhythmic initiation

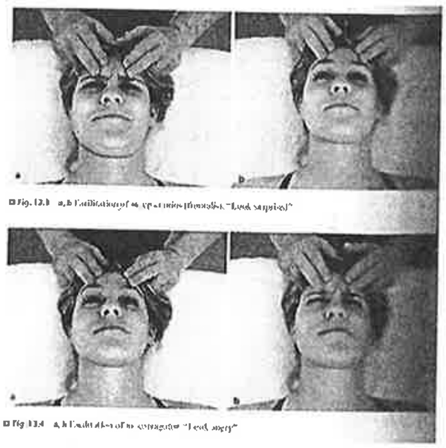
• do at good side first



- A mirror can help patients to control their facial movements

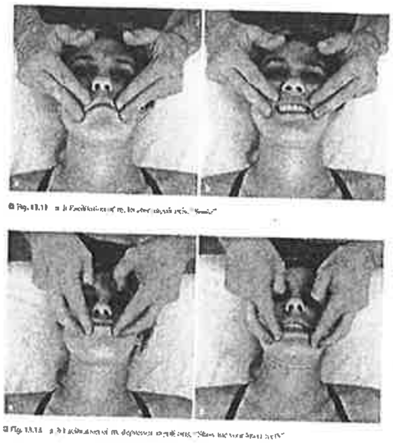
(Beckers & Buck, 2021, p.304)

* PNF need to do at Good side



(Beckers & Buck, 2021, p.304)

↳ give resistance at Good side only.



(Beckers & Buck, 2021, p.309)

5.4 PNF for Breathing

- Treat the sternal, costal and diaphragmatic areas to improve inspiration
- Exercise the abdominal muscle to strengthen forced exhalation
- Facilitate chest mobilization, trunk and shoulder mobility, relief of pain, active recuperation after exercise, relaxation and to decrease spasticity
- Use hand to guide the force in line with normal chest motion
- Use stretch to facilitate the initiation of inhalation
- Use repeated contraction to facilitate an increase in inspiratory volume and resistance will strengthen the respiratory muscles
- Resistance to the sound side will facilitate activity on the weaker side
- Should utilize breathing exercise in all positions with emphasizing in functional positions:
  - Supine
  - Side lying
  - Prone
  - Prone on elbows

Fig. 13.20 a, b Breathing in the supine position. a Pressure on the sternum, b Pressure on the lower ribs

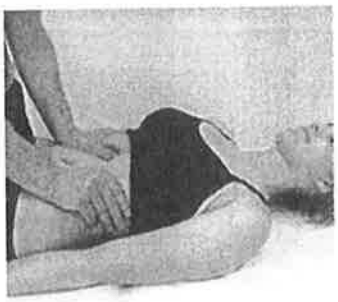
(Beckers & Buck, 2021, p.315)

Fig. 13.21 Breathing in a side-lying position

Fig. 13.22 Breathing in the prone position

(Beckers & Buck, 2021, p.316)

- Prone in elbow position



- Diaphragm facilitation

(Beckers & Buck, 2021, p.316-317)

6. PNF Contraindications

- Pain – e.g. sh. subluxation –
- Inflammation
- Severe cardiopulmonary disease:
  - Severe coronary artery disease
  - Carditis
  - Cardiac myopathy

anything related heart problem –

Mana lebih sukar?

