JHARKHAND RAI UNIVERSITY

RANCHI

LAB MANUAL

ADVANCE EXERCISE THERAPY-I

(23A303P)

LIST OF PRACTICALS

S.NO	PRACTICAL
1.	To learn joint mobilization techniques for peripheral joints.
2.	To learn joint mobilization techniques for vertebral joints.
3.	To learn about different types and techniques of stretching.
4.	To demonstrate different types of resistance exercise techniques.
5.	To demonstrate Progressive Resistance Exercise (PRE) classification.
6.	To demonstrate the grades of Manual Muscle Testing (MMT).
7.	To demonstrate PNF techniques for upper and lower extremities.

PRACTICAL – 1

AIM: To learn joint mobilization techniques for peripheral joints.

MOBILIZATION

Mobilization are passive, skilled manual therapy technique applied on joint and relative soft tissues at varying speed and amplitudes using physiologic and accessory motions for therapeutic purposes. It enhances joint movement to get normal range of motion and reduce pain. Therapists use their hands to apply force.

Mobilization Techniques are used for:

1. Reduction of Joint Stiffness – when a joint has become stiff due to any kind of injury, prolonged immobility or surgery, then mobilization can help to reduce stiffness and pain by improving blood circulation and releasing tension in shock tissue.

2. Pain relief- By reducing stiffness and improving joint and tissue movement mobilization can decrease pain in the affected area, particularly in conditions like osteoarthritis, tendinitis or muscle tension.

3. Reducing Muscle Tension – Soft tissue mobilization targets tight or restricted muscles, tendons, and fascia, helping to relieve tension and improving flexibility.

4. Reducing Inflammation – Mobilization can increases blood flow to the tissues, promoting healing and reducing inflammation.

5. Improving Functional Movement – During recovery, mobilization helps regain normal movement patterns and improve overall functional performance.

Maitland Joint Mobilization Technique

- Geoffrey Maitland introduced the technique of peripheral and vertebral joint mobilization.
- The Maitland technique is a specific manual therapy technique approach used for the assessment and treatment of musculoskeletal disorders, particularly focusing on joint mobility and pain relief.
- In this mobilization technique, the main concept is the oscillatory or rhythmical movements of the joints to increase its range of motion. Maitland's approach involves both treatment and assessment through passive movement.
- Mobilization is applied to peripheral joints such as the shoulder joint, hip joint etc. as well as in spine like – cervical, lumbar etc.

Maitland Mobilization Grades:-

- Grade I – Small amplitude, out of resistance, oscillatory rhythmical movement performed at the beginning of the joint range. Primarily used to reduce pain and muscle guarding.
- Grade II – Large amplitude, out of resistance, oscillatory rhythmical movement performed at the beginning of the joint range or within the joint range but not reaching the end range. Used for pain relief and maintaining joint mobility.
- Grade III – Large amplitude, into or with resistance, oscillatory rhythmical movement performed up to the limit of available. Aimed at increasing joint mobility.
- Grade IV – Small amplitude, into resistance, oscillatory rhythmical movement performed at the very end range of the joint's motion.
- Grade V – High-velocity, low-amplitude thrust at the end range of joint movement. This movement is commonly referred to as manipulation.

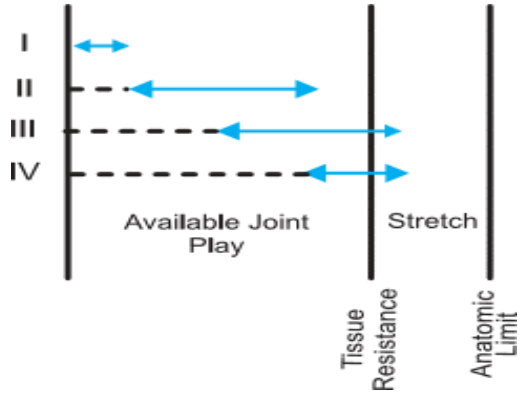

Figure 1.1 Maitland grades of mobilization

Maitland Mobilization for Peripheral Joints

1. Shoulder Joint (Glenohumeral Joint)

The shoulder joint is a ball-and-socket joint, where the head of the humerus fits into a shallow socket called the glenoid cavity of the scapula.

It allows a wide range of movements, including: Flexion, Extension, Abduction, Adduction, and Rotation

The concave glenoid fossa receives the convex humeral head, enabling smooth movement.

Surface Marking

a) **Position of the Joint –** The glenohumeral joint is located at the upper lateral part of the shoulder.

b) Landmarks:

• Acromion Process – The bony prominence on the top of the shoulder joint. The joint lies just beneath it.

• Coracoid Process – The coracoid process can be felt about 2 cm below the lateral end of the clavicle. The joint is approximately 2-3 cm lateral and slightly inferior to this structure.

• Greater Tubercle of the Humerus – Slide your finger just inferior and lateral from the acromion, 1-2 cm below. Another bony prominence is present here, called the greater tubercle.

c. Surface Projection -The glenohumeral joint is located 2.5 cm inferior to the top of the acromion process. This can be palpated by gently passing just below the acromion process while the arm is passively moved in different directions.

- Resting Position - The shoulder is abducted 55°, horizontally adducted 30°, and rotated so that the forearm is in the horizontal plane with respect to the body (called the plane of the scapula).
- Treatment Plane - The treatment plane is in the glenoid fossa and moves with the scapula as it rotates.
- Stabilization- Fixate the scapula with a belt or have an assistant help.

Glenohumeral Distraction or Lateral Glide

Indication

• Testing; initial treatment (sustained Grade II).

• Pain control (Grade I or II oscillations).

• General mobility (sustained Grade III).

Patient Position-Supine, with arm in the resting position.

Therapist Position and Hand Placement

- Stand at the patient's side, facing toward their head.
- Use the hand nearer to the part being treated (e.g., left hand if treating the patient's left shoulder) and place it in the patient's axilla with your thumb just distal to the joint margin anteriorly and fingers posteriorly. Support the forearm between your trunk and elbow.
- Your other hand supports the humerus from the lateral surface.

Procedure

• With the hand in the axilla laterally, move the humerus laterally.

• The entire arm moves in a translatory motion away from the plane of the glenoid fossa. Distraction may be performed with the humerus in any position.

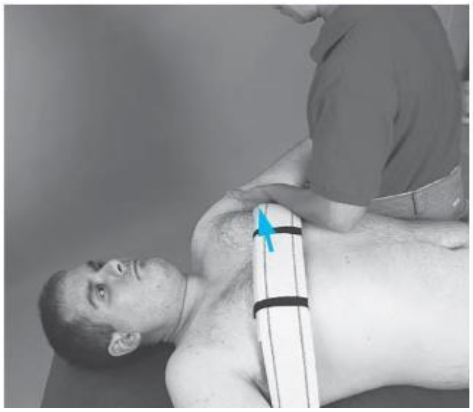

Figure 1.2 Glenohumeral distraction/lateral glide

Glenohumeral Caudal Glide

Indications: To increase abduction (sustained Grade III).

