JHARKHAND RAI UNIVERSITY

RANCHI

LAB MANUAL

FUNDAMENTALS OF BIOMECHANICS & EXERCISE THERAPY

BPT II

List of Practical

1. To study the types and uses Goniometer.
2. To study the application of Goniometer for upper limb.
3. To study the application of Goniometer for lower limb.
4. To study the application of Goniometer for cervical spine.
5. To study the various components of Suspension therapy Apparatus.
6. To study the application of suspension bed for lower extremity.
7. To study the application of suspension bed for upper extremity
8. To study the Fundamental and Derived positions.

PRACTICAL 1

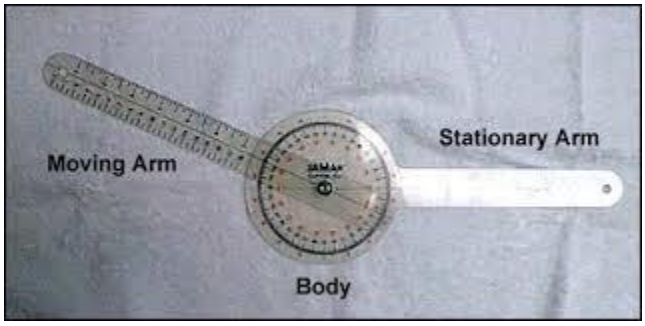
INTRODUCTION TO GONIOMETRY

Aim: To study the types and uses of goniometer.

The term goniometry is derived from two Greek words, gonio, meaning angle, and metron, meaning measure. Therefore, goniometry refers to the measurement of angles, in particular the measurement of angles created by human joints.

Procedure: To measure the range of motion at a joint, the center of the goniometer is positioned at the axis of rotation of a joint, and the arms of the goniometer are aligned with the long axis of the bones of the adjacent segments.

A goniometer is usually made of plastic and is often transparent. Occasionally goniometers are made of metal. There are two "arms" of the goniometer: the stationary arm and the moveable arm. Each arm is positioned at specific points on the body and the center of the goniometer is aligned at the joint to be measured.



TYPES OF GONIOMETER

1. **Universal goniometry:** These are most commonly used instrument. The body of a universal goniometer resembles a protractor and may from full or half circle. Measurement scales are located on the body (0-180 or 0-360). It consists of two arms stationary or fixed arm and movable arm. Stationary cannot be moved. Movable arm is attached to the fulcrum which is the center of the body and it can be moved. It contain a black line extend the length of the arm for measuring the angle.
2. **Fluid inclinometer:** It has fluid filled circular chamber containing an air bubble. It is similar to a carpenter's level, but being circular, has a 360 degree scale.

3. **Pendulum goniometer:** It consists of a 360 degree protractor with a weighted pointer hanging from the center of the protractor.
4. **Electro goniometers:** These are used primarily in research to obtain dynamic joint measurements. It is similar to that of universal goniometer.

PRACTICAL 2

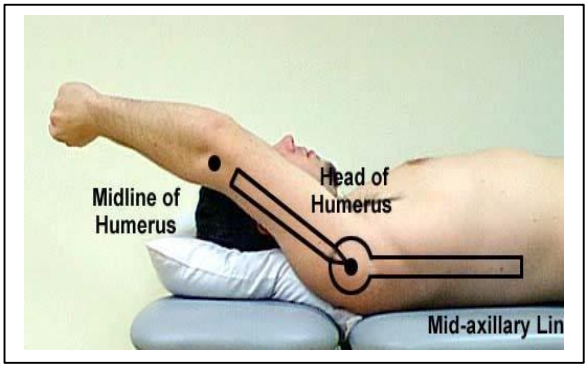
GONIOMETRY UPPER LIMB

Aim: To study the application of Goniometer for upper limb.

Shoulder joint range of motion

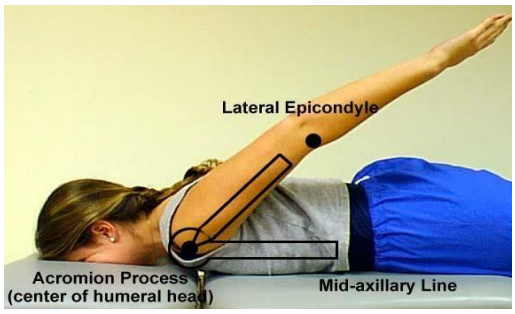
1. Flexion

Recommended testing position: Supine lying.
Normal ROM: 0-180
Fulcrum: Acromial process.
Movable arm: Middle line of humerus.
Fixed arm: Mid axillary line of thorax.



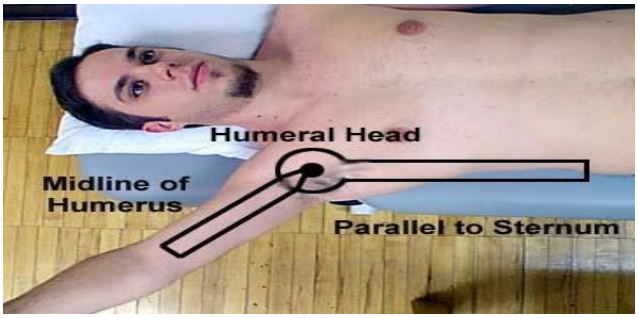
2. Extension

Recommended testing position: Prone lying
Normal ROM: 0-50^0
Fulcrum: Coracoid process
Movable arm: Lateral midline of the humerus.
Fixed arm: Midaxillary line of thorax



3. Abduction

Recommended testing position: Supine lying
Normal ROM: 0-180
Fulcrum: Acromial process
Movable arm: Medial midline of humerus
Fixed arm: Parallel to the midline of the anterior Aspect of the sternum.



