

## UNIT 1:- Mechanical Anatomy of Motion and posture

### ▪ Types of Movement/Motion

Movement takes place at joints and is brought about by either the patient's muscular efforts or by the application of an external force.

Movements may be classified as passive or active.

#### ✓ **Passive**

Passive movements are those brought about by an external force which in the absence of muscle power in the part may be mechanical or via the therapist:

(1) Mechanical – the pull of gravity causing 'flopping'.

(2) The therapist performing movements. The therapist may produce accessory or anatomical movement at joints.

*Anatomical movements* are those which the patient could perform if his muscles worked to produce that movement.

#### ✓ **Active**

These are performed by the patient either freely, assisted or resisted.

(1) Freely – in which case mechanical factors will play a part offering either resistance or assistance.

(2) Assisted – when the therapist adopts the grips as for passive movements and assists the patient to perform the movement. The disadvantage of assisted active movements is that it is impossible for either party to detect how much work is being performed by each of them.

(3) Resisted – when mechanical or manual resistance is applied. The mechanical resistance may be in the form of weights, springs, water, auto loading or the mode of performance of the activity.

### ▪ **Posture:-**

Posture is not just how you hold your neck or the slump of your shoulders and low back.

Everything in the body is connected, and our posture is the coordinated workings of all the different mechanical parts of the body. The body's motion system controls posture. Scientists call this system the neuro-musculo-skeletal system (NMS), and break it down into three sub-systems.

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## Unit 2:- Evaluation/Assessment:-

<input type="checkbox"/> <b>Shoulder:</b> <input type="checkbox"/> Speed Test (Biceps or Straight Arm Test)	- Bicipital Tendinitis
<input type="checkbox"/> Yergason's Test	- Bicipital Tendinitis
<input type="checkbox"/> Lippman's Test	- Bicipital Tendinitis
<input type="checkbox"/> Supraspinatus Test (Empty Can Test)	- Supraspinatus Tear
<input type="checkbox"/> Drop Arm Test (Codman's Test)	- Rotator Complex
<input type="checkbox"/> Neer Impingement Test	Supraspinatus & Biceps Tendon
<input type="checkbox"/> Roos Test	- Thoracic Outlet Syndrome
<input type="checkbox"/> Wright Test	- Thoracic Outlet Syndrome
<input type="checkbox"/> Adson Test	- Thoracic Outlet Syndrome
<input type="checkbox"/> Allen's Test	- Thoracic Outlet Syndrome
<input type="checkbox"/> Upper Limb Tension Test (ULTT) ULTT 1 ULTT 2 ULTT 3 ULTT 4	- Median nerve & anterior interosseous nerve - C5, 6, 7, Median nerve, Musculocutaneous nerve & axillary nerve - Radial nerve - C8, T1, Ulnar nerve
<input type="checkbox"/> Apprehension Test	- Anterior Shoulder Dislocation
<input type="checkbox"/> Rockwood Test	- Anterior Shoulder Instability
<input type="checkbox"/> Dugas Test	- Anterior Shoulder Dislocation
<input type="checkbox"/> Posterior Apprehension Test	- Posterior Shoulder Dislocation
<input type="checkbox"/> Push Pull Test	- Posterior Shoulder Dislocation
<input type="checkbox"/> Sulcus Test	- Inferior Shoulder Instability
<input type="checkbox"/> Clunk Test	- Labral Tear

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### UNIT 3:- SPECIAL ORTHOPAEDIC TESTS

#### EXERCISE OF SHOULDER AND HIP:-

##### ➤ Exercises of Shoulder:-

- **Active Shoulder Movements.**
- **Pendular Exercises:-**
  - ✓ **Position of Patient:-** Standing on the side of the table with the support of edge of it. Little bit bending forward.
  - ✓ **Procedure of Exercises:-**
  - ✓ **Flexion and Extension:-** Therapist will ask patient to move his/her hand in forward and backwards movement. It will be repeated for 10-15 times
  - ✓ **Abduction and Adduction:-** Therapist will ask patient to move his/her hand in sideways movement. It will be repeated for 10-15 times
  - ✓ **Circumduction:-** Therapist will ask patient to move his/her hand in Rotational movement . It will be repeated for 10-15 times both clock wise and anti-clock wise

##### ▪ **Finger Ladder:-**

- ✓ **Flexion and Extension: -**
- ✓ **Position of Patient:-** Standing in the front of the ladder
- ✓ **Procedure of Exercises:-** Therapist will ask patient to move his/her fingers in upward as we use to walk in steps. It will be repeated for 10 times
- ✓ **Abduction and Adduction: -**
- ✓ **Position of Patient:-** Standing in the side of the ladder

- ✓ **Procedure of Exercises:-** Therapist will ask patient to move his/her fingers in upward as we use to walk in steps. It will be repeated for 10 times

- **Shoulder Wheel**

- ✓ **Flexion and Extension: -**

- ✓ **Position of Patient:-** Standing in the side of the Shoulder Wheel

- ✓ **Procedure of Exercises:-**Therapist will ask patient to move his/her hand in Rotational movement and rotate the wheel. It will be repeated for 10-15 times both clock wise and anti-clock wise

- ✓ **Abduction and Adduction: -**

- ✓ **Position of Patient:-** Standing in the front of the shoulder wheel

- ✓ **Procedure of Exercises:-**Therapist will ask patient to move his/her hand in Rotational movement and rotate the wheel. It will be repeated for 10-15 times both clock wise and anti-clock wise

- **Exercises of Hip:-**

- **Active Movements of Hip**

- **SLR:-** Patient will be in supine lying position. Therapist will ask to do Hip Flexion and hold it at 30-40 degree angle and this procedure will be repeated for 10-15 times.

- **Half Squats/ Chair Position:-** Patient will be in standing position. Therapist will ask him/her to half squats or come in chair position, therapist will ask him/her to hold this position for 5-6sec this procedure will be repeated for 10-15times.

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#### UNIT 4:- EXERCISE FOR FOOT AND HAND:-

##### ➤ Exercises of Foot:-

###### ▪ Ankle Pump:-

✓ **Position of the Patient:** -Supine Lying

✓ **Procedure of Exercise:** -

✓ Patients will be asked to do dorsiflexion and plantarflexion for ten times.

✓ Patients will be asked to do rotational movement clock and anti-clock wise for ten times.

###### ▪ Toe Curling:-

✓ **Position of the Patient:** - Sitting

✓ **Procedure of Exercise:** - Patient is asked to do keep his/her foot on the towel and curl the toes in such a way that it decreases it. This procedure is done for 10-15 times.

###### ▪ Picking up the Marble balls:-

✓ **Position of the Patient:** - Sitting

✓ **Procedure of Exercise:** - Patient is asked to do keep his/her foot on floor and asked to pick up the marbles of different sizes with toes. This procedure is done for 10-15 times.

###### ▪ Ankle rolling over a bottle:-

✓ **Position of the Patient:** - Sitting

✓ **Procedure of Exercise:** - Patient is asked to do keep his/her foot on bottle and asked to move the ankle in to and fro motion so that ankle moves over the bottle. This procedure is done for 10-15 times.

➤ **Exercise of Hand:-**

▪ **Active Ankle Movements**

▪ **Pressing up the Ball or Putty with all the fingers:-**

✓ **Position of the Patient:** - Sitting

✓ **Procedure of Exercise:** - Patient is asked to hold ball or putty and asked to Press it with wrist and fingers in all the available movements. This procedure is done for 10-15 times.

▪ **Pressing hand exerciser:-**

✓ **Position of the Patient:** - Sitting

✓ **Procedure of Exercise:** - Patient is asked to Press it with fingers in Flexion and Extension movements. This procedure is done for 10-15 times.

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## UNITS:- EXERCISE FOR KNEE AND ELBOW:-

- ✓ **Exercises of Knee:-**
  - **Active Movement of knee.**
- ✓ **Isometric Quadriceps:-**
- ✓ **Position of the Patient:-** Supine Lying
- ✓ **Procedure:-** A towel roll will be placed below the knee Joint. Therapist will ask him/her to press the roll with the force of the knee joint with ankle in dorsiflexion so that there is the production of contraction at Quadriceps. The created pressure will be hold for 5-6 sec, this procedure will be repeated for 10-15 times.
- ✓ **Isometric Hamstrings:-**
- ✓ **Position of the Patient:-** Supine Lying
- ✓ **Procedure:-** A towel roll will be placed below the Ankle Joint. Therapist will ask him/her to press the roll with the force of the ankle joint with ankle in dorsiflexion so that there is the production of contraction at Hamstrings. The created pressure will be hold for 5-6 sec, this procedure will be repeated for 10-15 times.
- ✓ **Isometric Vastrus Medialis Oblique(VMO):-**
- ✓ **Position of the Patient:-** Supine Lying with knee flexion
- ✓ **Procedure:-** A towel roll will be placed between the both knees. Therapist will ask him/her to press the roll with the force of both knees so that there is the production of contraction at VMO. The created pressure will be hold for 5-6 sec, this procedure will be repeated for 10-15 times.
- **Dynamic Quadriceps:-**
- ✓ **Position of the Patient:-** High Sitting on the edge of the table or chair
- ✓ **Procedure:-**Therapist will ask patient to do knee extension and at the end we will ask patient to do dorsiflexion. This position should be held for 5-6sec, this procedure will be repeated for 10-15 times.

➤ **Exercises of Elbow:-**

➤ **Active Elbow movement:-** Flexion & Extension.

**Unit 6:- Vicarious Motion (Trick Movement):-**

VARIOUS MOTIONS TRICK MOVEMENT

The term 'trick movements' generally suggests unnatural movements, seen when muscles are either incapacitated or hindered - for instance, the hitching up of the shoulder by the trapezius when the supraspinatus ligament is kindled or the deltoid deadened.

Grouping of trick movements:

- (1) Direct substitution of well-set muscles.
- (2) Accessory inclusion.
- (3) Tendon action.
- (4) Rebound.
- (5) Anomalous nerve supply.
- (6) Gravity.

(1) Direct substitution of well-set muscles: Full snatching and rise of the shoulder is conceivable in spite of loss of motion of deltoid, by utilizing muscles which cross the shoulder-joint - the long head of biceps and triceps, the pectoralis major.

(2) Accessory inclusion: The abductor pollicis brevis and the flexor pollicis brevis idle into the extensor development of the thumb. It is consequently conceivable to broaden the interphalangeal joint of the thumb when the spiral or back interosseus nerves are incapacitated. The abductor digiti minimi might be embedded into the volar part of the proximal phalanx and would thus be able to flex the metacarpophalangeal joint.

(3) Tendon activity: This alludes to the shortening of a ligament when the rival contracts unequivocally; it happens in muscles which cross two joints and have regularly a constrained length. In this way, when there is loss of motion of the long flexors of the fingers, hyperextension of the wrist causes a ligament activity at the terminal interphalangeal joints because of the restricted length of the flexors. This may look as though the long flexors are contracting.

(4) Rebound: This alludes to the wonder of an appearing constriction in the agonist when the rival contracts firmly and afterward unwinds rapidly. Solid constriction of the extensor pollicis longus and abrupt unwinding may look as though the long flexor is working.

(5) Anomalous nerve supply: In 20 % of every single ordinary subject there is irregular nerve supply in the helpful gravity and along these lines the hand must be held with the ulnar outskirt up. The commonest inconsistencies are ulnar stockpile of the opponens, the second lumbrical and the flexor pollicis brevis. Signs of complete ulnar or finish middle stock of all the inborn have been portrayed.