Patient Position- Supine, with arm in the resting position.

Therapist Position and Hand Placement

• Stand lateral to the arm of the patient being treated and support the forearm between your trunk and elbow.

• Place one hand in the patient's axilla to provide a Grade I distraction.

• The web space of your other hand is placed just distal to the acromion process.

Procedure- With the superiorly placed hand, glide the humerus in an inferior direction.

Figure 1.3 Glenohumeral caudal glide

Glenohumeral Posterior Glide

Indications: To increase flexion and internal rotation.

Patient Position-Supine, with the arm in resting position.

Therapist Position and Hand Placement
• Stand with your back to the patient, between the patient's trunk and arm.

• Support the arm against your trunk while grasping the humerus with your distal or lateral hand. This position provides Grade I distraction to the joint.

• Place the lateral border of your top hand just distal to the anterior joint, with your fingers pointing superiorly. This hand provides the mobilizing force.

Procedure*:* Glide the humeral head posteriorly by moving the entire arm as you bend your knees.

Figure 1.4 Glenohumeral posterior glide

Glenohumeral Anterior Glide

Indications: To increase extension and external rotation.

Patient Position
Prone, with the arm in resting position and over the edge of the treatment table, supported on your thigh. Stabilize the acromion with padding. The supine position may also be used.

Therapist Position and Hand Placement
• Stand facing the top of the table with the leg closer to the table in a forward stride position.

• Support the patient's arm against your thigh with your outside hand; this provides a Grade I distraction.

• Place the ulnar border of your other hand just distal to the posterior angle of the acromion process, with your fingers pointing medially; this hand provides the mobilizing force.

Procedure: Glide the humeral head in an anterior and slightly medial direction. Bend both knees so that the entire arm moves anteriorly.

Figure 1.5 Glenohumeral anterior glide

2. ELBOW JOINT

The elbow joint is a hinge joint, consisting of two articulations:

- **Humeroulnar Joint**
- **Humeroradial Joint**

Landmarks:

• Medial Epicondyle - Palpate the medial epicondyle, which is easily felt on the inner side of the elbow. This serves as a medial reference point for the humeroulnar joint.

• Olecranon Process - Palpate the olecranon process at the posterior aspect of the elbow. It is the prominent bony landmark when the elbow is flexed. The humeroulnar joint is just deep to the soft tissue in this area, approximately 2-3 cm from the medial epicondyle.

Resting Position: The elbow is flexed at 70° and the forearm is supinated at 10°.

Treatment Plane: The treatment plane is in the olecranon fossa, angled approximately 45° from the long axis of the ulna.

Stabilization: Fixate the humerus against the treatment table with a belt or ask an assistant to hold it. The patient may roll onto their side and fixate the humerus with the contralateral hand if muscle relaxation can be maintained around the elbow joint being mobilized.

Humeroulnar Distraction and Progression

Indications

- Testing; initial treatment (sustained grade II);
- pain control (grade I or I oscillation);
- To increase flexion or extension (Grade III or IV).

Patient Position

- Supine, with the elbow over the edge of the treatment table or supported with padding just proximal to the olecranon process.
- Rest the patient's wrist against your shoulder, allowing the elbow to be resting position for the initial treatment.
- To stretch into either flexion or extension position the joint at the end of its available range**.**

Therapist Position and Hand Placement

- When in the resting position or at end-range flexion
- Place the fingers of your medial hand over the proximal ulna on the volar surface; reinforce it with your other hand.
- To isolate the mobilization force to the humeroulnar articulation, be sure that your hand is not in contact with the proximal radius.
- With at end-range extension, stand and place the base of your proximal hand over the proximal portion of the ulna and support the distal forearm with your other hand.

Procedure: - Apply force against the proximal ulna at a 45° angle to the shaft of the bone.

Figure 1.6 Humeroulnar distraction

Humeroulnar Distal Glide

Indications- to increase flexion.

Patient Position- Supine, with elbow over the edge of the treatment table.

Therapist Position and Hand Placement

- Stand facing the patient. Begin with the elbow in the resting position. Progress by positioning it at the end-range of flexion.
- Place the fingers of your medial hand over the proximal ulna on the volar surface, reinforce & with your other hand.
- To isolate the mobilization force to the humeroulnar articulation, be sure that your hand is not in contact with the proximal radius.

Procedure- Firstly, apply a distraction force to the joint at a 45 ° angle to the ulna, then while maintaining the distraction, direct the force in a distal direction along the long axis of the ulna using a scooping motion.

Figure 1.6 Humeroulnar distal glide

Humeroulnar Radial Glide

Indications- To increase varus. This is an accessory motion of the joint that accompanies elbow flexion and is therefore used to progress flexion.

Patient Position- Side-lying on the arm to be mobilized with the shoulder laterally rotated and the humerus supported on the table.

Therapist position and Hand Placement

- Stand facing the patient. Begin with the elbow in resting position, progress to end-range flexion.
- Place the base of our proximal hand just distal to the elbow, support the distal forearm with other hand.

Procedure- Apply force against the ulna in a radial direction.

Figure 1.7 Humeroulnar radial glide

Humeroulnar Ulnar Glide

Indications-To increase valgus. This is an accessory motion of the joint that accompanies elbow extension and is therefore used to progress extension.

Patient Position

- Same as for radial glide except a block or wedge is placed under the proximal forearm for stabilization (using distal stabilization).
- Initially, the elbow is placed in a resting position and is progressed to end-range extension.

Therapist Position and Hand Placement

Stand facing the patient. Place the base of our proximal hand just distal to the elbow, support the distal forearm with the other hand.

Procedure- Apply force against the distal humerus in a radial direction, causing the ulna to glide ulnarly.

Humeroradial Joint-To convex capitulum articulates with the concave radial head.

Landmarks

- **Lateral Epicondyle -** This is a prominent bony structure on the lateral side of the distal humerus.
- **Radial Head-**Palpable just below the lateral epicondyle when the elbow is flexed.
- **Resting position-** The Elbow is extended and the forearm is supinated to the end of the available range.
- **Treatment Plane –** The treatment plane is in the concave radial head perpendicular to the long axis of the radius.
- **Stabilization-** Fixate the humerus with one of your hand.

Humeroradial Distraction

Indications-To Increase mobility of the humeroradial joint, to manipulate a pushed elbow (proximal displacement of the radius).

Patient Position-Supine or sitting, with the arm resting on the treatment table.

Therapist Position and Hand Placement

- Position yourself on the ulnar side of the patient's forearm as you are between the patient's hip and upper extremity.
- Stabilize the patient's humerus with your superior hard.
- Grasp around the distal radius with the fingers and thenar eminence of your inferior head. Be sure you are not grasping around the distal ulna.