7. References

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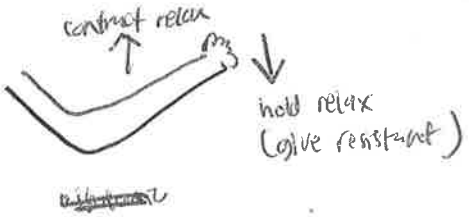
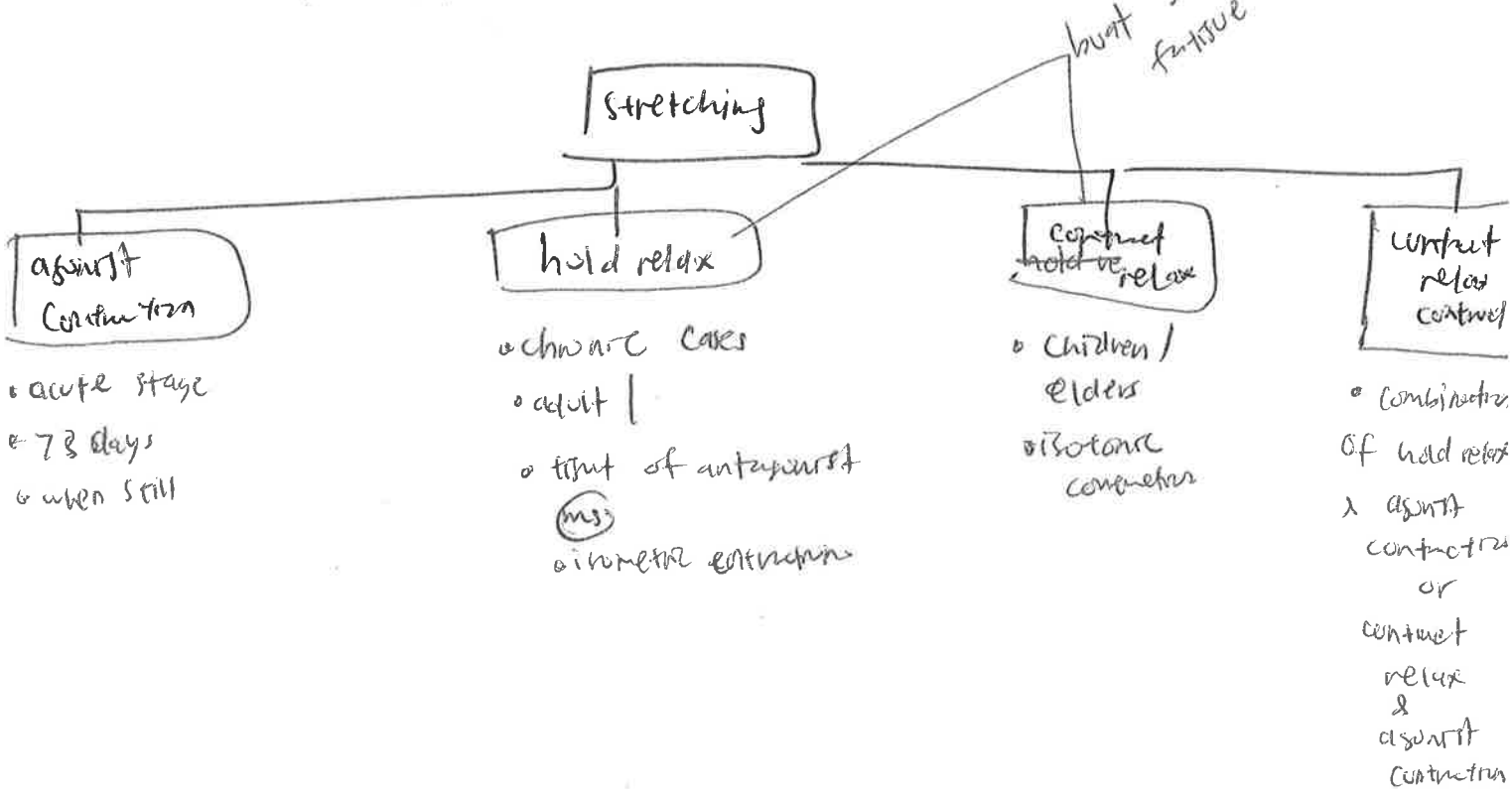
*hold relax - opposite side (give pressure)
contract relax - same side

e.g :- bicep problem (bicep tightness)





* strengthening aim for tissue & the (msj)

* stretching hurt dekat affected area
* strengthening hurt dekat unaffected area.

UPM HSAAS Workshop 2025

EMPOWERING REHABILITATION WITH PNF (Lecture I)

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WHY ARE YOU HERE?

2

CAN YOU ANSWER THESE?

- Do you master basic PNF techniques?
- Can you name sources of "overflow" for PNF strengthening?
- Can you contrast the contract relax from hold relax technique?
- Can you demonstrate UL D1 extension normal pattern?
- Can you describe differences between normal timing and timing for emphasis?