(6) Gravity: The elbow can without much of a stretch be reached out by gravity when the triceps is incapacitated given the shoulder is beneath 90 degrees. So as to stay away from the trick activity of gravity the shoulder must be held at 90 degrees or higher.

#### UNIT 7:- JOINT MOTION ASSESSMENT:-

##### ➤ GONIOMETRY

- ✓ Gonio =Angle, metron =measure
- ✓ It is a technique used to measure and document amount of available range of motion of joints.
- ✓ Both PROM and AROM can be measured.
- ✓ Tests of muscle strength (MMT) and neurological function are used in conjunction with goniometry

##### ➤ Use of Goniometry

- ✓ To identify abnormal conditions related to muscles, tendons and joints. Such as:
  1. Contractures
  2. Decreased ROM due to disuse or injury
- ✓ Developing treatment goals
- ✓ For evaluating progress/lack of progress in rehabilitation treatment.
- ✓ Finding effectiveness of specific therapeutic technique, medication or surgical procedure.

##### ➤ Type of Goniometer

- ✓ A standard (universal) goniometer
- ✓ Consists of :
  1. Stationary arm: It is part of body, cannot move independently
  2. Moving arm: Attached to fulcrum in the center of body
  3. Body: A full circle on which  $0^{\circ}$  to  $360^{\circ}$ 
    - Degrees are drawn.



➤ **Degree of Freedom:-**

- ✓ Joints are described in relation to number of planes that they can move in.
- ✓ Uniaxial: movement in only one plane, E.g. elbow joint, knee joint
- ✓ Biaxial : movement in 2 planes. E.g. wrist joint
- ✓ Multiaxial: movement in 3 planes, e.g. shoulder joint

➤ **End Feel:-**

The feeling of a structure being a barrier for further motion at the end of joint range is called END FEEL.

- ✓ The types of structures limiting ROM have their own characteristic end feel.
- ✓ These are of 2 types

1. Normal
2. Abnormal

➤ **Procedure:-**

- ✓ Ask the patient to acquire recommended testing position.
- ✓ Place the joint in zero position (neutral position)
- ✓ Stabilize the proximal joint component.
- ✓ Before using goniometer, ask patient to move distal joint component to complete range, until end feel is determined.
- ✓ Now palpate bony landmark
- ✓ Align the goniometer
- ✓ Read and record the measurement.

➤ **Active ROM:-**

Shoulder Joint	Range
Flexion	0-180
Extension	0-40
Abduction	0-180
Internal rotation	0-80
External rotation	0-90

Movement	Average Range	Norm	Fulcrum	Stationary Arm	Movable Arm	Gravity eliminated position	Special notes	MMT Hand Placement
Shoulder flexion	zero to 180	170 - 180	1" below acromion process	Parallel to trunk	Along humerus	Side lying on opposite side	Thumb facing forward	Hand over shoulder joint and distal humerus
Shoulder extension	Zero to 60	60	1" below acromion process	Parallel to trunk	Along humerus	Side lying on opposite side	Thumb forward	Hand over shoulder and over triceps
Shoulder abduction	Zero to 170	170	Posterior of acromion process in line with head of humerus	Parallel to trunk	Along humerus pointing at lateral epicondyle	Supine	Anatomical position, arm kinda rotates	Hand over
Shoulder external rotation	0 - 80	80	Olecranon process.  Both goni arms start together	Parallel to forearm, aligned with ulna	Aligned with ulna	Alternate: shoulder is adducted and elbow is at 90	Start with should at 90 degrees abduction and elbow at 90 degrees flexion	Hand on elbow, hand before wrist ' don't let me push u forward

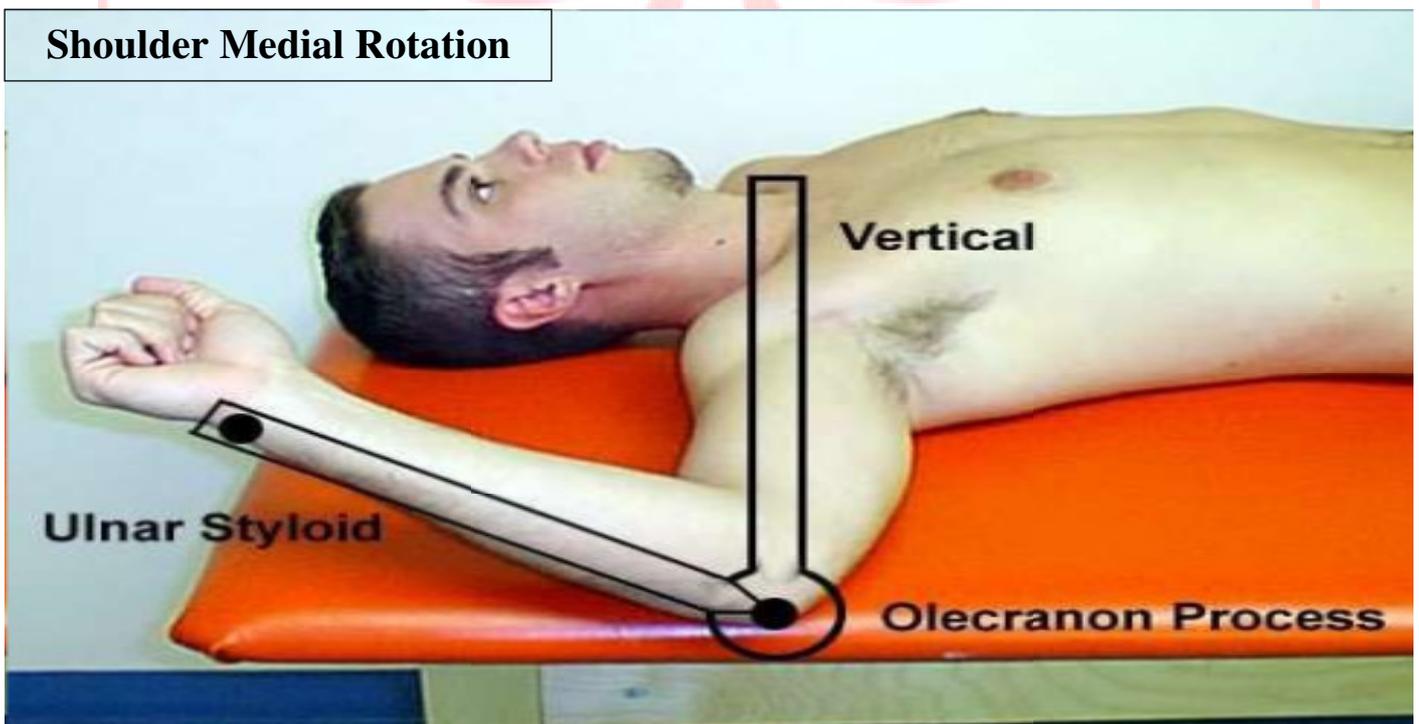
rotation			Both goni arms start together	aligned with ulna		adducted and elbow is at 90	degrees abduction and elbow at 90 degrees flexion	hand inside wrist ' don't let me push u back
Elbow flexion	0 – 135/150	135 - 150	Lateral epicondyle <u>Upsidedown lolipop</u>	Parallel to midline to humerus or head of humerus	Parallel to radius	Lying on side	Start in anatomical position	Hand inside wrist and on elbow
Forearm supination	0 - 80/90	80/90	Proximal to ulna styloid process	Perpendicular to floor	Inside wrist	Shoulder at 90 degrees flexion, elbow 90 flexion	Start forearm in mid position, elbow at 90, thumb to ceiling	Hands on both sides of wrist, flat, push into pronation
Forearm pronation	0 - 80/90	80/90			Outside wrist	Another alternate position: put fulcrum on <u>mcp</u> of middle finger, open to 180,	Start forearm in mid position, elbow at 90, thumb to ceiling	Hands on both sides of wrist, flat, push into supination



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Supination			Ulnar styloid process	to floor		90 degrees flexion, elbow 90 flexion	in mid position, elbow at 90, thumb to ceiling	both sides of wrist, flat, push into pronation
Forearm pronation	0 - 80/90	80/90			Outside wrist	Another alternate position: put fulcrum on MCP of middle finger, open to 180,	Start forearm in mid position, elbow at 90, thumb to ceiling	Hands on both sides of wrist, flat, push into supination
Wrist extension	0-70	70	Distal to anatomical snuff box,	Parallel to radius	First metacarpal	Mid position so already gravity eliminated		3 fingers below MPs and push
			Gravity eliminated so on table					
Wrist flexion	0-80	80	Distal to anatomical snuff box  Gravity eliminated so on table	Parallel to radius	First metacarpal	Mid position so already gravity eliminated		Have her supinate, 3 fingers palm of hand push down

## Shoulder Medial Rotation



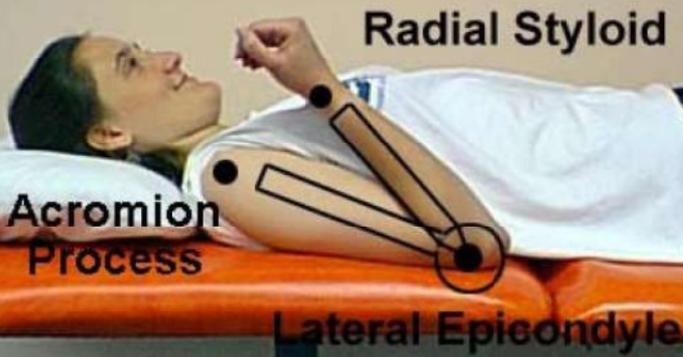
## Elbow Normal ROM

Elbow Joint	Range
Flexion	0-150

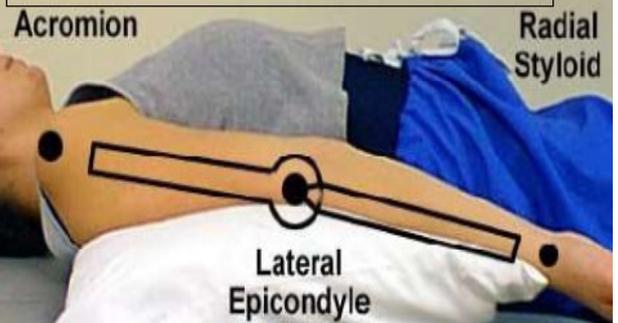
  

Radio-ulnar joint	Range
Supination	0-80
pronation	0-80

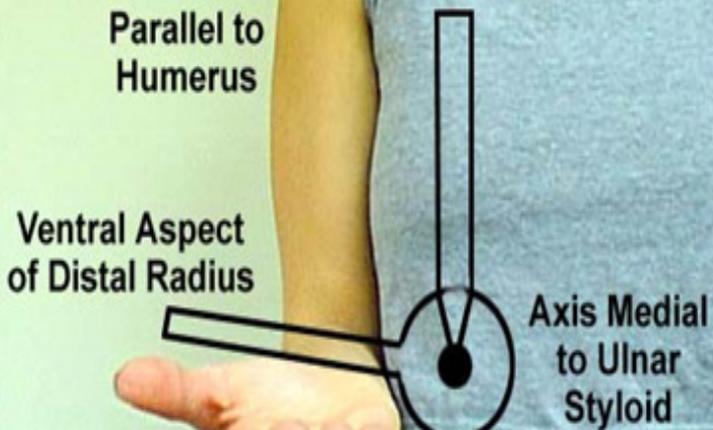
**Elbow Flexion**



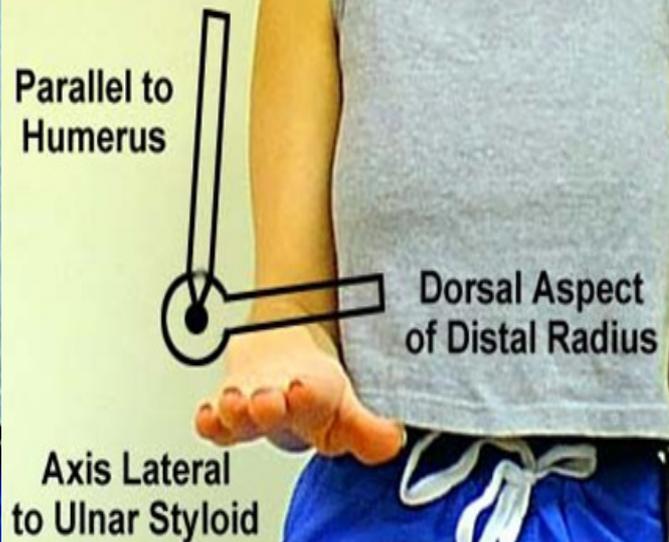
**Elbow Extension**



**Forearm Supination**



**Forearm Pronation**



## ➤ **Manual Muscle Examination:-**

### **1. Introduction**

During manual muscle testing (MMT), each muscle bunch is tried reciprocally. For show purposes, just one side is tried right now every one of the 6 muscle gatherings. One hand of the analyst applies opposition or palpates the muscle or ligament for compression while the other hand settles the furthest point being tried to keep it in the test position. The test is rehased if the patient doesn't comprehend the guidelines or isn't having any significant bearing most extreme exertion.