Procedure- Pull the radius distally (long -axis traction causes joint traction).

Figure 1.8 Humeroradial distraction glide

Humeroradial Dorsal /Volar Glides

Indications-Dorsal glide head of the radius to increase elbow extension; volar glide to increase flexion.

Patient Position-Supine or sitting with the elbow extended and supinated to the end of the available range.

Therapist Position and Hand Placement

- Stand facing the patient. Stabilize the humerus with your hand that is on the medial side of the patient's arm.
- Place the palmar surface of your lateral hand on the volar aspect and your fingers on the dorsal aspect of the radial head.

Procedure

- Move the radial head dorsally with the palm of your hand or volarly with your fingers.
- If a stronger force is needed for the volar glide, realign your body and push with the base of your hand against the dorsal surface in a volar direction.

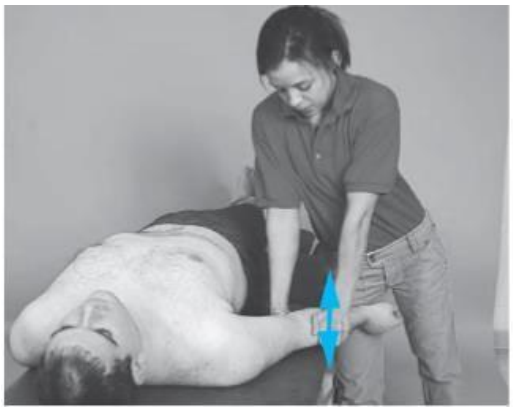

Figure 1.9 Humeroradial dorsal/volar glide

Humeroradial Compression

Indications-To reduce a pulled elbow subluxation.

Patient Position-Sitting or supine.

Therapist Position and Hand Placement

- Approach the patient right hand to right hand or left hand to left hand.

- Stabilize the elbow posteriorly with the other hand. If supine, the stabilizing hand is under the elbow supported on the treatment table.
- Place your thenar eminence against the patient's thenar eminence (locking thumbs).

Procedure- Simultaneously, extend the patient's wrist, push against the thenar eminence and compress the long axis of the radius while supinating the forearm.

Figure 1.8 Humeroradial compression

3. HIP JOINT

It is the ball and socket variety of synovial joint (multi-axial). It is joint between the head of the femur and the acetabulum of the pelvis. Concave acetabulum receives convex femoral head.

Landmarks:-

a) **Anterior Superior Iliac Spine (ASIS)**
This is the bony prominence at the front of the tip of the pelvic bone.

b) **Pubic Symphysis-** The midline joint between the left and right pubic bones.

c) **Greater Trochanter of the femur-** The large, palpable bony prominence on the outer aspect of the upper thigh.

Marking-The hip Joint is lies approximately 2.5cm below the midpoint of a line draw between the anterior posterior and the pubic symphysis.

Resting Position- The resting position is hip flexion 30°, abduction 30°, and slight external rotation.

Treatment plane – The treatment is in the acetabulum**.**

Stabilization- Fixate the pelvis to the treatment table with belts.

Hip Caudal Glide

Indications- Testing; initial treatment; pain control; general mobility**.**

Patient position-Supine, with the hip in resting position and the knee extended.

Therapist Position and Hand Placement

- Stand at the end of the treatment table.
- Place your hands proximal to the malleoli. It allows you to use your body weight to apply the mobilizing force.

Procedure- Apply a long-axis traction by pulling on the leg as you lean backward.

Figure 1.9 Hip distraction/caudal glide

Hip Posterior Glide

Indications- To increase flexion; to increase internal rotation.

Patient Position

- Supine, with hips at the end of the table.
- The patient helps stabilize the pelvis and lumbar spine by flexing the opposite hip and holding the thigh against the chest with the hands.
- Initially, the hip to be mobilized in resting position; progress to the end of the range.

Therapist Position and Hand Placement

- Stand on the medial side of the patient's thigh.
- Place your distal hand under patient's thigh and hold the weight of lower extremity.
- Place your proximal hand on of the proximal thigh. The anterior surface of the proximal thigh.

Procedure- Keep your elbows extended and flex your knees, apply the force through your proximal hand in a posterior direction.

Figure 1.10 Hip posterior glide

Hip Anterior Glide

Indications- To increase flexion; to increase external rotation.

Patient Position- Prone with the trunk resting on the table and hips over the edge. The opposite foot is on the floor.

Therapist Position and Hand Placement

- Stand on the medial side of the patient's thigh.
- Place your one hand (distal hand) on the patient's leg and hold patient's leg.
- Place your proximal hand posteriorly on the proximal thigh just below the buttock.

Procedure- Keep your elbow extended and flex your knees; apply the force through your proximal hand in an anterior direction.

Figure 1.11 Hip anterior glide

4. KNEE JOINT

The knee is the largest and most complex joint of the body. This joint is a modified hinge joint. The complexity is the result of the fusion of joint in one:

I. Tibiofemoral joint
II. Patellofemoral joint

Landmarks:

- **Patella (Kneecap):** Triangular-shaped bone palpable on the anterior aspect of the knee.
- **Tibial Tuberosity:** Located below the patella on the anterior aspect of the tibia.
- **Medial and Lateral Condyles of the Femur:** Bony prominences of the distal femur, palpable on the medial and lateral sides of the knee.

  Marking: Palpate the lower edge (apex) of the patella. Move your finger 1 cm downward while the knee is extended. The knee joint is located just below this point.

Tibiofemoral Articulations: The concave tibial plateaus articulate on the convex femoral condyles.

- **Resting Position:** 25° flexion.
- **Treatment Plane:** Lies along the surface of the tibial plateaus and moves with the tibia as the knee angle changes.

- **Stabilization:** The femur is stabilized with a belt or by the table.

Tibiofemoral Distraction (Long-Axis Traction)

Indications: Testing, Initial treatment, Pain control, General mobility.

Patient Position:

- Sitting, supine, or prone, beginning with the knee in the resting position.
- Progress to positioning the knee at the limit of flexion or extension.
- Internal rotation of the tibia may be added before applying traction (use internal rotation at end-range flexion and external rotation at end-range extension).

Therapist Position and Hand Placement:

- Stand on the medial side of the patient's leg.
- Grasp the distal leg, proximal to the malleoli, with both hands.

Procedure: Pull on the long axis of the tibia to separate the joint surfaces.

Figure 1.11 Tibiofemoral distraction

Tibiofemoral Posterior Glide

Indications: Testing, to increase flexion.

Patient Position:

- Supine, with the foot resting on the table.

- The position for the drawer test can be used to mobilize the tibia either anteriorly or posteriorly, although no grade I distraction can be with the glides in this position.

Therapist Position and Hand Placement:

- Sit on the table with your thigh stabilizing the patient's foot.
- Grasp around the tibia with both hands, fingers pointing posteriorly and thumbs anteriorly.