3

- proximal - distal - contra lateral - opposite; stretching technique; strengthening technique; target specific ms; e.g.: hamstring strain; using a lot of involved ms, e.g. stroke cases

Course Learning Outcome

- Define and explain the principles, physical and physiological effects of PNF techniques
- Perform treatment using PNF techniques
- Identify indication and contraindication of selected treatment techniques.

4

Content

Topic

1. What is PNF?
2. Definition
3. PNF Historical Perspective
4. Recent EBP
5. PNF Philosophy
6. Basic Neurophysiological Principles
7. PNF Therapeutic Goals
8. Rational for Use
9. PNF Basic Principles
10. Technique Application
11. PNF Diagonal Patterns
12. References

1. What is PNF? (Beckers & Buck, 2021)

- **Proprioceptive:**
  Having to do with any of the sensory receptors that give information concerning movement and position of the body
- **Neuromuscular:**
  Involving the nerves and muscles
- **Facilitation:**
  Making easier

6

* PNF - only for ms tightness - not for capsule - not for (PNS) [illegible]; - frozen sh not for PNF - sebab capsule not ms tightness; * if nerve (PNS) intact, PNF - xleh buat; * stroke boleh sebab xsemua

..."Pssst...by the name, I know it is complicated!"...

....PNF shows potential benefits if performed correctly and consistently:..

Hindle BK, Whitcomb TJ, Briggs WO & Hong J (2012), Proprioceptive Neuromuscular Facilitation (PNF): Its Mechanisms and Effects on Range of Motion and Muscular Function, *Journal of Human Kinetics* (page 105-113)..

2. Definition

- Techniques designed to call into action the body's receptors that influence relaxation, muscle tone, and muscle lengthening.
  - Jonas: Mosby's Dictionary of Complementary and Alternative Medicine (c) 2005, Elsevier.
- An approach to therapeutic exercise that combines functionally based diagonal patterns of movement with techniques of neuromuscular facilitation to evoke motor responses and improve neuromuscular control and function.
  - Kisner & Colby (1999)

type of exercise.

3. PNF Historical Perspective

- Developed at the Kabat-Kaiser Institute Washington, D.C
- 1946 -1951 by Herman Kabat, MD, a clinical neurophysiologist and the Physiotherapist, Margaret Knott.
- Originally developed for patients with neurological deficits especially Poliomyelitis
- Later for musculoskeletal and neurological deficits.
- 1948 - Maggie Knott began to teach other Physios the patterns and techniques of PNF and started a post-graduate training program that attended by therapists from all over the world

- 1952 - Dorothy Voss joined Dr. Kabat and Maggie Knott
- Dorothy and Maggie authored the first PNF book in the early 1960's
- Together, the three of them continued to develop and refine the foundational concepts of what we know today as PNF.
- Susan Adler – in 1980s formed and designed PNF instructor course under IPNFA
- 1993 – Susan Adler, Dom Beckers and Math Buck written PNF textbook for IPNFA courses

- "Proprioceptive Facilitation", a term developed by Dr. Kabat
- In 1954, Dorothy Voss added the word "neuromuscular"

4. Recent EBP

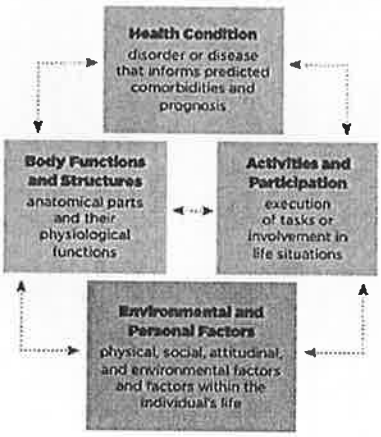
- PNF is an effective treatment for the improvement of gait parameters in patients with stroke (Gunning & Uszynski, 2018)
- PNF may increase cardiorespiratory muscle function in patients post stroke. (de Souza, 2020)
- Eight weeks of PNF contract-relax stretching is effective in increasing neuromuscular activity and muscle strength in the hamstring muscles. (Latouf et al, 2023)
- PNF exercises has a high impact in improving both balance and may enhance neuroplasticity. (Kumar el al 2024)

5. PNF Philosophy (Beckers & Buck, 2021)

- **PNF is an integrated approach:**
  - each treatment is directed at a total human being, not just at a specific problem or body segment.
- **Mobilizing reserves:**
  - based on untapped existing potential of all patients, the therapist will always focus on mobilizing the patient's reserves.
- **Positive approach:**
  - the treatment approach is always positive, reinforcing and using that which the patient can do, on a physical and psychological level.