### **2. Grading follows the Medical Research Council (MRC) system.**

shows a calculation for the MRC muscle quality scoring framework. On the off chance that the subject is feeling the loss of an appendage, has a cast, or can't be put in the right testing position, muscle quality is evaluated as "unfit to survey". In the event that the patient has a fixed contracture, however can in any case play out the test, the muscle is evaluated. Clinical gadgets, for example, catheters and channels, and mechanical ventilation as a rule don't obstruct muscle testing, except if a joint is immobilized to guarantee legitimate working of a gadget.

### **3. Procedure**

1. For each muscle tried, the analyst stands to the side being tried, and the patient is sitting upstanding and situated to permit full development of the joint against gravity. The inspector shows the ideal development against gravity. The inspector at that point demands the patient to rehase the movement.
2. In the event that the patient can move through the ideal scope of movement against gravity, the analyst endeavors to apply opposition in the testing position while expressing "Hold it, don't let me push it down" or "Hold it, don't let me twist it" (Figure 2). On the off chance that the patient endures no obstruction, the muscle score is Grade 3. In the event that the patient endures some opposition, the score is Grade 4, and full obstruction, Grade 5.
3. On the off chance that the patient can't move against gravity, the patient is repositioned to permit development of the furthest point with gravity dispensed with. In the case of supporting the appendage, the inspector gives neither help nor protection from the patient's willful development. This gravity-disposed of situating will shift for each muscle tried. On the off chance that the patient can't finish at any rate halfway scope of movement with gravity wiped out, the muscle or ligament is watched or potentially palpated for compression.

4. For a disabled patient who can't sit up in a bed set in the seat position or on the edge of the bed, interchange positions for testing the lower furthest point are remembered for this convention.

#### 4. Shoulder Abduction

1. Testing position - arm out from the side at shoulder level. The inspector exhibits the movement, at that point states "Lift your arm out to the side to bear level." The hand giving obstruction is shaped over the patient's arm simply over the elbow. The other hand balances out the shoulder over the shoulder joint. The analyst states "Hold it, don't let me push it down." To evaluate grades 3, 4, or 5, if you don't mind see area 3.2 above.
2. If more weaker than Grade 3, the patient untruths recumbent with arms along the edge. The inspector underpins the arm simply over the elbow and at the wrist to guarantee that the shoulder doesn't remotely pivot (turn outward). The patient endeavors to move the arm out to the side. The analyst states: "Attempt to move your arm out to the side". Evaluation 2 is allocated if the patient moves with gravity killed.
3. If more weaker than Grade 2, the inspector states "Try to move your arm out to the side" and palpates the center deltoid muscle, as illustrated, for withdrawal, and scores as Grade 1 or 0 as recently characterized. Shoulder MMT can be performed with central venous catheters (e.g., subclavian and jugular) in place, including those used for dialysis. (Figure 2)
4. The rest of the evaluations will be finished comparatively to above utilizing explicit test positions for the patient and inspector, and explicit directions for the patient's development.

#### 5. Elbow Flexion

1. Test position - lower arm supinated and flexed marginally in excess of 90 degrees. Verbal directions: "Curve your elbow somewhat in excess of 90 degrees". The hand giving obstruction is shaped over the flexor surface of the lower arm proximal to the wrist. The analyst's other hand applies counterforce by measuring the palm over the foremost unrivaled part of the shoulder. The analyst at that point states: "Hold it. Try not to let me push it down" and scores Grades 3, 4, or 5 as recently portrayed.
2. If more weaker than Grade 3, the shoulder is kidnapped to 90 degrees. The inspector underpins the arm under the elbow and, if fundamental, the wrist too. The lower arm is turned with the thumb confronting the roof. With the elbow expanded, the patient endeavors to flex the elbow. The inspector states: "Attempt to twist your elbow." Grade 2 is allotted if the patient can flex the elbow.

3. If more weaker than Grade 2, the lower arm is supinated and situated along the edge in around 45 degrees of elbow flexion. The analyst states "Attempt to twist your elbow", palpates the biceps ligament and scores as either Grade 1 or 0.6.

## 6 Wrist Extension:-

1. Test position - arm along the edge, elbow flexed to 90 degrees with the lower arm pronated and the wrist completely expanded. Verbal directions: "Curve your wrist up beyond what many would consider possible." The inspector's hand giving opposition is set over the rear of the patient's hand only distal to the wrist. The inspector's other hand underpins the patient's lower arm. The inspector at that point states: "Hold it. Try not to let me push it down" and scores Grades 3, 4 or 5.
2. If more weaker than Grade 3, the elbow is flexed to 90 degrees and lower arm turned with thumb confronting the roof. The lower arm and wrist are bolstered by the inspector. The inspector states: "Curve your hand toward me". Evaluation 2 is allocated if the patient can broaden the wrist.
3. If more weaker than Grade 2, the inspector states "Twist your wrist toward me" and palpates the two extensor ligaments, one on each side of the wrist, as illustrated, and scores as Grade 1 or 0. The analyst is mindful so as not to palpate the ligaments in the wrist.
4. This test isn't performed if there is an ipsilateral outspread blood vessel catheter set up.

## 7. Hip Flexion

1. Test position - sitting with the hip completely flexed and knee bend. The patient may put their hands on the bed or table for steadiness. Verbal directions: "Raise your knee up as high as it will go." The inspector's hand giving opposition is set on the thigh only proximal to the knee. The other hand gives security along the edge of the hip. The analyst at that point states: "Hold it. Try not to let me push it down" and scores Grades 3, 4 or 5.
2. If more weaker than Grade 3, the patient sets down as an afterthought not being tried. For instance, the patient lays on the correct side to test the left hip. The inspector remains behind the patient with one arm supporting the leg being tried with the hand supporting under the knee. The contrary hand keeps up arrangement of the storage compartment at the hip. The inspector states: "Bring your knee toward your chest." Grade 2 is doled out if the patient can flex the hip.
3. If more weaker than Grade 2, the patient is prostrate. The inspector asks, "May I contact your leg here?" (highlighting the internal part of the hip joint). With the patient's consent, the

analyst states "Twist your hip" and palpates the iliopsoas ligament, as illustrated, and scores as Grade 1 or 0.

4. In an out of commission quiet, grades 5, 4, and 3 are tried with the bed in the seat position, or the leader of the bed raised beyond what many would consider possible. Pads are set under the knee to flex the hip to 90 degrees. The inspector guarantees that the foot is lifted off the bed when requesting that the patient raise the knee off the bed. Evaluations 2 and 1 are scored as recently depicted.

5. This test can be acted in patients with flawless and very much made sure about femoral intravascular catheters.

## 8. Knee Extension

1. Test position - sitting upright with the knee fully extended to 0 degrees. Avoid knee hyperextension. Verbal instructions; "*Straighten your knee*". The hand giving resistance is contoured on top of the leg just proximal to the ankle. The other hand is placed under the thigh above the knee. The examiner then states "*Hold it. Don't let me bend it*" and scores Grades 3, 4 or 5.
2. If weaker than Grade 3, the patient lays on the non-testing side. The examiner stands behind the patient at knee level. The leg not being tested may be flexed for stability. One arm cradles the leg being tested around the thigh with the hand supporting the underside of the knee. The other hand holds the leg just above the ankle. The examiner states: "*Straighten your knee.*" Grade 2 is assigned if the patient can extend the knee (Figure 3).
3. If weaker than Grade 2, the patient is supine and the examiner states: "*Push the back of your knee down*" or "*Tighten your knee cap*" and palpates the quadriceps tendon, and scores as Grade 1 or 0.
4. For the bedridden patient, in scoring Grades 3, 4, and 5, the patient is positioned in the same manner as for hip flexion and graded as described above for knee extension (Figure 4).

## 9. Ankle Dorsiflexion

1. Test position - sitting, with the heel on floor, foot in full dorsiflexion, and shoes and socks removed. Verbal instructions: "*Bend your foot up as far as possible.*" The toes are relaxed during the test. The hand giving resistance is cupped over the top of the foot proximal to the toes. The other hand is contoured around the front of the leg just proximal to the ankle. The examiner then states "*Hold it, don't let me push it down*" and scores Grade 3, 4 or 5.

2. If weaker than Grade 3, but there is partial range of motion against gravity, assign Grade 2.

3. If weaker than Grade 2, palpate the tibialis anterior tendon, and score as Grade 1 or 0.

4. The bedridden patient is tested supine, with the leg extended and a pillow placed under the knee.

5. This test can usually be applied with an intact and secured pedal intravascular catheter. Be careful not to dislodge the catheter.

#### Manual Muscle Test Grading System

Grade	Manual Muscle Test
5	Movement against gravity plus full resistance
4	Movement against gravity plus some resistance
3	Completes the available test range of motion against gravity, but tolerates no resistance
2	The patient completes full or partial range of motion with gravity eliminated
1	Slight contractility without any movement
0	No evidence of contractility (complete paralysis)

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## UNIT 8:- THE THERAPEUTIC GYMNASIUM:-

### ➤ Finger Ladder

The finger stepping stool, or divider climb, is an exercise based recuperation procedure that assists with reestablishing scope of movement to the shoulder after a physical issue, particularly to the rotator sleeve. It is likewise useful in mitigating constant rotator sleeve issue. The objective of the activity is to improve the scope of movement that a patient can accomplish without torment in the shoulder. Commonly, they comprise of plastic or wooden divider mounts that are designed in a grouping of "steps", every one of which is level on top and cut at a 45-degree edge underneath. Along these lines, the patient is compelled to raise their finger to a specific tallness with each progression and can likewise follow progress by denoting the quantity of steps moved with each endeavor.