Procedure: Extend your elbows and lean your body weight forward. Push the tibia posteriorly with your thumbs.

Figure 1.12 Tibiofemoral posterior glide

Tibiofemoral Anterior Glide

Indications: To increase extension.

Patient Position:

- Prone, beginning with the knee in the resting position; progress to the end of the available range.
- Place a small pad under the distal femur to prevent patellar compression.
- The drawer test position can also be used.

Therapist Position and Hand Placement:

- Stand on the lateral side of the patient's leg.
- Grasp the distal tibia with the hand closer to it.

- Place the palm of the proximal hand on the posterior aspect of the proximal tibia.

Procedure:

- Apply force with the hand on the proximal tibia in an anterior direction.
- The force may be directed to the lateral or medial tibial plateau to isolate one side of the joint.

Figure 1.13 Tibiofemoral anterior glide

Patellofemoral Joint

The patella must have mobility to glide distally on the femur for normal knee flexion and glide proximally for normal knee extension.

Patellofemoral Joint, Distal Glide

Indications: To increase flexion.

Patient Position: Supine, with the knee extended; progress to positioning the knee at the end of the available range in flexion.

Therapist Position and Hand Placement:

- Stand next to the patient's thigh, facing the patient's feet.
- Place the web space of the hand that is closer to the thigh around the superior border of the patella. Use the other hand for reinforcement.

Procedure: Slide the patella in a caudal direction, parallel to the femur.

Figure 1.14 Patellofemoral distal glide

Patellofemoral Medial or Lateral Glide

Indications: To increase patellar mobility.

Patient Position: Supine, with the knee extended. Side-lying may be used to apply a medial glide.

Therapist Position and Hand Placement:

- Stand next to the patient's thigh and feet, facing the patient's feet.
- Place the heel of your hand along either the medial or lateral aspect of the patella. Stand on the opposite side of the table to position your hand for medial glide and on the same side of the table to position your hand along the lateral border.
- Place the other hand under the femur to stabilize it.

Procedure: Glide the patella in a medial or lateral direction against the restriction.

Figure 1.15 Patellofemoral medial/lateral glide

PRACTICAL-2

Aim: To learn joint mobilization techniques for vertebral joints.

Maitland Mobilisation Technique for Vertebral Joints

Cervical Vertebrae: The cervical vertebrae form the uppermost part of the spine, located in the neck region. There are seven cervical vertebrae (C1 to C7).

Surface Marking:

- **C1 (Atlas): It has no body, and** the transverse process can be palpated just below or at the base of the skull.
- **C2 (Axis):** The spinous process of C2 can be felt in the midline at the base of the skull. The spinous process is the first palpable midline structure below the skull.
- **C3 to C6:** Spinous processes are difficult to palpate individually due to overlying muscles but they lie approximately in the midline of the neck.
- **C7 (Vertebra Prominence):** The longest spinous process, making it easy to locate. Most prominent structure easily felt at the base of the neck when the head is flexed forward.

Cervical Posterior-Anterior/Central Vertebral Pressure

Indications: To increase cervical flexion.

Patient Position:

- Prone, with arms resting comfortably at the patient's side.
- Place a pillow under the clavicular region for comfort and to maintain a neutral cervical-thoracic curve.

Therapist Position and Hand Placement:

- Stand on one side of the patient, facing their head.
- Use a two-thumb contact (thumb-on-thumb) on the spinous process of the superior restricted segment of the three joint complex.

Procedure: Using force through the thumbs, slide the superior (cervical) vertebra in a cephalad-anterior direction (toward head or anterior-posterior direction). The force should be minimal.

Figure 2.1 Cervical posterior-anterior glide

Cervical Transverse Vertebral Pressure

Indications: Pain control, General mobility.

Patient Position: Prone, with arms resting comfortably at the sides. Use a pillow for comfort and to promote a neutral cervical-thoracic curve.

Therapist Position and Hand Placement:

- Stand on one side of the patient, facing their head.
- Palpate the spinous process of superior restricted vertebra from thumb pads and then slightly slip to both the sides of transverse processes on the superior restricted vertebra of the three-joint complex causes alternate glides toward the direction of restriction. For example- if the goal is to reduce pain at C6 segment the therapist would push on transverse process of C6 alternatively.

Procedure:

Using force through the thumb pads, slide the superior vertebra in a cephalad-anterior direction.

Lumbar Vertebrae

The lumbar spine consists of five vertebrae in lower back. Lumbar vertebrae (L1 to L5) located below the 12 thoracic vertebrae and above the five fused sacrum vertebra.

Surface Marking:

- **Spinous Processes:** Palpable as a series of bumps in the midline of the lower back.
- **L4-L5: L1 →**Found just below the last rib (12th thoracic vertebra).

  L4 and L5 → align with the iliac crest.

Lumbar Posterior-Anterior/ Central Vertebral Pressure

Indications: To increase lumbar flexion.

Patient Position: Prone, with arms by the sides and head turned to one side for comfort.

Therapist Position and Hand Placement:

- Stand on one side of the patient, facing their back.
- Palpate the spinous process of the restricted segment and place your thumbs on it and place the thumbs on the spinous process of the restricted segment.

Procedure:

- Position your shoulders above your hands and transmit pressure through the thumbs.
- Slide the restricted vertebra in the posterior-anterior direction.

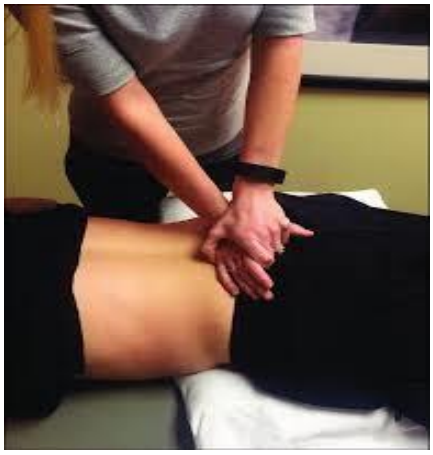

Figure 2.2 Lumbar posterior-anterior glide

Lumbar Transverse Vertebral Pressure

Indications: Pain control, General mobility.

Patient Position: Prone, with arms by the sides and head comfortably turned to one side.

Therapist Position and Hand Placement:

- Stand on one side of the patient, facing their back.
- Palpate the spinous process of the lower restricted vertebra from thumb pads and then slightly slip to both sides of the transverse processes on the lower restricted vertebra, causing alternate glides toward the direction of restriction. For example, if the goal is to reduce pain at L3 segment therapist would push on the transverse process of L3 alternatively.

Procedure: Position your shoulders above his or her hands and transmit the pressure through the thumbs alternatively. Slide the vertebra in anterior anterior-posterior direction.