- **Highest level of function:**
  - the primary goal of all treatment is to help patients to achieve their highest level of function
- **Motor learning and motor control:**
  - to reach this highest level of function, the therapist integrates principles of motor control and motor learning. This includes treatment at the level of body structures, at the activity level, as well at the participation level (ICF, International Classification of Functioning, WHO 1997)

ICF: International Classification of Functioning, Disability and Health

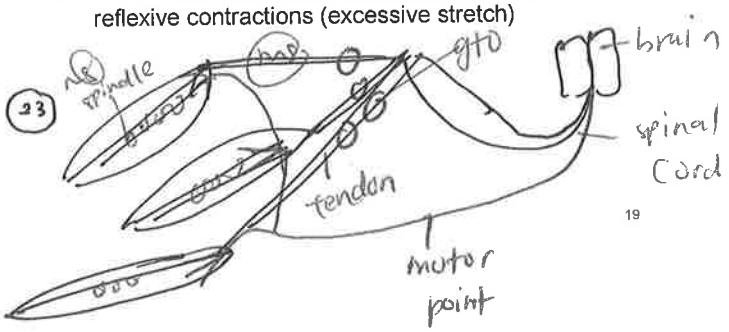


6. Basic Neurophysiological Principles

- **Afterdischarge:**
  - The effect of a stimulus continues after the stimulus stops
- **Temporal summation:**
  - A succession of weak stimuli occurring to cause excitation
- **Spatial summation:**
  - Weak stimuli applied simultaneously to different areas of the body reinforce each other to cause excitation

- **Irradiation:**
  - spreading and increased strength of a response.
  - occurs when either the number of stimuli or the strength of the stimuli is increased.
- **Successive induction:**
  - an increased excitation of the agonist muscle follows stimulation of their antagonist.
- **Reciprocal inhibition:**
  - contraction of muscles is accompanied by simultaneous inhibition of their antagonist

- **Autogenic inhibition:**
  - GTO's ability to override excitatory impulses, dominates weaker muscle spindle signaling resulting in muscle relaxation
  - inhibit impulses that last through the duration of the increased tension
  - Protective mechanism – muscle injury due to reflexive contractions (excessive stretch)



detect (MS) length.

Stretch Reflex

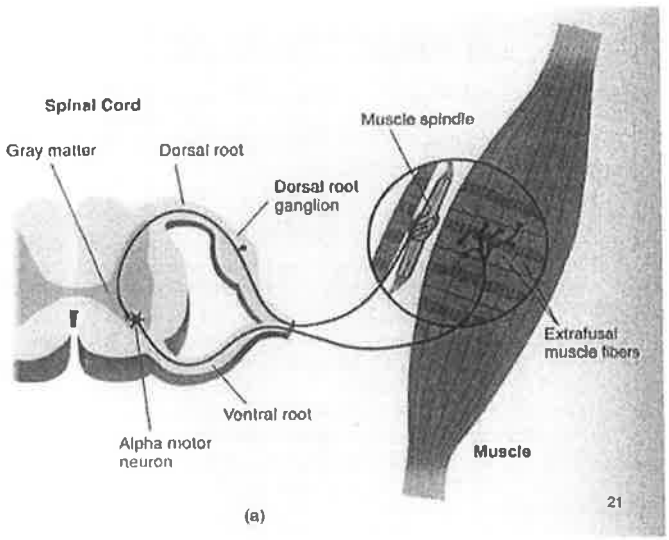
- **Muscle spindles**
  - Sensitive to length changes and rate of length change
- **Golgi tendon organs (GTO)**
  - Detect changes in tension

• detect stretch

in between b/w MS & tendon

tendon

non-contract tissue.