### ➤ Theraband

Therabands are versatile exercise groups. They are about 20cm wide and very long and they are stretchy. Theraband obstruction groups are broadly utilized for restoration from muscle and joint wounds and for high impact exercise and general molding. Therabands are the main resistive exercise groups embraced by the American Physical Therapy Association (APTA). These 6" wide latex groups come in various, shading coded opposition levels, recognized by the thickness of the band:

Theraband Color Theraband Thickness Comparison: pounds of pull expected to extend a 12" band length to 24"

Yellow Thin 2.5 lb

Red Medium 4.5 lb

Green Heavy 5.0 lb

Blue additional overwhelming 7.5 lb

Dark unique overwhelming 9.0 lb

Silver overly overwhelming 15.0 lb

### ➤ DUMB-BELL

A short bar with a weight at each end, used typically in pairs for exercise or muscle-building. Dumbbells are one of the most widely used weight-training equipment pieces. One dumbbell consists of two equal weights that are attached to a handle, and the weights can be fixed or removable. The main reason why people use dumbbells is to build and tone muscles, and they can be used to develop muscles in most parts of the body. Dumbbells come in many different weights and sizes, and they can be made of metal, concrete or other materials.

### Types of Dumbbells

Presently, there are three main types of dumbbells:

- adjustable dumbbells

- fixed weight dumbbells

- selectorized dumbbells

#### ➤ **Sand Bags**

Clinical Sand Bags are utilized for an assortment of uses in the clinical business, for example, persistent situating, restorative and recovery applications, and to help encourage hemostasis after surgeries. Sand Bags have been explicitly intended to give adjustment in a wide assortment of positions. They fit over the shoulders, or fold over a kid's hand or lower leg for situating. They likewise fit over the knees, or around the pelvis for adjustment. The one of a kind stretched neck, saddlebag shape, and delicate "kneadable" substance offer agreeable help for a huge number of employments.

#### ➤ **Therapeutic Ball**

An exercise ball is a ball constructed of soft elastic with a diameter of approximately 35 to 85 centimeters (14 to 34 inches) and filled with air. The air pressure is changed by removing a valve stem and either filling with air or letting the ball deflate. It is most often used in physical therapy, athletic training and exercise. It can also be used for weight training. The ball, while often referred to as a Swiss ball, is also known by a number of different names, including balance ball, birth ball, body ball, ball, fitness ball, gym ball, gymnastic ball, physioball, pilates ball, Pezzi ball, sports ball, stability ball, Swedish ball, therapy ball, or yoga ball. Stretch, strengthen, balance, bounce or roll; the uses of the Therapy Balls are limitless. For exercises in a sitting position on the ball, the user should have the feet flat on the floor with the knees bent to 90° or less. The ball should be inflated to a size that is appropriate for the height of the user. Note: the size listed for each ball is the maximum inflation. Please allow for compression of the ball. When a user is between sizes, select the larger size as it can be under inflated slightly. These burst-resistant balls slowly deflate if punctured. They are packaged with a convenient foot operated air pump, instructions, a measuring tape, a plug, a plug remover and an air fill adapter.

#### ➤ **Medicine Ball**

A Medicine Ball alludes to a weighted ball that can be utilized for doing a wide scope of activities to improve wellness, quality and coordination just as help sportsmen recuperate from wounds. This sort of ball can be made of cowhide, nylon, vinyl, elastic, polyurethane and different materials, and it comes in a wide range of loads, going from 2 lb to 25 lb. The standard Medicine Ball has a measurement of 14 inches, however different sizes are additionally accessible.

#### ➤ **Parallel Bar**

The mechanical assembly comprises of two even bars set corresponding to one another in customizable upstanding backings, the floor by a metal supporting system. The bars are made out of wood or other material, with an external covering of wood. The utilization of Parallel Bars in rehabilitative and non-intrusive treatments is fundamentally significant in the social insurance calling. Parallel Bars are utilized to assist individuals with recovering their quality, balance, scope of movement, and freedom. For individuals recuperating from wounds, diseases, and other incapacitating conditions, Parallel Bars are significant things of non-intrusive treatment, restoration, and gym equipment.

#### ➤ **Shoulder Wheel**

Shoulder wheel is a restorative gadget utilized for recovery of upper appendage. Shoulder Wheel's scope of-movement circular segment can be changed from 10 creeps to 39 crawls by moving handle, and the opposition gave can be fluctuated by turning the obstruction handle. The Shoulder Wheel's tallness can alter 26 inches vertically to permit situated and standing treatment. This Shoulder Rehabilitation Wheel is perfect for medical clinics, centers, and exercise based recuperation offices.

The advantages are:

- Increase quality of upper appendage muscles.
- Increase ROM
- Increase dissemination

## UNIT 9:- EXERCISE IN WATER (AQUATIC THERAPY/ HYDROTHERAPY)

### ➤ Definition of Aquatic Exercise

Aquatic exercise refers to the use of water (in multidepth immersion pools or tanks) that facilitates the application of established therapeutic interventions, including stretching, strengthening, joint mobilization, balance and gait training, and endurance training. Most patients easily tolerate aquatic exercise. However, the practitioner must consider several physiological and psychological aspects of immersion that affect selection of an aquatic environment.

### ➤ Physical Properties of Water

The properties provided by buoyancy, hydrostatic pressure, viscosity, and surface tension have a direct effect on the body in the aquatic environment.

### ➤ Buoyancy

➤ **Definition:-** Buoyancy is the upward force that works opposite to gravity.

➤ **Properties:-**

➤ Archimedes' principle states that an immersed body experiences upward thrust equal to the volume of liquid displaced.

➤ **Clinical significance:-**

➤ The effects of buoyancy include the following.

- Buoyancy provides the patient with relative weightlessness and joint unloading by reducing the force of gravity on the body. In turn, this allows the patient to perform active motion with increased ease.
- Buoyancy provides resistance to movement when an extremity is moved against the force of buoyancy. This technique can be used to strengthen muscles.
- The amount of air in the lungs will affect buoyancy of the body. Buoyancy will be increased with fully inflated lungs and decreased with deflated lungs.

- Body composition will also affect buoyancy. Obese patients will have increased buoyancy due to fat tissue having a lower specific gravity. Patients with increased bone density will have less buoyancy than those with decreased bone density.
- Buoyancy allows the practitioner three-dimensional access to the patient.

#### ➤ **Hydrostatic Pressure**

➤ **Definition:-** Hydrostatic pressure is the pressure exerted by the water on immersed objects.

➤ **Properties:-**

➤ Pascal's law states that the pressure exerted by fluid on an immersed object is equal on all surfaces of the object. As the density of water and depth of immersion increase, so does hydrostatic pressure.

➤ **Clinical significance:-**

➤ The effects of hydrostatic pressure include the following.

- Increased pressure reduces or limits effusion, assists venous return, induces bradycardia, and centralizes peripheral blood flow.
- The proportionality of depth and pressure allows patients to perform exercise more easily when closer to the surface.

➤ **Viscosity**

➤ **Definition:-** Viscosity is friction occurring between molecules of liquid resulting in resistance to flow.

➤ **Properties:-**

➤ Resistance from viscosity is proportional to the velocity of movement through liquid.

➤ **Clinical significance:-**

➤ Water's viscosity creates resistance with all active movements.

- Increasing the velocity of movement increases the resistance.
- Increasing the surface area moving through water increases resistance.

➤ **Surface Tension**

➤ **Definition:-** The surface of a fluid acts as a membrane under tension. Surface tension is measured as force per unit length.

➤ **Properties:-** The attraction of surface molecules is parallel to the surface. The resistive force of surface tension changes proportionally to the size of the object moving through the fluid surface.

➤ **Clinical significance:-** The effect of surface tension includes the following.

- An extremity that moves through the surface performs more work than if kept under water.
- Using equipment at the surface of the water increases the resistance.

➤ **Goals and Indications for Aquatic Exercise**

The specific purpose of aquatic exercise is to facilitate functional recovery by providing an environment that augments a patient's and/or practitioner's ability to perform various therapeutic interventions. Aquatic exercise can be used to achieve the following specific goals:

- Facilitate range of motion (ROM) exercise
- Initiate resistance training
- Facilitate weight-bearing activities
- Enhance delivery of manual techniques
- Provide three-dimensional access to the patient
- Facilitate cardiovascular exercise
- Initiate functional activity replication
- Minimize risk of injury or reinjury during rehabilitation
- Enhance patient relaxation

➤ **Precautions and Contraindications to Aquatic Exercise**

Most patients easily tolerate aquatic exercise. However, the practitioner must consider several physiological and psychological aspects of immersion that affect selection of an aquatic environment.

- Fear of Water
- Neurological Disorder
- Respiratory Disorder
- Cardiac Dysfunction

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## UNIT 10:- RESISTANCE EXERCISES:-

### ➤ **Definition: -**

- **Resisted exercise** is any form of active exercise in which dynamic or static muscle contraction is resisted by an outside force applied manually or mechanically.
- **Strength:** Muscle strength is the greatest measurable force that can be exerted by a muscle or muscle group to overcome resistance during a single maximum effort.
- **Power:** Muscle power is defined as work produced by the muscle per unit of time. Power= force X distance/time
- **Endurance:** It is the ability to perform low intensity repetitive or sustained activities over a prolonged period of time.

### ➤ **Types of muscle works:**

- **Isometric muscle work:** In this type of muscle work there is increase in tone of the muscle without any change in the muscle length. **E.g.** Isometric strengthening for neck extensors: the clasped hand behind the head is pushed back by the head. No movement of the head or neck occurs but the tone of neck extensors increases.
- **Isotonic muscle work:** in this type of muscle work there is change in length of the muscle while it maintains an even tone throughout the contraction period. This is of two types
- **Concentric work:** here the origin and insertions come closer and the muscle length shortens. E.g. getting up from a chair: knee and hip extensors contract concentrically to bring about extension in these two joints.
- **Eccentric work:** here the origin and the insertion go away from each other and the muscle length increases. E.g. sitting on a chair from standing: knee and hip extensors contract eccentrically to bring about flexion in these two joints.

### ➤ **Principles resistance exercise**

- **Principle of overload:** If muscle performance is to improve, a load that exceeds the metabolic capacity of the muscle must be applied; that is a muscle must be challenged to perform at a level greater than to which it is accustomed.
- Overload can be applied by increasing the intensity or volume. In strength training the intensity is increased whereas in endurance training the volume i.e. Frequency, repetitions and time is increased.
- **SAID (Specific Adaptation to Imposed Demand) Principle:**
  - Adaptations produced by the training are highly specific to the nature of the stimulus or overload applied.
  - SAID applies to all the systems of the body.
  - The adaptations are specific to strength, power, endurance, functional activity, joint angle, sequence of muscle activations, energy systems and virtually all other variables present.
- **Principle of Reversibility:**
  - The adaptations achieved through resistance exercise persist as long as the resistance exercise is performed regularly and go back gradually to the pre exercise levels once the training is stopped. This means the effects of resistance training are reversible.
- **Inter individual variability:**
  - Every individual responds to resistance exercise in a different way, thus similar stimuli may bring about a lot of improvement in one patient and no improvement in others.
- **Group action of muscles:-**
  1. Prime movers/ agonists
  2. Antagonists
  3. Synergists
  4. Fixators
- **Prime movers:** - They are the muscles who bring about the movement by contraction. They are responsible for most of the forces generated in the movement. E.g. for shoulder abduction deltoid is acting as the prime mover.
- **Antagonists:** - These are the muscles that are opposing group of prime movers. They relax and are lengthened (either passively or eccentrically) to allow controlled movement. E.g. shoulder adductors lengthen passively during abduction, knee extensors lengthen eccentrically during knee flexion in standing to sitting
- **Synergists:** - They work or relax to modify the movement of the prime movers. They may alter the direction of pull of prime mover or when a multijoint muscle is the prime mover,

fix the joint where movement is not required in a position of advantage. E.g. rotator cuff in shoulder alters the pull of deltoid and creates abduction. Without them the deltoid would create an upward translation.