Contraindications for Joint Mobilization

- Fractures in the treatment region.
- Bone diseases (e.g., osteosarcoma, osteoporosis).
- Acute radiculopathy.
- Suspected joint hypermobility or instability, sensor issues.
- Sensory deficits in the treatment area.
- Malignancy in the treatment region.
- Cauda equina lesions.
- Bowel or bladder dysfunction.
- Ligamentous rupture.
- Inflammation or ankylosis of the joint.
- Vascular disorders in the treatment region.
- Blood clotting disorders or use of blood-thinning medications.
- Joint effusion, Joint refreshment.
- Vertebrobasilar insufficiency.

Precautions for Joint Mobilization

- Confirmed or suspected malignancy (e.g., Patient > 50 years old, failure to respond, unexplained weight loss, history of cancer).
- Long-term corticosteroid use.
- Joint replacements.
- Pregnancy or postpartum period, oral contraceptives, anticoagulant therapy.
- Recent trauma, Radiculopathy (distal to knee/elbow).
- Cauda equina syndrome.
- Early healing phase of newly developing connective tissue.
- Bone diseases not detectable on radiograph (e.g., osteoporosis, osteopenia, osteomalacia, chronic renal failure, osteopetrosis).
- Systemic connective tissue disorders (e.g., rheumatoid arthritis, Down syndrome).
- Unfused growth plates.
- Skin rashes or open wounds in the treatment area.
- Patients unable to communicate reliably (e.g., elderly, young children, cognitive impairment).
- Psychogenic patients with symptom magnification or irritability**.**
- Elevated pain levels that hinder palpation or stabilization unreasonable.

PRACTICAL-3

Aim: To learn about different types and techniques of stretching.

Stretching: Stretching is a form of exercise where a specific muscle, tendon, or muscle group is extended and flexed to improve flexibility, range of motion, and comfortable muscle tone.

Effects of Stretching:

1. Improves flexibility, delaying age-related mobility decline.
2. Enhances physical performance.
3. Reduces injury risk and damage.
4. Improves blood circulation, reducing muscle soreness and speeding recovery.
5. Increases range of motion.

Indications of Stretching

- Increase joint and muscle range of motion.
- Alleviate muscle tightness and soreness.
- Correct poor posture and alignment.
- Manage pain (e.g., chronic back pain, arthritis, muscle strains).
- Enhance performance and reduce injury risk.
- Reduce stress and promote relaxation.

Types of stretching

1. **Static Stretching:** This involves extending a muscle or group of muscles to its farthest point and holding that position for a period of time, typically 20-30 seconds. This type of stretching is commonly used during cool downs after workouts. Example: - A hamstring stretch where you sit on the ground with one leg extended and reach towards toes.
2. **Dynamic Stretching:** This consists of controlled movements through the full range of motion. It is used as part of a warm-up routine before engaging in physical activity. Example: Leg swings (swinging one leg forward and backward).

3. **Ballistic Stretching:** This uses momentum (bouncing) to force a body part beyond its normal range of motion, often involving bouncing movements. A forceful intermittent stretch, that is, a high-speed and high-intensity stretch, is commonly called ballistic stretching. Example: Repeatedly bouncing to touch toes.

4. **Active Stretching:** This requires to hold a position using only the strength of the agonist muscles without any assistance stance from external forces. This is one where patient assume a position and then holds it there with no assistance other than using the strength of muscles. Example: - Lifting your leg straight up in front and holding it there without support.

5. **Passive stretching:** This involves holding a position with the help of an external force such as gravity, assistance or an apparatus. Example: - A partner lifting your leg while you lie on your back to deepen the stretch.

6. **Isometric Stretching:** This involves tensing the stretched muscle against an immovable object or resistance while in a stretched position. This technique helps develop strength in addition to flexibility. Example: - Pushing against a wall while trying to stretch your calf muscles.

7. **Proprioceptive neuromuscular facilitation (PNF) Stretching-** This combines passive stretching and isometric contractions to achieve greater flexibility gains. It often requires a partner for assistance. Example: The hold-relax technique where you stretch a muscle passively, then contract it against resistance before relaxing into a deeper stretch.

Stretching of Upper Limb

Biceps Brachii Stretching

Indications: To increase elbow extension.

Patient Position: Seated or standing, arm extended straight with palm facing up. The elbow should be extended and forearm should be supinated.

Therapist Position: Stand beside the patient, facing the same direction to ensure effective stretching.

Procedure:

- **G**ently grasp the patient's wrist or hand and slowly extend the arm backward while stabilizing the shoulder to avoid any discomfort.

- Hold for 15–30 seconds; repeat 2–3 times.

- Ensure that the patient is comfortable throughout the procedure and that the stretch is performed within a pain-free range.

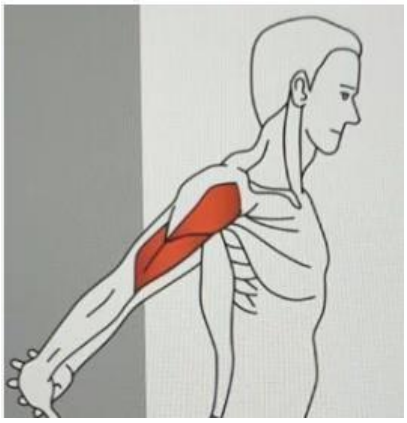

Figure 3.1 Biceps brachii stretching

Stretching of Lower Limb

Hamstring Stretching

Indications: To increase hip flexion and knee extension.

Patient Position: Patient should lie in the supine position, legs extended, hand should be side to the body and palm is pronated and face is directed upward.

Therapist Position: Stand beside the patient, facing the same direction as the patient's leg to ensure effective stretching.

Procedure:

- The therapist gently lifts the extended leg while keeping the knee straight.
- The therapist's one hand placed under the patient's ankle and the other hand on the knee to stabilize the leg.
- The therapist should raise the leg slowly until the patient feels a mild to moderate stretch in the hamstring. It is crucial to avoid any sudden movements that could cause Injury.
- The stretch should be held for 15-30 seconds, allowing the muscle fibers to elongate gradually. This process can be repeated 2-3 times, ensuring that that patient remains comfortable throughout.

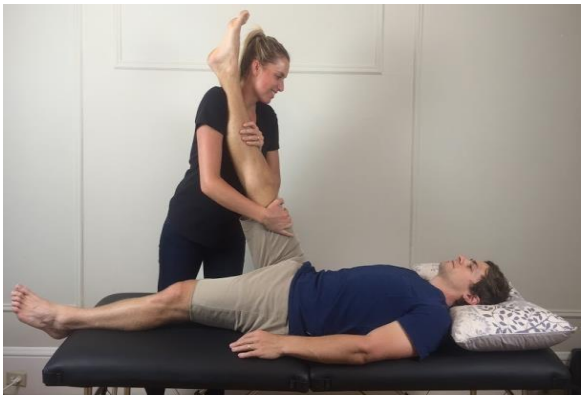

Figure 3.2 Hamstring stretching

Contraindications of Stretching

- Avoid during the initial stages of acute injuries (e.g., sprains, strains).
- Severe pain during stretching.
- Fractures or suspected fractures.
- Avoid during Deep vein thrombosis (DVT) as it can increase the risk of dislodging a blood clot in people with DVT.
- Conditions like osteoporosis or hypermobility syndrome (modify as needed).