- **Performing a stretch**
  - Increases impulse frequency transmitted to spinal cord from muscle spindles
  - Results in increased impulses sent via motor neurons back to muscle causing reflexive resistance to stretch
  - Increased tension activates GTO that relays message to spinal cord which ultimately produces an inhibitory effect on motor nerves (relax muscle)

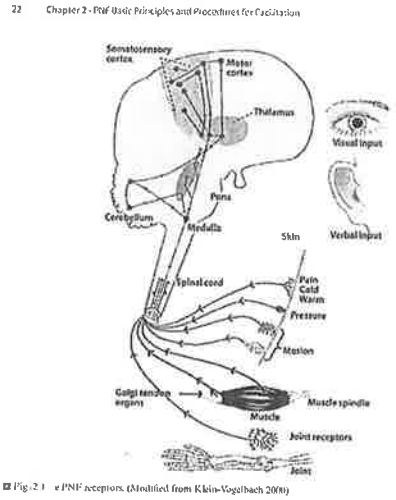


Fig. 2-1 • PNF receptors. (Modified from Klein-Vogelbach 2000)

7. PNF Therapeutic Goals

- Develop muscular strength and endurance
- Increase ROM using muscle lengthening and relaxation
- Facilitate:
  - Stability
  - Mobility
  - Neuromuscular Control
  - Coordinated movement
- As foundation for the restoration of function

8. Rationale for Use

- Aimed at what patient can do physically within limitation of injury
- Used to increase deficits in strength, range of motion and neuromuscular control
  - Emphasis on selective re-education of individual motor elements
  - Develop neuromuscular control, joint stability and coordinated mobility
- PNF attempts to provide maximal response
  - Program intensity vs. goals and stages of healing

- PNF approach is holistic
  - Integrates sensory motor and psychological aspects of rehabilitation
  - Incorporates reflexive spinal cord activities (inhibitory or facilitatory)
- Role of brain
  - Recognize gross movements, not individual muscle actions
- Strength of muscle contraction is proportional to motor unit recruitment
  - Irradiation or overflow effect

..."Overflow in Proprioceptive Neuromuscular Facilitation means - a stronger muscle helps a weaker one by initiating the works and influence the weaker to do it!"...

- Stronger muscles help weaker ones in task completion
- Results in return of completion of movement patterns (restoration of function)

9. PNF Basic Principles

- **Optimal resistance:**
  - The intensity of resistance depends on the patient's capabilities and on the treatment goal.
- **Irradiation and reinforcement:**
  - the spread of the response of nerve impulses of a given stimulation.
  - Increase stimulation by the addition of a new stimulus.
- **Manual contact:**
  - Stimulation to of skin receptors to increase power and guide motion with grip and pressure.

- **Body position and body mechanics:**
  - guidance and control of motion or stability
- **Verbal stimulation:**
  - use of words and the appropriate vocal volume to direct the patient.
- **Visual stimulation:**
  - use of vision to guide motion.
- **Traction:**
  - The elongation of the limbs and trunk by performed by the therapist.

- **Approximation:**
  - Compression of the limbs and trunk to facilitate motion and stability.
- **Stretch stimulus:**
  - The use of muscle elongation and the stretch reflex to facilitate contraction and decrease muscle fatigue.
- **Timing:**
  - Sequencing of motions
  - **Normal timing** – continuous, coordinated motion, from distal to proximal or vice versa

(Adler, Beckers & Buck, 2008)

  - **Timing for emphasis** – changing the normal sequencing of motions to emphasize a particular muscle or a desired activity
- **PNF patterns:**
  - Synergistic mass movements, components of functional normal motion.
  - Three dimensional muscle contraction

10. Technique Application

- **Manual Contacts**
  - Refers to the therapist's hand placement
  - One hand over the tendinous insertion of the agonist
  - The other more proximally
- **Maximal resistance**
  - Greatest amount of resistance that still allows the patient to move smoothly and without pain

- **Position and movement of the therapist**
  - Wide base of support, aligned along diagonal planes of motion facing the moving limb
  - Use of effective body mechanics and body weight
- **Stretch:**
  - **Stretch stimulus**
    - Placing of body segments in position that lengthen the muscles before contracting (in diagonal starting position)
  - **Stretch reflex**
    - Rapid stretch/overpressure just past the point of tension to the elongated muscle and followed by sustained resistance to the agonist muscles to keep the tension.