## INDICATIONS

### ➤ 1. Curative:

- Muscle: weakness or paralysis
- Bone: to increase density
- Aerobic system: improves aerobic capacity
- Other connective tissues: improve pliability and strength

### ➤ 2. Preventive:

- To preserve muscle power in all the conditions where muscle weakness is anticipated.
- To live a healthy life with high levels of fitness.

➤ **Preparative:** To prepare for some specific activity where the adaptations of resistance exercise will be useful, e.g. training for arm muscles of a boxer will prepare him for a better performance.

➤ **Recreative:** Various form of resistance training is used as sports and recreation activity, like body building.

### ➤ DETERMINANTS OF RESISTANCE TRAINING

- Frequency
- Intensity
- Time
- Type
- Alignment & Stabilization
- Volume
- Periodization
- Rest interval
- Sequencing
- Integration to functional activities (FITT pas vir)
- The determinants are interdependent for a successful regime

#### ➤ Frequency

- No. of exercise sessions per day or per week.
- Depends on the goal or adaptation desired, should be set in accordance with intensity and volume.
- Importance: Decides the rest time between two sessions of exercise. The rest is needed to recover from the fatigue and for the adaptations (e.g. protein synthesis) to occur.

- Higher the intensity and volume lower should be the frequency, as strong exercises creates microtrauma which needs time to recover.
- In immediate post-surgery conditions short sessions of exercise is given several times a day whereas high intensity exercise for body building are usually performed 3-5 sessions a week.
- Excessive frequency: progressive fatigue, decline in performance, overuse injury
- Inadequate frequency: no or minimal adaptations

#### ➤ **Intensity/ exercise load/ training load**

- The intensity is the amount of resistance/ load imposed on the contracting muscles during each repetitions of an exercise.
- **2 types:**
- Maximal:- Maximal intensity resistance of a muscle is the highest resistance a muscle can withstand, higher than maximal intensity being beyond the muscle's capacity
- Submaximal:- Submaximal intensity resistance is a resistance that is lower than the maximal intensity, usually some percent of the maximal intensity (between 30 to 80%)
- 

#### ➤ **Repetition Maximum (RM):-** RM is a method of quantifying exercise intensity, given by Delorme

#### ➤ **Definition:**A repetition maximum is defined as the greatest amount of weight a muscle can move through the available ROM a specific no of times.

➤ 1 RM for a muscle is the maximum weight (resistance) with which the muscle can contract through full/ available ROM for one time. The muscle will be unable to perform the repetition for a second time.

➤ 10 RM for a muscle is the maximum weight (resistance) with which the muscle can contract through full/ available ROM for 10 times. The muscle will be unable to perform an 11th repetition.

#### ➤ **Uses of RM:-**

- To document a baseline measurement of dynamic strength of a muscle
- To identify an exercise load to be used during exercise
- To find out prognosis in reassessment and alter the exercise regime accordingly.

#### ➤ **How to measure 1RM**

- Measured by repetitions to fatigue method using equations/ charts.
- Various equations and charts are available e.g.  $1\text{ RM} = (\text{No of reps}/30+1) \times \text{weight used}$   
Example: if one lifts 15 kg for 20 times,  $1\text{RM}=?$

- For reps to fatigue the muscle is warmed up and stretched and then given a weight (preferably free weight) which can be performed comfortably over 5 repetitions. The no of repetition the candidate can perform before fatigue is noted.

- **Training zone**

- The amount of resistance to be used in a training program is usually a percentage of 1RM
- For sedentary: 30-40% of 1 RM
- For untrained healthy individual: 60-70% of 1 RM For highly trained: 80-95% of 1 RM

- **Time/duration:-**

- The duration of a resistance training regime is the total no of weeks or months during which the exercise program is carried out.
- Duration determines the adaptations:
- <4 weeks program-neural adaptation only.
- 6-12 weeks program- musculoskeletal adaptation (hypertrophy, increased vascularization)

- **Alignment and stabilization:-**

- Alignment and stabilization is necessary for isolation of muscle and to prevent substitution.
- Stabilization can be external or internal by isometric contraction of a fixator, (e.g. abdominals in case of SLR)

- **Volume:-**

- Volume is the summation of the total no of repetitions and sets of a particular exercise during a single exercise session multiplied by the resistance used.
- Higher the intensity lower the no. of repetitions. Repetitions

- **Repetitions:-**

- Repetitions is a no of times a particular movements is repeated in a series of complete and continuous excursions against a specific load.

- **Set:-**

- A predetermined no of repetitions grouped together is known as a set or bout. After each set there is a brief interval of rest.

- **Rest interval:-**

- Rest between the sets in a session and between two sessions.

- It allows the muscles to overcome the acute effects of exercise related to fatigue.
- Depends on the intensity and volume of the exercise. Higher the intensity longer the rest interval. Also phasic muscles need longer rest than tonic muscles.
- Moderate intensity: 2-3 min rest between sets High intensity: 4-5 min.
- While one group is resting opposite group can be exercised.
- Active recovery which involves exercising without resistance between the sets is more efficient than passive recovery.
- For rehabilitative purposes and heavy exercise 48 hrs. Between the sessions gap is needed.

#### ➤ **Periodization:-**

- Systematic variation of intensity and volume of exercise at regular intervals over a specific period of time.
- Its purpose is to optimize training and performance during the time of competition in a calendar.
- Most useful for competition athlete, less useful for rehab purposes.

#### ➤ **Parts:-**

- Preparation phase, competition phase (peaking) & recuperation phase.

#### ➤ **Sequencing:- Exercise order:**

- When multiple muscle groups are exercised in a session, large groups to be exercised before
- Small, multijoint muscles to be exercised before single joint muscles, higher intensity exercise to be performed before lower intensity exercise.

#### ➤ **Types of resistance**

- Manual and mechanical
- Static and dynamic
- Concentric and eccentric
- Open and closed chain
- Constant and variable load
- Isokinetic exercise.

#### ➤ **Manual and mechanical resistance**

#### ➤ **Manual resistance:**

- Resistance is provided by hand.
- Can be provided by a therapist or self-resisted. Cannot quantify resistance
- Useful for weak muscles in the early stages of rehab or conditions which needs careful control.

➤ **Mechanical resistance:**

- Resistance is applied through the use of equipment or mechanical apparatus.
- Amount of resistance can be measured and can be increased progressively.
- Useful when strong exercises needed.

➤ **Types of mechanical resistance**

**1. Weights:-** Sandbags/ metal weights/ medicine bags etc. are used. The weights are either held in hand or secured to the body part by some comfortable means like straps.

- **Advantage:-** Less equipment- convenient for home Resistance can be measured and altered easily Easy to understand and perform
- **Disadvantage:-**Resistance always works vertically, in the direction of gravity. It is difficult to position some muscles for adequate resistance

**2. Weight and pulley circuit.**

- It uses weights and a no of pulleys with a rope.
- **Advantage:-**The pulleys change direction of pull and thus the direction of resistance is not only limited to vertical, like free weights.
- **Disadvantage:-**Costly, space occupying machines needed.

**3. elastic resistive devices.**

- Various substances of elastic nature, e.g. spring, theraband and theratubes are used with increasing popularity.

- **Advantage:-**Calibrated resistance, often with color codes.Direction not limited as in gravity dependent resistances Handy, easy to carry
- **Disadvantage:-** Variation of resistance is difficult, needs change of equipment.

**4. Malleable resistance:-** Putty, clay, wax, plasticizes etc.

**5. Water:**

➤ **Static and dynamic exercise**

➤ **Static exercise: indications**

1. To prevent atrophy when joint movement. Is not possible
2. To activate muscles without disturbing healing tissues
3. To develop postural/ joint stability
4. To develop isometric muscle strength
5. To improve muscle strength when dynamic strengthening is painful

➤ **Types of static exercise**

**1. Setting exercise:**

Low intensity isometric with very low or no resistance. Decreases pain and spasm and promotes relaxation and circulation

**2. Stabilization:**

Sustained submaximal co contraction in weight bearing / anti-gravity position.

**3. Multiple angle isometrics:**

When joint motion is permissible but dynamic movement. Is not advisable.

**4 Dynamic resistance exercise:**

This type of exercise allows movement with resistance. Can be concentric or eccentric.

➤ **Open and closed kinematic chain exercise**

- **OKC:**In this type of exercise the distal end of the limb is not fixed and movements of any joint can occur isolatedly without the movement of other joints in the chain.
- **CKC:**In this type of exercise the distal end of the limb is fixed and movements of any joint brings about movements in the other joints of the chain.

➤ **Isokinetic exercise**:-In this type of exercise the angular velocity of the movement remains constant. This type of exercise needs computer controlled equipment which matches the resistance with patient's effort.

➤ **PRE**

- Progressive resistance exercise is a dynamic resistance training in which a constant external load is applied to the contracting muscle by some mechanical means and incrementally increased.
- The RM is used as the basis of progression in the resistance.
- Multiple sets are used in a session, which may consist of 2-3 sets of 6-12 repetitions of 6-12 RM
- Common variants are DeLorme, Oxford and McQueen method.

➤ **Contraindication**

- Pain
- Inflammation
- Dynamic exercise is contraindicated in inflammation of the joint
- Severe cardiopulmonary disease.
- Loss of joint integrity

## UNIT 11:- BRIEF ISOMETRIC EXERCISES

✓ **Isometric Quadriceps**:-

✓ **Position of the Patient**:- Supine Lying

✓ **Procedure**:- A towel roll will be placed below the knee Joint. Therapist will ask him/her to press the roll with the force of the knee joint with ankle in dorsiflexion so that there is the production of contraction at Quadriceps. The created pressure will be hold for 5-6 sec, this procedure will be repeated for 10-15 times.

✓ **Isometric Hamstrings**:-

✓ **Position of the Patient**:- Supine Lying

✓ **Procedure:-** A towel roll will be placed below the Ankle Joint. Therapist will ask him/her to press the roll with the force of the ankle joint with ankle in dorsiflexion so that there is the production of contraction at Hamstrings. The created pressure will be hold for 5-6 sec, this procedure will be repeated for 10-15 times.

✓ **Isometric Vastus Medialis Oblique (VMO):-**

✓ **Position of the Patient:-** Supine Lying with knee flexion

✓ **Procedure:-** A towel roll will be placed between the both knees. Therapist will ask him/her to press the roll with the force of both knees so that there is the production of contraction at VMO. The created pressure will be hold for 5-6 sec, this procedure will be repeated for 10-15 times.

➤ **Isometric Neck:-**

To begin, sit in a seat with your feet level on the floor. Your weight ought to be somewhat forward with the goal that you're adjusted equally on your posterior. Loosen up your shoulders and keep your head level. Utilizing a seat with arms may assist you with keeping your equalization.

1. Press your palm against your forehead. Resist with your neck muscles. Hold for 10 seconds. Relax. Repeat 5 times.
2. Do the exercise again, pressing on the side of your head. Repeat 5 times. Switch sides.
3. Do the exercise again, pressing on the back of your head. Repeat 5 times.