PRACTICAL-4

Aim: To demonstrate different types of resistance exercise techniques.

Resistance exercise

Resistance exercise is any form of active exercise in which dynamic or static muscle contraction is resisted by an outside or external force applied manually or mechanically.

Resistance exercise, also referred to as resistance training, is an essential element of rehabilitation programs for persons with impaired function and an integral component of conditioning programs for those who wish to promote or maintain health and physical well-being, potentially enhance performance of motor or prevent skills and or reduce the risk of injury and disease.

Benefits:

- Enhanced muscle performance (restoration, improvement or maintenance of muscle strength, power, endurance).
- Stronger connective tissues (tendons, ligaments).
- Improved bone mineral density or less bone demineralization.
- Reduced joint stress during activity.
- Better balance and functional performance.
- Positive change in body composition: - increase lean muscle mass or decrease body fat.
- Enhanced feeling of well-being. Possible improvement in perception of disability and quality of life.

Types of resistance exercise techniques

1. Manual resistance exercise

- It is a type of active-resistive exercise in which resistance is provided by a therapist or other health professional. A patient can be taught how to apply self-resistance to selected muscle groups.
- Although the amount of resistance cannot be measured quantitatively, this technique is useful in the early stages of an exercise program when the muscle to be strengthened is weak and can overcome only minimal to moderate resistance.

- It is also useful when the range of joint movement needs to be carefully controlled. The amount of resistance given is limited only by the strength of the therapist.

  Example: Biceps Curl with manual Resistance: The patient performs a bicep curl while the therapist provides resistance by pushing down on the forearm as the person tries to lift their arm.

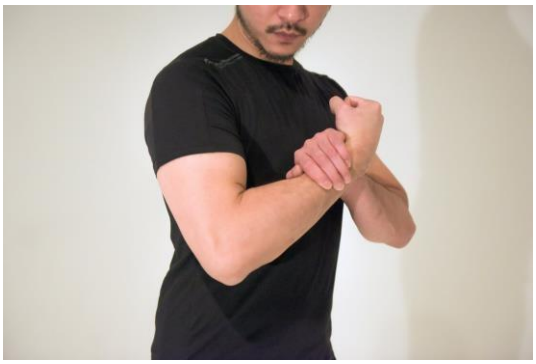

Figure 4.1 Biceps curl with manual resistance

2. Mechanical resistance exercise

- It is a form of active-resistive exercise in which resistance is applied through the use of equipment or mechanical apparatus.
- The amount of resistance can be measured quantitatively and incrementally progressed over time. It is useful when the amount of resistance required is greater than what the therapist can apply manually.

  Example: Dumbbell Bench Press: This exercise primarily works the chest muscles (pectorals), triceps, and shoulders. It is performed by lying on a bench while pressing dumbbells upward from chest level.

Figure 4.2 Dumbbell bench press

3. Isometric exercise

- It is a static form of exercise in which a muscle contracts and produces force without an appreciable change in the length of the muscle and without visible joint movement.
- Although no mechanical work is done (force × distance), a measurable amount of tension and force output are produced by the muscle.
- Sources of resistance for isometric exercise include holding against a manually applied force, maintaining a position against body weight, or pushing/pulling an immovable object.

Examples:

- Plank: Holding a plank position engages core muscles without movement.
- Gluteus Bridge Hold: Lying on your back with knees bent and feet flat on the floor, lift your hips off the ground and hold the position.

Figure 4.3 Isometrics exercise (gluteus bridge hold)

4. Isotonic exercise

- It refers to a type of strength training where muscles contract and change length while lifting a constant load muscles.
- The term "isotonic" comes from the Greek words "iso" (equal) and "tonos" (tension).
- In isotonic exercises, the tension in the muscle remains relatively constant throughout the movement, allowing for both concentric (muscle shortening) and eccentric (muscle lengthening) contractions.

- Concentric Exercise: A form of isotonic or dynamic muscle loading where tension develops and physical shortening of the muscle occurs as an external force (resistance) is overcome (e.g., lifting a weight).
- Eccentric Exercise: Involves dynamic loading of a muscle beyond its force-producing capacity, causing physical lengthening of the muscle as it attempts to control the load (e.g., lowering a weight).

Example: Strengthening of Elbow Flexors: This exercise targets the elbow flexors by lifting a dumbbell from a resting position at your side up to your shoulder and then lowering it back down. It involves both concentric (lifting) and eccentric (lowering) contractions.

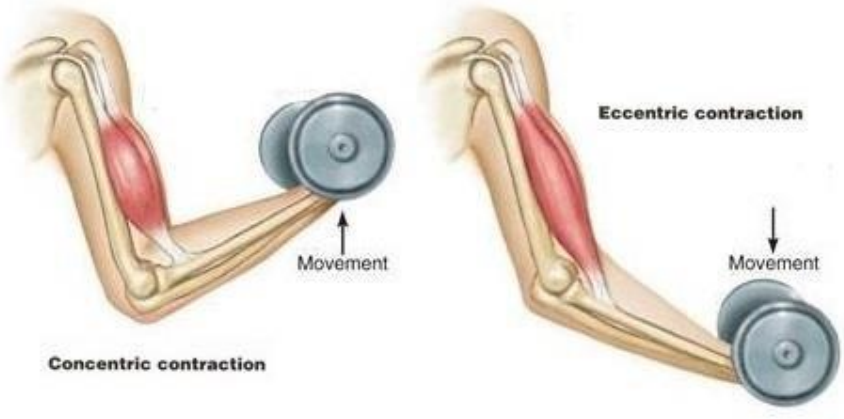

Figure 4.4 Concentric and eccentric isotonic exercise

5. Dynamic exercise: constant and variable resistance

- The most common system of resistance training used with dynamic exercise against constant or variable resistance is progressive resistance exercise (PRE).

a) Dynamic constant external resistance (DCER) exercise:

- It is a form of resistance training where a limb moves through a range of motion (ROM) against a constant external load, provided by free weights (e.g., dumbbells), weight machines, or pulley systems.
- This terminology is used instead of "isotonic exercise" because although the imposed load (weight) does not change, the torque imposed by the weight and the tension generated by the muscle vary throughout the movement.
- If the load is less than the torque generated by the muscle, the muscle contracts concentrically and accelerates the load.
- If the load exceeds the muscle's torque production, the muscle contracts eccentrically to decelerate the load.

c) Variable Resistance Exercise:

- It is a form of dynamic exercise that addresses the primary limitation of DCER exercises.
- Specially designed resistance equipment imposes varying levels of resistance to the contracting muscles, allowing the muscles to work more effectively at multiple points in the ROM.
- The resistance is altered throughout the range by means of:
    - A weight-cable system moving over an asymmetrically shaped cam.
    - A lever arm system.
    - Hydraulic or pneumatic mechanisms.