- **Irradiation/overflow**
  - No strengthening without overflow
  - Initiate technique by giving resistance to stronger muscle group
  - Stronger muscle group will influence firing of motor point of the weaker group
  - Source of irradiation:
    - Proximal
    - Distal
    - Opposite
    - Contra-lateral side

Fig. 2.2. Irradiation into the trunk flexor muscles when doing bilateral leg patterns

(Beckers & Buck, 2021, p.23)

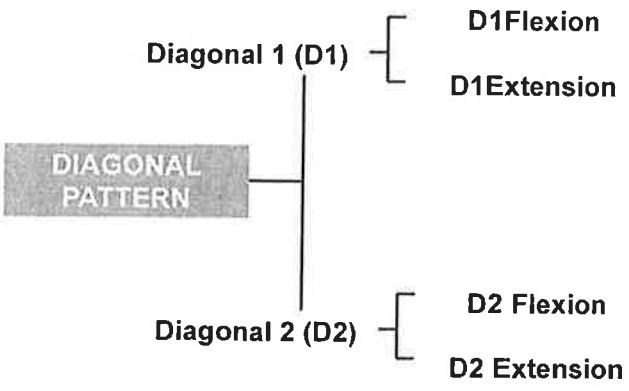
Fig. 2.2 Irradiation into the trunk flexor muscles when doing bilateral leg patterns

- **Normal timing**
  - Sequence of distal to proximal, coordinated muscle contraction during diagonal motion
  - Distal component motions should completed halfway through pattern
  - Correct sequencing promotes neuromuscular control and coordinated motion.
- **Traction**
  - To inhibit pain and facilitate motion
  - Most applied during flexion pattern

- **Approximation** — balance
  - ~~Gentle compression~~ of joint surfaces to stimulates co-contractions of agonist and antagonist to enhance dynamic stability and postural control via mechanoreceptors
- **Verbal commands**
  - Enhance motor output and maintain patient's attention
- **Visual cues**
  - Enhance control of movement throughout the ROM

11. Diagonal Patterns

- Composed of multi-joint, multi-planar, diagonal and rotational movements of:
  - Extremities
  - Trunk
  - Neck
- Multiple muscle groups simultaneous contraction

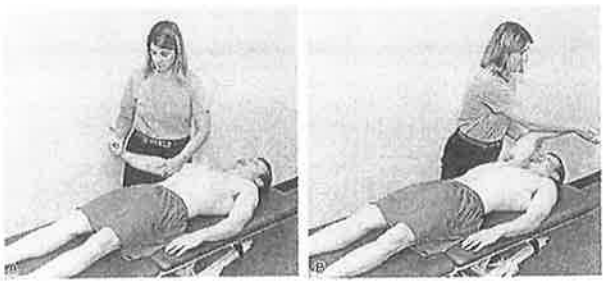


ARM PATTERN

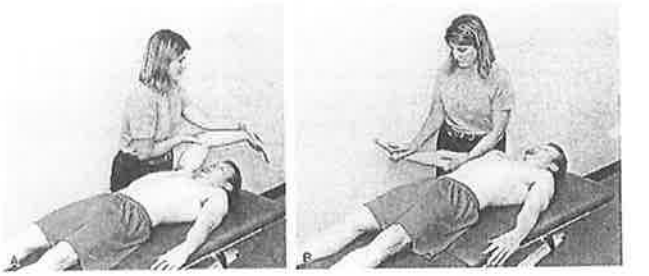
Pattern	Starting Position	End Position
D1 Flexion	Sh. extension, abduction, internal rotation + fingers extension	Sh. flexion, adduction, external rotation + fingers flexion
D1 Extension	Sh. flexion, adduction, external rotation + fingers flexion	Sh. extension, abduction, internal rotation + fingers extension