## **UNIT 12:- EXERCISE BASED ON NEURO-PHYSIOLOGICAL PRINCIPLES:-**

### **Proprioceptive NeuromuscularFacilitation**

PNF stretching techniques, sometimes referred to as active stretching or facilitative stretching, integrate active muscle contractions into stretching maneuvers purportedly to inhibit or facilitate muscle activation and to increase the likelihood that the muscle to be lengthened remains as relaxed as possible as it is stretched.

➤ **Types of PNF Stretching:-**

There are several types of PNF stretching procedures, all of which have been shown to improve ROM. They include:

- Hold-relax (HR) or contract-relax (CR)

- Agonist contraction (AC)
- Hold-relax with agonist contraction (HR-AC).

With classic PNF, these techniques are performed with combined muscle groups acting in diagonal patterns but have been modified in the clinical setting and in a number of studies and resources by stretching in a single plane or opposite the line of pull of a specific muscle group

➤ **Hold-Relax and Contract-Relax:-**

With the HR and CR procedures, the range limiting target muscle is first lengthened to the point of tissue resistance or to the extent that is comfortable for the patient. The patient then performs a prestretch, end-range, isometric contraction (for about 5 seconds) followed by voluntary relaxation of the range-limiting target muscle. The limb is then passively moved into the new range as the range-limiting muscle is elongated. A sequence for using the HR and CR technique to stretch shortened pectoralis major muscles bilaterally and increase horizontal abduction of the shoulders is illustrated

**PRECAUTION:** It is not necessary for the patient to perform a maximal isometric contraction of the range-limiting target muscle prior to stretch. Multiple repetitions of maximal prestretch isometric contractions have been shown to result in an acute increase in arterial blood pressure, most notably after the third repetition. To minimize the adverse effects of the Valsalva maneuver (elevation in blood pressure associated with a high-intensity effort), have the patient breathe regularly while performing submaximal (low-intensity) isometric contractions held for about 5 seconds with each repetition of the HR or CR procedure. From a practical perspective, a submaximal contraction is also easier for the therapist to control if the patient is strong.

➤ **Agonist Contraction:-**

Another PNF stretching technique is the agonist contraction (AC) procedure. This term has been used by several authors but can be misunderstood. The “agonist” refers to the muscle opposite the range-limiting target muscle. “Antagonist,” therefore, refers to the range-limiting muscle. Think of it as the short muscle (the antagonist) preventing the full movement of the prime mover (the agonist). Dynamic range of motion (DROM) and active stretching are other terms that have been used to describe the AC procedure.

To perform the AC procedure, the patient concentrically contracts (shortens) the muscle opposite the range-limiting muscle and then holds the end-range position for at least several seconds. The movement of the limb is controlled independently by the patient and is deliberate and slow, not ballistic. In most instances, the shortening contraction is performed without the addition of resistance.

For example, if the hip flexors are the range-limiting target muscle group, the patient performs end-range, prone leg lifts by contracting the hip extensors concentrically; the end-range contraction of the hip extensors is held for several seconds. After a brief rest period, the patient repeats the procedure. Increased muscle length and joint ROM using the AC procedure have been reported. However, when the effectiveness of the AC technique has been compared to static stretching, the evidence is mixed.

- **PRECAUTIONS:** Avoid full-range, ballistic movements when performing concentric contractions of the agonist muscle group. Rest after each repetition to avoid muscle cramping when the agonist is contracting in a very shortened portion of its range. Classic PNF theory suggests that when the agonist (the muscle opposite the range-limiting muscle) is activated and contracts concentrically, the antagonist (the range-limiting muscle) is reciprocally inhibited, allowing it to relax and lengthen more readily. However, the theoretical mechanism of reciprocal inhibition has been substantiated only in animal studies. Evidence of reciprocal inhibition during the AC procedure has not been demonstrated in human subjects. In fact, an increase of EMG activity, not reciprocal inhibition, has been identified in the range-limiting muscle during application of the AC stretching procedure.
- **Hold-Relax with Agonist Contraction:-**

The HR-AC stretching technique combines the HR and AC procedures. The HR-AC technique is also referred to as the CR-AC procedure<sup>24</sup> or slow reversal hold-relax technique.

To perform the HR-AC procedure, move the limb to the point that tissue resistance is felt in the range-limiting target muscle; then have the patient perform a resisted, prestretch isometric contraction of the range-limiting muscle followed by voluntary relaxation of that muscle and an immediate concentric contraction of the muscle opposite the range-limiting muscle.

For example, to stretch knee flexors, extend the patient's knee to a comfortable, end-range position and then have the patient perform an isometric contraction of the knee flexors against resistance for about 5 seconds. Tell the patient to voluntarily relax and then actively extend the knee as far as possible, holding the newly gained range for several seconds.

### UNIT 13:- CRUTCHES AND CANES EXERCISES

- **Crutches:-**
- Crutches are a kind of Walking Aids that serve to expand the size of a person's base of help. It moves weight from the legs to the chest area and is frequently utilized by individuals who can't utilize their legs to help their weight (i.e. transient wounds to deep rooted handicaps).
- **Crutches Type**

There are three sorts of crutches; Axilla crutches, Elbow crutches and Gutter crutches.

- **Axilla or underarm crutches** they ought to really be situated around 5 cm underneath the axilla with elbow flexed 15 degree roughly. The plan incorporates an axilla bar, a hand piece and twofold uprights joined distally by a solitary leg. They are customizable in stature, both the general tallness and handgrip tallness can be balanced (flexible around 48 to 60 inches (12 to 153 cm))
- **Forearm crutches** (or lofstrand, elbow or Canadian crutches). Thier configuration incorporates a solitary upstanding, a lower arm sleeve and a hand hold. The tallness of the lower arm crutches are demonstrated from handgrip to the floor (flexible from 29 to 35 inches or 74 to 89 cm).
- **Gutter Crutches** (or adjustable arthritic crutches, forearm support crutches) these are extra sort of crutches, which is made out of cushioned lower arm bolster made up of metal, a lash and movable hand piece with elastic ferrule. These crutches are utilized for patients who are on fractional weight bearing like rheumatoid disease.

➤ **Walking Pattern:-**

- **2 Point:-** In this type patient is asked to move his/her crutch of unaffected side along with the affected limb together. Then he/she moves crutch of affected side along with the unaffected limb together.
- **3 Point:-** when patient is unable to do weight bearing on the affected limb. In this type patient is asked to move his/her crutch of affected side then he/she moves unaffected limb then he/she moves the unaffected crutch.
- **4 Point:-** In this patient is asked to move unaffected side crutch then affected limb is moves then affected crutch is moved then unaffected limb is moved.
- **Swing Through:-** In the patient is asked to move his/her leg beyond the crutches.
- **Swing To:-** In the patient is asked to move his/her leg behind the crutches.

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➤ **Indication:-**

The use of crutches may be indicated if a patient:

- Has lost the use of a limb (it is either injured or amputated).

- Is having problems with Balance and impaired strength

➤ **Canes:-**

➤ Canes are mobile assistive gadgets utilized for improving postural stability. It is commonly recommended for individuals with moderate degrees of portability debilitation, It is regularly utilized when insignificant strength is required. Canes in like manner everyday utilization are known as walking sticks. A stick can either be made of wood or a light metal, for example, aluminum. The wooden sticks as a rule have a law breaker handle and can only with significant effort have multi point tips. Aluminum strolling sticks can either have a level or "swan-neck" top and have the upside of being movable long and can have numerous focuses for example a tripod.

➤ **Types of Canes:-**

- Tripods:- In this type of canes there are three point on its base for its support.
- Quadripodes:- In this type of canes there are Four point on its base for its support.

➤ **Walking Pattern:-**

- **2 Point:-** In this type patient is asked to move his/her cane of affected side along with the unaffected limb together. Then he/she moves the affected limb together.
- **3 Point:-** In this type patient is asked to move his/her cane of affected side then he/she moves unaffected limb then he/she moves the affected limb.
- **Swing Through:-** In the patient is asked to move his/her leg beyond the cane.
- **Swing To:-** In the patient is asked to move his/her leg behind the cane.

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**UNIT 14:- GAIT TRAINING (CYCLE)**

➤ **Gait Cycle:-**

- It has two phases
- Stance Phase
- Swing Phase

➤ Stance Phase:-

- **Heal Strike:** - while walking when we hit our heel on the ground.
- **Foot Flat:** - It is the point where our foot become flat on the ground
- **Mid Stance:** - In this we shift our weight in the leg which is flat on the ground
- **Heel Off:** - In this we lift our heel off the ground.
- **Toe Off:-** In this we lift our toe that means we lift our entire foot off the ground

➤ Swing Phase:-

- **Acceleration or Initial swing:-** In this our foot leaves the ground is in air at its initial swing
- **Mid Swing:-** In this time the foot is exactly perpendicular to the ground in the air
- **Deceleration or Late Swing:-** In this our foot comes towards the ground is in air at its terminal swing

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**UNIT 15:- PRINCIPLES OF THERAPEUTIC EXERCISES**

➤ Definition of Therapeutic Exercise

Therapeutic exercise is the systematic, planned performance of bodily movements, postures, or physical activities intended to provide a patient/client with the means to:

- Remediate or prevent impairments.
- Improve, restore, or enhance physical function.
- Prevent or reduce health-related risk factors.
- Optimize overall health status, fitness, or sense of well-being.

The beneficial effects of therapeutic exercise for individuals with a wide variety of health conditions and related physical impairments

➤ **Components of Physical Function:**

➤ **Definition of Key Terms:-**

- **Balance:-** The ability to align body segments against gravity to maintain or move the body (center of mass) within the available base of support without falling; the ability to move the body in equilibrium with gravity via interaction of the sensory and motor systems.
- 
- **Cardiopulmonary fitness:-** The ability to perform moderate intensity, repetitive, total body movements (walking, jogging, cycling, swimming) over an extended period of time. A synonymous term is cardiopulmonary endurance.
- **Coordination:-** The correct timing and sequencing of muscle firing combined with the appropriate intensity of muscular contraction leading to the effective initiation, guiding, and grading of movement. Coordination is the basis of smooth, accurate, efficient movement and occurs at a conscious or automatic level.
- **Flexibility:-** The ability to move freely, without restriction; used interchangeably with mobility.
- **Mobility:-** The ability of structures or segments of the body to move or be moved in order to allow the occurrence of range of motion (ROM) for functional activities (functional ROM). Passive mobility is dependent on soft tissue (contractile and noncontractile) extensibility; in addition, active mobility requires neuromuscular activation.
- **Muscle performance:-** The capacity of muscle to produce tension and do physical work. Muscle performance encompasses strength, power, and muscular endurance.
- **Neuromuscular control:-** Interaction of the sensory and motor systems that enables synergists, agonists and antagonists, as well as stabilizers and neutralizers to anticipate or respond to proprioceptive and kinesthetic information and, subsequently, to work in

correct sequence to create coordinated movement. Postural control, postural stability, and equilibrium. Used interchangeably with static or dynamic balance.

- **Stability**:- The ability of the neuromuscular system through synergistic muscle actions to hold a proximal or distal body segment in a stationary position or to control a stable base during superimposed movement. Joint stability is the maintenance of proper alignment of bony partners of a joint by means of passive and dynamic components.



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## UNIT 16:- POSTURES

## Posture

Posture is an alternative name for position but in an exercise context is usually taken to be a dynamic position in which the body components relate to one another so that the centre of gravity is over the base and the muscle work to maintain the position is reduced to a minimum.