Examples:

- DCER Exercise: Squats with a barbell provide constant resistance as you lower and raise your body.
- Variable Resistance Exercise: Chain-weighted deadlifts, where chains added to the barbell create variable resistance (more chain lifts off the ground as you rise, increasing the load).

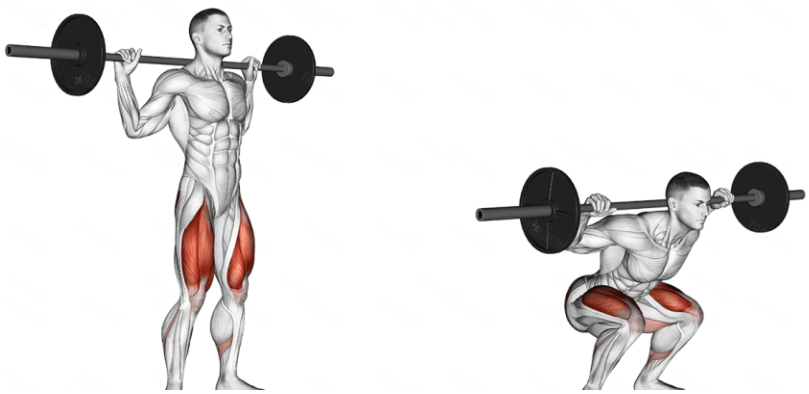

Figure 4.5 DCER exercise (squats with barbell)

6. Isokinetic exercise

- It is a form of dynamic exercise in which the velocity of muscle shortening or lengthening and the angular limb velocity are predetermined and held constant by a rate-limiting device known as an isokinetic dynamometer.

- The term "isokinetic" refers to movement that occurs at a constant velocity.
- Unlike DCER exercise, where a specific weight (amount of resistance) is selected and superimposed on the contracting muscle, in isokinetic training, the velocity of limb movement (not the load) is manipulated.
- The force encountered by the muscle depends on the extent of force applied to the equipment.
- Isokinetic exercise is also called accommodating resistance exercise.
- Example: Isokinetic Leg Extension Exercise: This exercise targets the quadriceps muscles in the front of the thigh. In an isokinetic setting, it is performed on a specialized machine that allows for constant speed throughout the movement.

7. Open-kinetic chain exercise

- These exercises are defined by the movement of a limb or body part that is not fixed to a surface, allowing for free motion.
- This type of exercise isolates specific muscles, making it particularly useful in rehabilitation settings and for training purposes where targeting particular muscle groups is essential.
- Example: Bicep Curl: This exercise targets the biceps brachii by flexing the elbow while holding a dumbbell.

8. Closed-kinetic chain exercise

- These exercises involve movements where the distal part of an extremity (such as a hand or foot) is fixed to a surface, meaning that movement at one joint in the kinetic chain affects other joints in the chain.
- This type of exercise is particularly beneficial for enhancing joint stability and improving functional strength because it engages multiple muscle groups simultaneously.
- Example: Push-ups: The hands are fixed on the ground while the body lowers and raises itself.

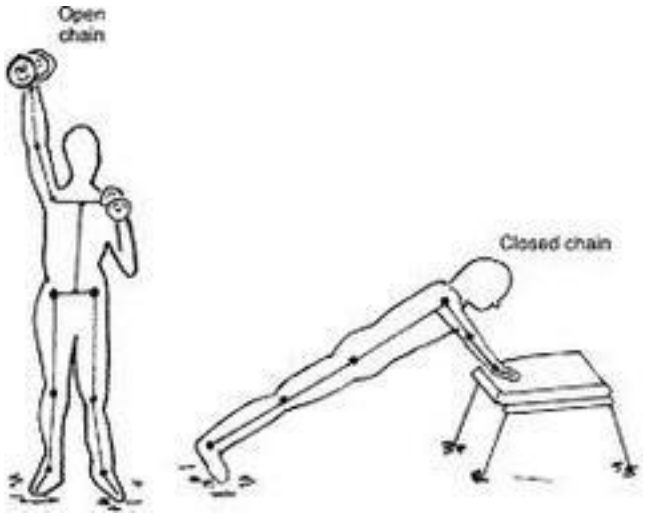

Figure 4.6 Open and close kinetic chain exercise

PRACTICAL - 5

Aim: To demonstrate Progressive Resistance Exercise (PRE) classification.

Progressive resistance exercise (PRE)

Progressive Resistance Exercise (PRE) is a system of dynamic resistance training in which a constant external load is applied to the contracting muscle through mechanical means (e.g., free weights or weight machines) and incrementally increased.

The repetition maximum (RM) is used as the basis for determining and progressing the resistance.

Classification of progressive resistance exercise

1. Delorme Regimen

- Introduced the concept of PRE nearly 60 years ago, originally termed heavy resistance training and later load-resisting exercise.
- **Proposed three sets of 10 repetitions with progressive loading during each set:**
    1. **10 reps @ 50% of 10RM**
    2. **10 reps @ 75% of 10RM**
    3. **10 reps @ 100% of 10RM**
- **Advantages:**
    - Incorporates a warm-up period.
    - Includes rest intervals between sets.
    - Incrementally increases resistance, resulting in strength gains over time.
- **Frequency:** 4 sessions weekly; progress 10RM once weekly.

2. Oxford Regimen

- Uses regressive loading in each set (resistance decreases with each set).
- **Protocol:**
    1. **10 reps @ 100% of 10RM**

2. **10 reps @ 75% of 10RM**
3. **10 reps @ 50% of 10RM**

- **Advantages:**
  - Reduces resistance as muscles fatigue.
  - Maintains joint mobility and control.
- Frequency: 5 times weekly.

3. DAPRE Regimen (Daily Adjustable Progressive Resistive Exercise)

- A systematic approach accounting for individual progression rates during rehabilitation or conditioning.
- Based on a 6RM working weight.
- The adjustable working weight, which is based on the maximum number of repetitions possible using the working weight in Set #3 of the regime, determines the working weight for the next exercise session.

DAPRE Technique:

Set	Repetitions	Amount of Resistance
1	10	50% of 6RM
2	6	75% of 6RM
3	Max possible	100% of 6RM (working weight)
4	Max possible	100% Adjusted working weight*

Calculation of Adjusted Working Weight:

Repetitions in Set 3	Set 4	Progression for Next Session
0-2 repetitions	Decrease 5-10 lbs	Decrease 5-10 lbs
3-4 repetitions	Decrease 0-5 lbs	Keep same weight
5-6 repetitions	Maintain current weight	Increase 5-10 lbs
7-10 repetitions	Increase 5-10 lbs	Increase 5-15 lbs
11+ repetitions	Increase 10-15 lbs	Increase 10-20 lbs

4. McQueen Regimen

- Emphasizes an individualized approach compared to Delorme and Oxford methods.
- **Protocol:**
    1. **10 reps @ 100% of 10RM**
    2. **10 reps @ 100% of 10RM**
    3. **10 reps @ 100% of 10RM**
    4. **10 reps @ 100% of 10RM**
- **Frequency:** 3 sessions weekly; progress 10RM every 1–2 weeks.