ARM PATTERN

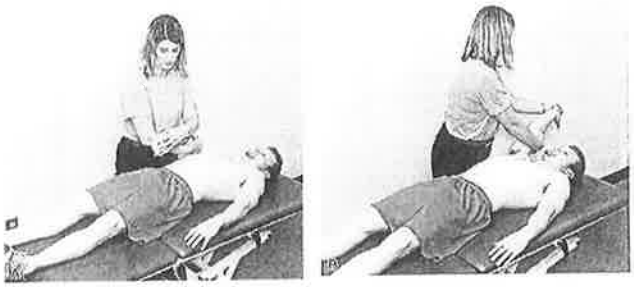
Pattern	Starting Position	End Position
D2 Flexion	Sh. extension, adduction, internal rotation + fingers flexion	Sh. flexion, abduction, external rotation + fingers extension
D2 Extension	Sh. flexion, abduction, external rotation + fingers extension	Sh. extension, adduction, internal rotation + fingers flexion



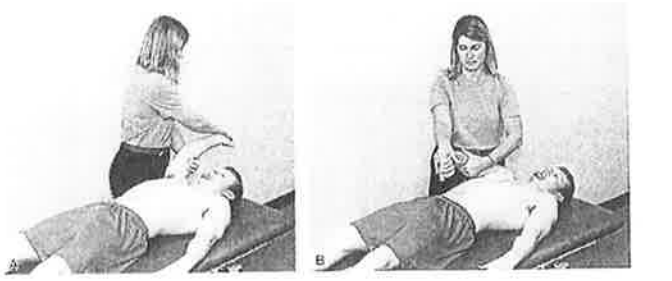
D1 Flexion UL



- D1 Extension UL



- D2 Flexion UL



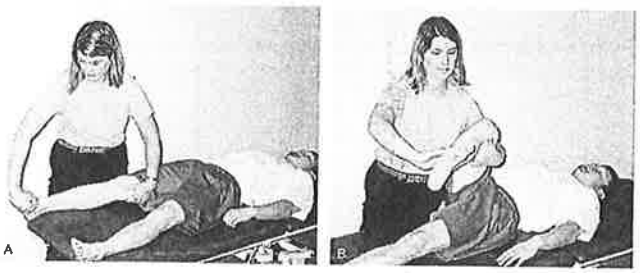
- D2 Extension UL

LEG PATTERN

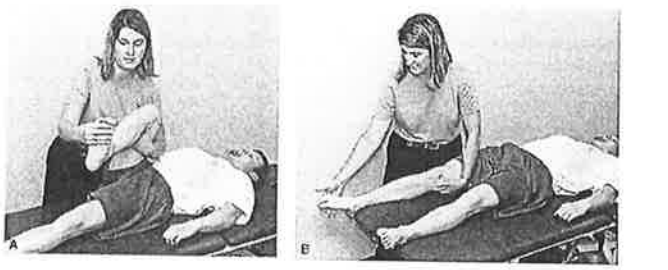
Pattern	Starting Position	End Position
D1 Flexion	Hip extension, abduction, internal rotation + plantar flexed, everted foot	Hip flexion, adduction, external rotation + dorsiflexed, inverted foot
D1 Extension	Hip flexion, adduction, external rotation + dorsiflexed, inverted foot	Hip extension, abduction, internal rotation + plantar flexed, everted foot

LEG PATTERN

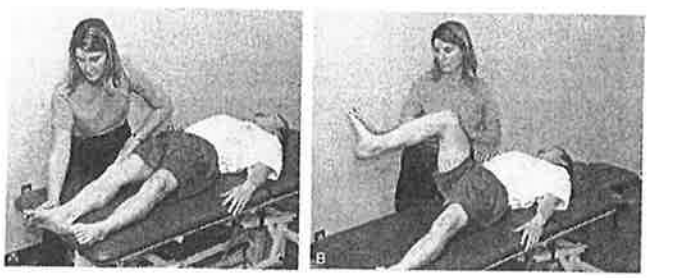
Pattern	Starting Position	End Position
D2 Flexion	Hip extension, adduction, external rotation + plantar flexed, inverted foot	Hip flexion, abduction, internal rotation + dorsiflexed, everted foot
D2 Extension	Hip flexion, abduction, internal rotation + dorsiflexed, everted foot	Hip extension, adduction, external rotation + plantar flexed, inverted foot