- **Good posture** is also pleasing to the eye and is dynamically adapted to the size of the base and the circumstances in which the body is resting or working. Good posture should not throw undue stress on muscle or joints and should be automatically resumed after displacement has occurred.
- **Poor posture** is frequently produced by bad habits, e.g. the slouching posture adopted by the adolescent following the fashion of walking and standing with their hands in the front pockets of jeans. The use of unsuitable equipment may induce poor posture, e.g. a too low working surface will cause a kyphotic posture of the back at its weakest point; and associated round shoulders and poking chin will follow.

Holding the head to one side in a 'listening' posture due to slight deafness may become a bad habit and lead to the adoption of resultant deviations of the relationships of pelvis to shoulder girdle or of the vertebrae to one another.

Standing with most of the weight on one leg will lead to lateral deviations of the vertebrae and pelvis–shoulder girdle relationship. When the cause is shortness of the lower limb of more than 2.5 cm, correction will occur if raised footwear is worn, but if any of the above postural habits are allowed to persist they will become permanent disfigurements and adaptive shortening of the soft tissues will ensue.

Early detection of poor posture and retraining to good position can be most rewarding and may need the following procedures:

- (1) The patient's interest must be gained and he must *want* to improve his posture.
- (2) Local relaxation may need to be taught, preferably in lying.

(3) The patient is then 'straightened' by teaching the correct alignment of each body component to the other starting with the pelvis–shoulder girdle relationship. At this point the patient may complain that 'It, or he, feels odd'. The new proprioceptive pathways are being stimulated and he will now have to learn that 'feeling odd' may be correct. During this part of the proceedings he should be encouraged to maintain maximum body length by feeling as though he was stretching like a piece of elastic between his feet and his head.

(4) It is now important to displace body components while maintaining the corrected position, e.g. perform arm or leg exercise and maintain the new posture.

(5) Next he must be totally displaced into a vigorous activity or maybe a game and then he must lie down and regain his new posture.

This procedure can be repeated several times perhaps during the course of a class but at the first treatment the patient must also experience his corrected posture in sitting and standing and by constant reminder in all dynamic positions assumed during the course of that day's treatment session.

The treatment must include, for each patient, the adoption of their normal work or daily activity position so that the therapist can teach correction of what may be a poor posture adopted for the greater part of the day.

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## UNIT 17:- EXERCISE FOR HEALTHY PERSONS:-

### Exercise plan

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A day by day Walking exercise program was presented. The separation and speed of strolling was balanced over the 2.5 long stretches of treatment and stairs and slopes were incorporated. Before the finish of the 2.5 weeks, Mrs. /Mr. X was practicing for 30 minutes five days of the week. She did a warm up of walking on the spot as solace permitted.

Strengthening exercises of the upper appendage were finished utilizing 2 kg then 3 kg loads. Activities included bicep twists and elbow expansions, 2 arrangements of 20 reiterations (expanded from one set at first). The quads seat for quadriceps and hamstring strengthening exercises was utilized rather than squats and rushes because of the patient's solid lower leg. Hip snatching with lower leg loads was done in side lying. She was given two 2 kg lower leg loads to use at home. The Strengthening exercises was done 2 – 3 times each week. All loads included were low so as not to include an excessive amount of worry with respect to her circulatory strain and were just included after her pulse was steady for 2-3 days.

An inspirational meeting was finished with Mrs./Mr. X during which she effortlessly recognized where exercise could be added to her day. She was even ready to think of an answer for making her own loads for her upper appendage practice program at home. She was resolved to proceed and was quick to remember her better half and kids for the program.

#### ➤ **Activities of Daily Living:-**

Activities of daily living (ADLs or ADL) is a term utilized in human services to allude to individuals' daily self-care activities. Sidney Katz et al introduced the term during the 1950s and the term has been updated since. Physiotherapists and other wellbeing professionals often utilize an individual's capacity or failure to perform ADLs as an estimation of their utilitarian status, especially as to individuals post-injury, with handicaps and the old.

## Basic and Instrumental ADLs

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For the most part, more seasoned grown-ups should have the option to oversee ADLs and IADLs so as to live freely without the help of someone else.

Essential ADLs-these are simply the fundamental consideration undertakings

- Walking (ambulating) capacity to get around the home or outside.
- Feeding, capacity to get nourishment from a plate into one's mouth.
- Dressing and preparing, capacity to choose garments, putting them on, and satisfactorily dealing with one's very own appearance.
- Toileting, capacity to get to and from the can, utilizing it properly, and cleaning oneself.
- Bathing, capacity to wash one's face and body in the shower or shower.
- Transferring, capacity to move starting with one body position then onto the next. This incorporates having the option to move from a bed to a seat, or into a wheelchair. This can likewise incorporate the capacity to stand up from a bed or seat so as to get a handle on a walker or other assistive gadget.

**Instrumental ADLs**-require more unpredictable reasoning abilities, including organizational aptitudes.

- Managing funds, for example, taking care of tabs and overseeing monetary resources.
- Managing transportation, either by means of driving or by organizing different methods for transport.
- Shopping and feast readiness. for example everything required to get a supper on the table. It additionally covers looking for attire and different things required for daily life.
- Housecleaning and home support. Cleaning kitchens in the wake of eating, keeping up living zones sensibly perfect and clean, and staying aware of home upkeep.
- Managing correspondence, for example phone and mail.
- Managing drugs, for example getting prescriptions and accepting them as coordinated.

## Physiotherapy

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Physiotherapists survey ADLs and IADLs as a feature of evaluating a more established individual's "work." Problems with ADLs and IADLs ordinarily reflect issues with physical wellbeing or potentially intellectual wellbeing. Recognizing useful troubles can assist us with diagnosing and oversee issues influencing their regular daily existence.

Physiotherapists assist individuals with performing ADLs through exercise treatment and improving quality and joint portability. Improving walk speed, hold quality, torment decrease, improved equalization and so forth all improve an individual's capacity to perform ADLs. A physiotherapists job is likewise to energize work out, endorse practices and were suitable allude to practice programs for example Otago practice program. These activities would all be able to help in the performance of ADL. Help is likewise accomplished through exhortation and showing the utilization of assistive gadgets for example 4 wheel walkers, orthotics



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## UNIT 18:- EXERCISE OF SPINE

- CERVICAL AND UPPER THORACIC
- REGION—STRETCHING TECHNIQUES
- Techniques to Increase Thoracic Extension
- Self-Stretching

**Patient position and procedure:** Hook-lying, with the hands behind the head and the elbows resting on the mat.

To increase the stretch, place a pad or rolled towel lengthwise under the thoracic spine between the scapulae.

Segmental breathing can also be used by having the patient start with the elbows together in front of the face and then inhaling as the elbows are brought down to the mat; holding; then exhaling as the elbows are brought together again.

**Patient position and procedure:** Hook-lying, with both arms elevated overhead. The patient attempts to keep the back flat on the mat while inhaling and expanding the anterior thorax.

**Patient position and procedure:** Supine, with a foam roll placed longitudinally down the length of the spine.

If the patient cannot balance on the roll or experiences tenderness along the spinous processes from pressure, tape two foam rolls together. The patient elevates both arms overhead in a “touchdown” position and allows gravity to apply the stretch force. The patient then abducts and laterally rotates both shoulders so the hands are facing the ceiling. This position also stretches the pectoralis major and subscapularis muscles. Breathing exercises can be added to mobilize the ribs.

**Patient position and procedure:** Sitting on a firm, straight-back chair with the hands behind the head or held abducted and externally rotated 90 degree. The patient then brings the elbows out to the side as the scapulae are adducted and the thoracic spine is extended (head held neutral,

not flexed). To combine with breathing, have the patient inhale as he or she takes the elbows out to the side and exhale as the elbows are brought in front of the face

- **Techniques to Increase Upper Cervical Flexion—Short Suboccipital Muscle Stretch**
- **Manual Stretching**

**Patient position and procedure:** Sitting. Identify the spinous process of the second cervical vertebra and stabilize it with your thumb or with the second metacarpophalangeal joint (and the thumb and index finger around the transverse processes). Have the patient slowly nod, doing just a tipping motion of the head on the upper spine. Guide the movement by placing the other hand across the patient's forehead.

**Patient position and procedure:** Supine. Sit on a stool at the head of the treatment table with your forearms resting on the table. One hand stabilizes the C2 vertebra by grasping the transverse processes between the proximal portions of the thumb and index finger; the other hand supports the occiput. Nod the patient's head with the hand under the occiput to take up the slack of the suboccipital muscles; then ask the patient to roll the eyes upward. This causes a gentle isometric contraction of the suboccipital muscles. After holding 6 seconds, ask the patient to roll the eyes downward. As the suboccipital muscles relax, take up the slack by passively nodding the head through any new range. Only motion between the occiput and C2 should occur. The contraction is gentle in order to not cause overflow into the multisegmental erector spinae and upper trapezius muscles.

- **Self-Stretching**

**Patient position and procedure:** Supine or sitting. Instruct the patient to nod the head, bringing the chin toward the larynx until a stretch is felt in the suboccipital area. Putting light pressure under the occipital region with the palm of your hand while tipping the patient's head forward reinforces the motion.

- **Techniques to Increase Lumbar Extension**

**PRECAUTION:** Do not perform if extension causes a change in sensation or causes pain to radiate down an extremity.

## ➤ Self-Stretch

**Patient position and procedure:** Prone, with hands placed under the shoulders. Have the patient extend the elbows and lift the thorax up off the mat but keep the pelvis down on the mat. This is a prone press-up. To increase the stretch force, the pelvis can be strapped to the treatment table. This exercise also stretches the hip flexor muscles and soft tissue anterior to the hip.

**Patient position and procedure:** Standing, with the hands placed in the low-back area. Instruct the patient to lean backward.

**Patient position and procedure:** Quadruped (hands and knees). Instruct the patient to allow the spine to sag, creating lumbar extension. This, alternated with posterior pelvic tilts, can also be used to teach the patient how to control pelvic motion.

## ➤ Techniques to Increase

### ➤ Lateral Flexibility in the Spine

Stretching techniques to increase lateral flexibility are used for intervention when there is asymmetrical flexibility inside bending as well as in the management of scoliosis. It is important to note that stretching has not been shown to correct or halt progression of structural scoliosis. If these exercises are used for patients with structural scoliosis, they may be beneficial in gaining some flexibility prior to surgical fusion of the spine for correcting a scoliotic deformity. They may also be used to regain flexibility in the frontal plane when muscle or fascial tightness is present with postural dysfunction. All of the following exercises are designed to stretch hypomobile structures on the concave side of the lateral curvature. When stretching the trunk, it is necessary to stabilize the spine either above or below the curve. If the patient has a double curve, one curve must be stabilized while the other is stretched.

**Patient position and procedure:** Prone. Stabilize the patient at the iliac crest (manually or with a belt) on the side of the concavity. Have the patient reach toward the knee with the arm on the convex side of the curve while stretching the opposite arm up and overhead. Instruct the patient to breathe in and expand the rib cage on the side being stretched.

**Patient position and procedure:** Prone. Have the patient stabilize the upper trunk (thoracic curve) by holding onto the edge of the mat table with the arms. Lift the hips and legs and laterally bend the trunk away from the concavity.

**Patient position and procedure:** Heel-sitting. Have the patient lean forward so the abdomen rests on the anterior thighs; the arms are stretched overhead bilaterally, and the hands are flat on the floor. Then have the patient laterally bend the trunk away from the concavity by walking the hands to the convex side of the curve. Hold the position for a sustained stretch.