PRACTICAL - 6

Aim: To demonstrate the grades of Manual Muscle Testing (MMT).

MMT (MANUAL MUSCLE TESTING)

Manual muscle testing is used to determine the extent and degree of muscular weakness resulting from disease, injury, or disuse. The results obtained from these tests provide a basis for planning therapeutic procedures and periodic re-testing. Muscle testing is an important tool for all members of the healthcare team dealing with physical disabilities**.**

GRADES OF MANUAL MUSCLE TESTING

Scale	Explanation
0	No contraction
1	Flicker or palpable contraction
2	Full range of motion with gravity eliminated
3	Full range of motion against gravity
4	Full range of motion against gravity with minimal resistance
5	Full range of motion against gravity with maximal resistance

DETAILED GRADING (+/- SYSTEM)

Grade	Description
0	No visible or palpable contraction
1 (Trace)	Visible or palpable contraction (no range of motion)
2-	Partial range of motion (50%) with gravity eliminated
2	Full range of motion with gravity eliminated
2+	Full range of motion with gravity eliminated against slight resistance
3-	Partial range of motion (50%) against gravity
3 (Fair)	Full range of motion against gravity

Grade	Description
3+	Full range of motion against gravity with slight resistance
4-	Full range of motion against gravity with mild resistance
4 (Good)	Full range of motion against gravity with moderate resistance
4+	Full range of motion against gravity with almost full resistance
5 (Normal)	Full range of motion against gravity with maximal resistance

PRACTICAL - 7

Aim: To demonstrate PNF techniques for upper and lower extremities.

PNF (PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION)

PNF techniques are advanced stretching and strengthening methods that enhance flexibility, mobility, and strength by stimulating proprioceptors. These techniques combine passive stretching with isometric contractions to improve neuromuscular function.

Definitions:

- **Proprioceptive:** Receiving stimulation within body tissues
- **Neuromuscular:** Pertaining to nerves and muscles
- **Facilitation:** The effect produced in nerve tissue by impulse passage

Principles of PNF

1. **Potential Growth:** Everyone has abilities that develop over time
2. **Development Direction:** Growth occurs head-to-toe (cephalocaudal) and centre-outward (proximal to distal)
3. **Reflexes and Maturity:** Early movements are reflexive, becoming purposeful with development
4. **Cyclic Trends:** Movement alternates between flexion and extension dominance
5. **Reversing Movements:** Functional activities involve alternating motions
6. **Balance of Muscles:** Normal movement requires synergy between opposing muscles
7. **Movement Patterns:** Development follows organized whole-body patterns
8. **Orderly Progression:** Development occurs sequentially with overlapping stages
9. **Learning Through Practice:** Motor skills improve with repetition
10. **Repetition and Stimulation:** Practice strengthens muscles and reinforces learning

Basic procedures

1. **Manual Contact:** Therapist's hands guide/support movement while stimulating skin receptors
2. **Traction:** Gentle joint pulling to increase mobility
3. **Approximation:** Joint compression to improve stability
4. **Stretch:** Muscle lengthening to activate reflexes
5. **Timing for Emphasis:** Focus on specific movement components
6. **Maximal Resistance:** Using optimal resistance to strengthen
7. **Verbal Commands:** Clear movement instructions
8. **Vision:** Using visual feedback to enhance contractions
9. **Timing:** Proper movement sequencing
10. **Body Position/Mechanics:** Maintaining correct posture/alignment
11. **Patterns:** Practicing specific movement combinations

PNF patterns

Diagonal Movement Patterns involve multi-joint, multi-planar motions with rotational components.

Upper Extremity Patterns:

1. **Diagonal 1 (D1)**
    - **Flexion: Shoulder flexion/adduction/external rotation → elbow flexion → forearm supination → wrist/finger flexion**
    - **Extension: Shoulder extension/abduction/internal rotation → elbow extension → forearm pronation → wrist/finger extension**
2. **Diagonal 2 (D2)**
    - **Flexion: Shoulder flexion/abduction/external rotation → elbow flexion → forearm supination → wrist/finger extension**

- **Extension: Shoulder extension/adduction/internal rotation → elbow extension → forearm pronation → wrist/finger flexion**

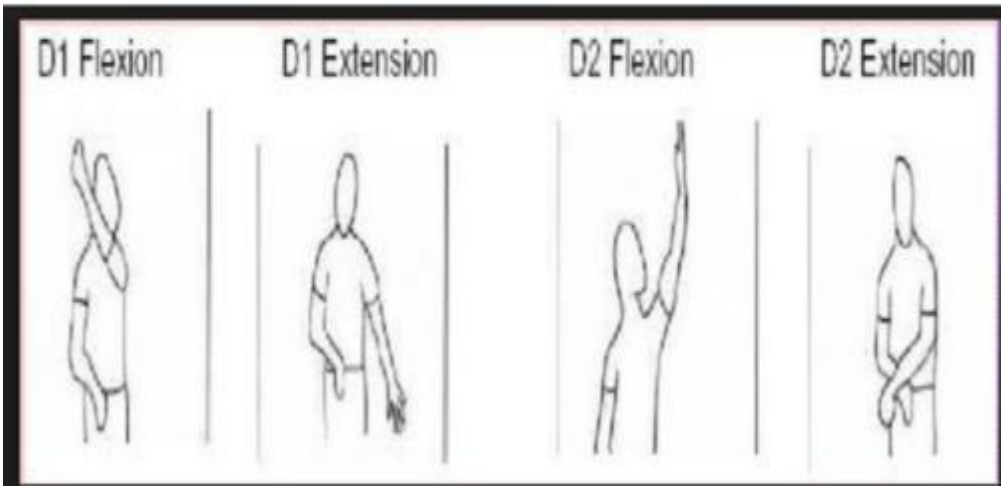

Figure 7.1 Upper extremity PNF pattern

Lower Extremity Patterns:

1. **Diagonal 1 (D1)**
    - **Flexion: Hip flexion/adduction/external rotation → knee flexion/extension → ankle dorsiflexion/inversion → toe extension**
    - **Extension: Hip extension/abduction/internal rotation → knee flexion/extension → ankle plantar flexion/eversion → toe flexion**
2. **Diagonal 2 (D2)**
    - **Flexion: Hip flexion/abduction/internal rotation → knee flexion → ankle dorsiflexion/eversion → toe extension**
    - **Extension: Hip extension/adduction/external rotation → knee extension → ankle plantar flexion/inversion → toe flexion**