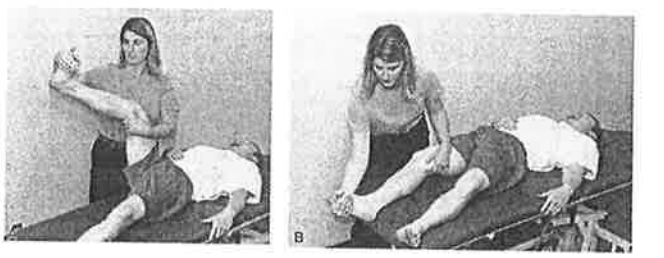
- D1 Flexion LL



- D1 Extension LL



- D2 Flexion



- D2 Extension LL

TABLE 6.9 Component Motions of PNF Patterns: Upper and Lower Extremities

Shoulder	*Flexion-adduction-external rotation*	*Extension-abduction-internal rotation*	*Flexion-abduction-external rotation*	*Extension-adduction-internal rotation*
Scapula	Elevation, abduction, upward rotation	Depression, adduction, downward rotation	Elevation, abduction, upward rotation	Depression, adduction, downward rotation
Elbow	Flexion or extension	Flexion or extension	Flexion or extension	Flexion or extension
Forearm	Supination	Pronation	Supination	Pronation
Wrist	Flexion, radial deviation	Extension, ulnar deviation	Extension, radial deviation	Flexion, ulnar deviation
Fingers and thumb	Flexion, adduction	Extension, abduction	Extension, abduction	Flexion, adduction
Hip	*Flexion-adduction-external rotation*	*Extension-abduction-internal rotation*	*Flexion-adduction-internal rotation*	*Extension-adduction-external rotation*
Knee	Flexion or extension	Flexion or extension	Flexion or extension	Flexion or extension
Ankle	Dorsiflexion, inversion	Plantarflexion, eversion	Dorsiflexion, eversion	Plantarflexion, inversion
Toes	Extension	Flexion	Extension	Flexion

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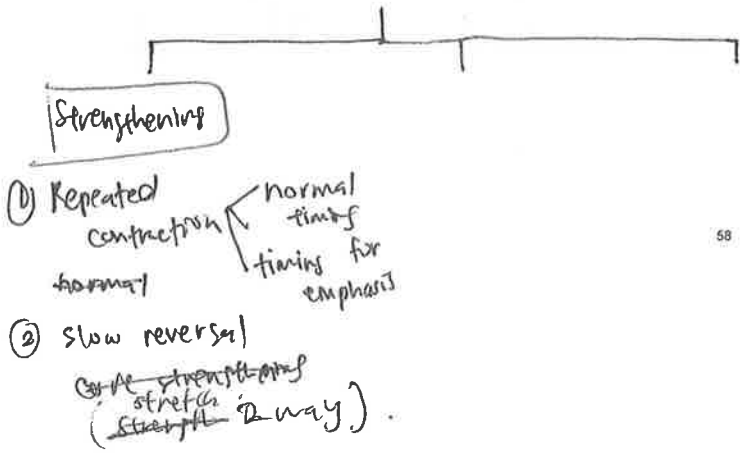

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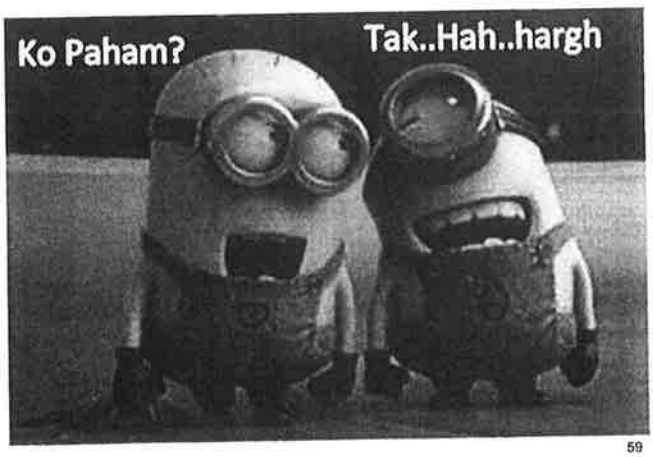

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