**Patient position and procedure:** Side-lying on the convex side of the curve. Place a rolled towel at the apex of the curve, and have the patient reach overhead with the top arm. Stabilize the patient at the iliac crest. Do not allow the patient to roll forward or backward during the stretch. Hold this position for a sustained period of time.

**Patient position and procedure:** Side-lying over the edge of a mat table with a rolled towel at the apex of the curve and the top arm stretched overhead. Stabilize the iliac crest. Hold this head-down position as long as possible



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## Low Back Pain Exercises



Standing hamstring stretch



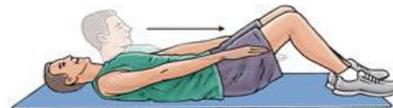
Cat and camel



Pelvic tilt



Quadrupedal arm/leg raise



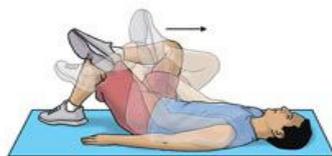
Partial curl



Extension exercise



Side plank



Gluteal stretch

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UNIT 19:- MASSAGE:-

Massage therapy is the logical control of the delicate tissues of the body, comprising fundamentally of manual (hands-on) systems, for example, applying fixed or portable weight, holding, and moving muscles and body tissues.

➤ **Massage Techniques:-**

➤ **Effleurage (Stroking):-**

The hands are passed rhythmically and consistently a client's skin, in one course in particular, with the point of expanding blood stream toward that path, extending tissues, loosening up the customer and helping the dispersal of waste items. The word effleurage is gotten from French, signifying "to skim". It includes stroking developments of the hands sliding over the skin and is consistently the first and last strategy (just as being utilized between different strategies) applied in a massage meeting. Effleurage might be utilized with shifting beat and weight as per the phase of the condition and whatever the ideal impact of the massage is.

➤ **Petrissage (Kneading):-**

The skin is lifted up, pushed down and crushed, squeezed and rolled. Substitute pressing and unwinding of the tissues invigorates the nearby dissemination and may have an agony soothing impact with some solid issue. Petrissage is gotten from a French word, signifying "to ply". The essential development is to pack, get and afterward discharge the delicate tissues. It is commonly utilized when a more profound impact than effleurage is wanted, and its methods include:

- Squeezing
- Picking up
- Shaking
- Rolling
- Wringing

➤ **Percussion/Tapotement manipulation**

It Includes Hacking, Clapping, Beating, Pounding or Vibration

➤ **Contraindication:-**

Include: Any sort of skin disease; Open injuries; Circulatory issues, for example, thrombosis, draining scatters; Less than 48 hours after injury; during intense aggravation; Tumors if in the region being massaged.

**UNIT 20:- SUSPENSION THERAPY:-**

## DEFINITION

Therapeutic exercise given to patients to increase ROM, increase muscle power and support body parts by using ropes and slings.

## PRINCIPLES

It is working under the principle of-

- Friction
- Pendulum
- Eliminating gravity movement

### A) Friction-

It happens during a specific surface proceed onward another. In suspension contact is less, in this manner causes smooth and simple development.

### B) Pendulum-

- Pendulum is substantial material suspended by the weightless string. At the point when power is applied on the pendulum it results in forward and backward development.
- In human body, pendular movement happens for the most part in shoulder and hip joints, forward leg developments arm swings while strolling.

### C) Eliminating gravity development

The patient ought to in any event have muscle power 2 for suspension therapy work out.

## ➤ PARTS OF SUSPENSION THERAPY

### 1) Suspension Frames

- It is made of tempered steel or plastic covered steel.
- In the top and head end side presents the 5-centimeter metal work, and the rest of the sides are kept open.

### 2) Supporting rope-

Three assortments of supporting ropes are utilized for the suspension to abstain from slipping.

- Single rope
- Double rope
- Pulley rope

#### a) Single rope

- Has a ring fixed toward one side by which it is hung up.
- The opposite finish of the rope at that point goes through one finish of the wooden projection through the ring of a canine clasp and through the opposite finish of the fitting and afterward tied.

#### b) Pulley rope

- This has a pouch cut appended toward one side of the rope which at that point disregards the wheel of a pulley
- The rope at that point goes through the fitting and second canine clasp.

#### c) Double rope

- Consists of two pulleys at upper and lower connections.
- So here there is a mechanical bit of leeway of 2.

#### 3) Slings

Four assortments of slings are accessible

- Single sling
- Double sling
- Three ring sling
- Head sling

#### TYPES OF SUSPENSION THERAPY

1. Axial suspension
2. Vertical suspension
3. Pendular suspension

### 1) Axial suspension

- Joint hub is taken as the purpose of the suspension
- The appendage is upheld by the slings over the hub of the joint.
- If the development is started the appendage is moves the two sides.
- The part moves corresponding to the floor.

#### Uses

1. Relaxation
2. Maintain strong property
3. Increase the blood flow
4. Increase the venous seepage
5. Increase the lymphatic seepage

### 2) Vertical suspension

- COG of the body part or the body is taken as purpose of suspension.
- Used to offer help to the body some portion of the patients.

#### Uses

1. To help the body part
2. To diminish the weight sore.

### 3) Pendular suspension

- Point of suspension ought to be moved away from the joint pivot.
- Movement for the most part happens against gravity.
- Muscle will get obstruction while moving, if the hub is moved inverse to that development.

Uses

1. To fortify the muscle.
2. To increment the muscle power
3. To increment the perseverance.

#### ADVANTAGES OF SUSPENSION THERAPY

- It lessen the weight for the specialist.
- Easy to lift the appendage.
- Active development can be performed effectively with least grating.

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## UNIT 21:- NEURO-MUSCULAR COORDINATION

**The cerebellum is the essential center in the mind for coordination for development and the capacity to execute smooth exact engine reaction.**

For composed developments to happen all the beneath frameworks are included

- Cerebellum
- Vestibular framework
- Motor framework.
- Flexibility and ROM.
- Deep sensations.
- Vision.

Types of Coordination

Motor coordination to finish an errand a joint effort of three abilities:

### 1. Fine Motor Skills

- Require facilitated development of little muscles (hands, face).
- Examples: incorporate composition, drawing, securing a shirt, blowing bubbles

### 2. Gross Motor Skills

- Require facilitated development of huge muscles or gatherings of muscles (trunk, limbs).
- Examples: incorporate strolling, running, lifting exercises.

### 3. Hand-eye Skills

- The capacity of the visual framework to facilitate visual data. Gotten and afterward control or direct the hands in the achievement of an undertaking.

- Examples: incorporate getting a ball, sewing, PC mouse use.

### **Test of Coordination of Upper Limb:-**

In the accompanying tests, you will be searching for indications of Intention tremors and Decomposition of developments or Dysmetria: as hypermetria or hypometria

- Finger-to-nose test - The shoulder is kidnapped to 90o with the elbow expanded, the patient is solicited to bring tip from the pointer to the tip of nose. Finger to advisor finger: the patient and the specialist site inverse to one another, the advisor pointer is held before the patient, the patient is solicited to contact the tip from the forefinger to the advisor forefinger.
- Finger-to-finger test - Both shoulders are stole to bring both the elbow expanded, the patient is approached to bring both the hand toward the midline and surmised the forefinger from restricting hand
- Finger-to-specialist's finger test - the patient on the other hand contact the tip of the nose and the tip of the advisor's finger with the forefinger.
- Adiadokokinesia or dysdiadokokinesia - The patient requested to do quickly rotating development for example lower arm supination and pronation, hand tapping.
- Rebound phenomenon - The patient with his elbow fixed, flex it against obstruction. At the point when the obstruction is out ofnowhere discharged the patient's lower arm flies upward and may hit his face or shoulder.
- Buttoning and unfastening test.

### **Test of Coordination of Lower Limb:-**

- Walking along a straight line. Foot near foot: in the event of cerebellar sore, there is deviation of walk
- Rom-berg test: Ask the patient to remain with heels together. Influencing or loss of parity happens while his eyes are open or shut.

### **Physiotherapy:-**

There are numerous intercessions that can be used to improve coordination, for example,

- Otago Exercise Program and utilization of Balance Boards
- Neuromuscular coordination works out. Look at the propelled instances of these beneath.
- Proprioceptive Neuromuscular Facilitation. The underneath video shows PNF being used
- Neurophysiological Basis of Developmental Techniques
- Sensory Integrative Therapy
- Frenkel's Exercises

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## UNIT 22:- STARTING POSITION:-

Movement can be initiated from a variety of positions. To accomplish a position we start at one and end in another. Stance is a position which one holds their body when standing, sitting or position it in a route fitting to the development that is alluring bowing, lying or for a particular work.

The postures from which the movement is initiated are known as starting positions, these can either be dynamic or detached in nature. There are 5 principal beginning positions

- Standing
- Kneeling
- Sitting
- Lying
- Hanging
- **Standing:-** in this position we stand in an Anatomical Position i.e. Eyes seeing in front, facefacing forward, palm facing forward, legs apart, toes facing forward.
- **Kneeling:-**In this position the body is supported on the knees which can be together or slightly apart. The feet are plantar flexed if kneeling on ground or in in mid position if on plinth, this is often used in praying
- **Lying:-**Lying is the easiest of the fundamental positions and most of us spend few hours as in sleeping or relaxing and most preferred position for rest it is as stable as possible
- It can be of three types:-
  1. Supine lying
  2. Prone lying
  3. Side lying

- **Sitting:-**This position is taken in chair or stool and the hips and knees are flexed to right angle and the feet rest on the floor most used position in daily life
- **Hanging:-**In hanging body is suspended by grasping onto something with the fingers and palm

#### UNIT 24:- CRYOTHERAPY:-

Cryotherapy, otherwise called ice application, is the most straightforward and most established approach to treat wounds. Its overall utilize spread due to its adequacy, accommodation, ease and simplicity of transportation. Ice is accepted to control torment by inducing neighborhood sedation. It additionally diminishes oedema, nerve conduction speeds, cell digestion and neighborhood blood stream. The impact of the cryotherapy relies upon the technique, the span, temperature of the ice and the profundity of the subcutaneous fat.

#### ➤ **Methods of Application**

- Ice Packs
- Ice Massage
- Immersion
- Vapocoolent Spray
- Ice Strokes
- Ice Packs:- Different pack are available in the market which is applied to the patients according to the area of injury. Treatment time is about 10-15min.
- Ice Massage:- Ice cubes are taken in a towel or a polybags then massage is given on the injured part in clock and anticlock wise for some time. Treatment time is about 10-15min.
- Immersion:- In this method we take equal amount of ice fridge cooled water in an treatment tray or unit. Patient is asked to dip the injured part in it. Treatment time is about 10-15min.

- Vapocoolant Spray:- In this method we use a spray on the injured area with a distance of 15 inches and with an angle of 45 degree.
- Ice Strokes:- Ice cubes are used from the broader end and strokes are given on the injured part toward the drainage areas. Treatment time is about 10-15min.

Principle of Cryotherapy:- The hunting reaction or hunting response is a process of alternating vasoconstriction and vasodilation in extremities exposed to cold. The term Lewis reaction is used too, named after Thomas Lewis,

➤ **Indication:-**

- Acute soft tissue injuries e.g. ankle sprain, muscular strain
- Post orthopedics surgery e.g. TKR, ACL reconstruction, arthroscopic shoulder surgery.
- Acute sports injuries
- DOMS

➤ **Contraindication:-**

- Be aware of conditions in which icing is contraindicated
- E.g. CRPS, hemoglobinuria, cryoglobulinemia, Raynaud's disease and cold urticarial

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