4. Adduction

Recommended testing position: Supine lying
Normal ROM: 180-0
Fulcrum: Acromial process
Movable arm: Medial midline of humerus
Fixed arm: Parallel to the midline of the anterior Aspect of the sternum

5. Medial rotation

Recommended testing position: Supine lying, with the arm placed at 90 of abduction
Normal ROM: 0-90
Fulcrum: Olecranon process
Movable arm: Parallel to ulna
Fixed arm: Parallel or perpendicular to the floor

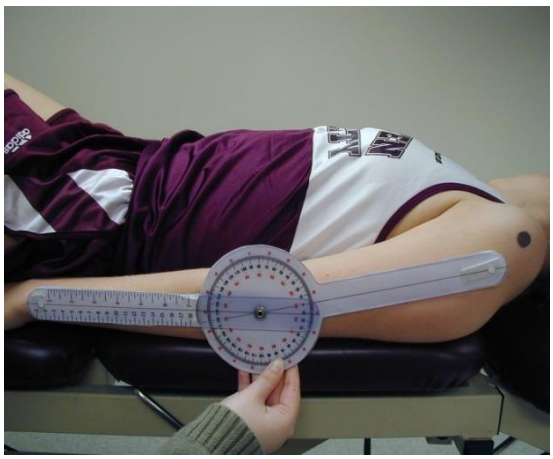
6. Lateral rotation

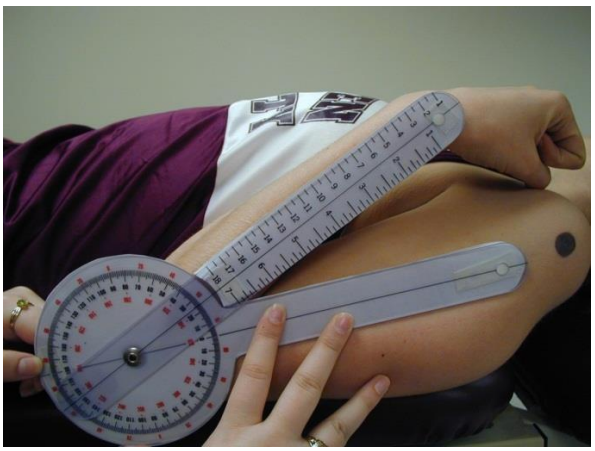
Recommended testing position: Supine lying, with the arm placed at 90 of abduction
Normal ROM: 0-100
Fulcrum: Olecranon process
Movable arm: Parallel to ulna
Fixed arm: Parallel or perpendicular to the floor

ELBOW

1. Flexion

Recommended testing position: Supine lying
Normal ROM: $0\text{-}145^0$
Fulcrum: Lateral epicondyle of humerus
Movable arm: Lateral midline of the humerus
Fixed arm: Midline of the humerus





2. Extension

Recommended testing position: Supine lying
Normal ROM: $145^0\text{-}0$
Fulcrum: Lateral epicondyle of humerus
Movable arm: Lateral midline of the humerus
Fixed arm: Midline of the humerus

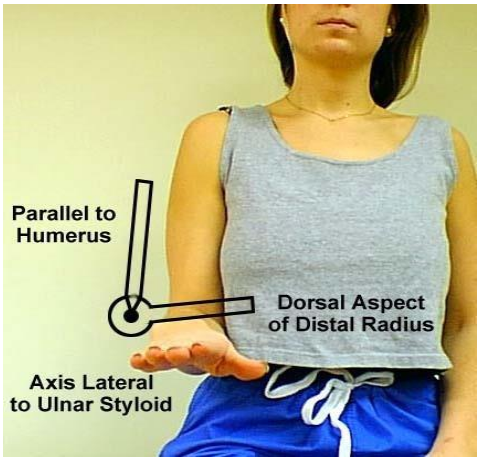
FOREARM

1. Supination

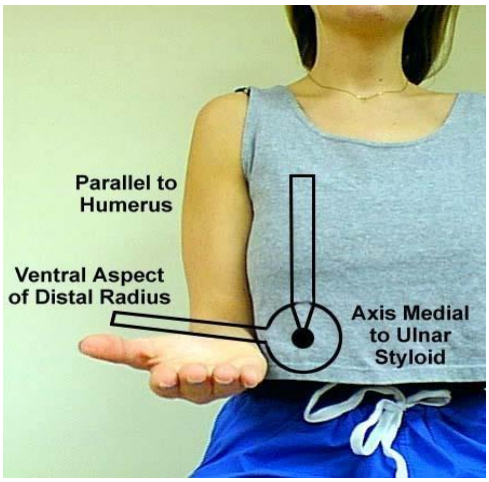
Recommended testing position: -Sitting with upper arm at the side of the body, elbow flexed to 90 and forearm supported.

Normal ROM: -0-80
Fulcrum: -Lateral to the ulnar styloid process
Movable arm: -Ventral aspect of the forearm, proximal to Styloid process

Fixed arm: -Anterior midline of humerus



PRONATION



SUPINATION

2. Pronation

Recommended testing position: -Sitting with upper arm at the side of the body, elbow flexed to 90 and forearm supported

Normal ROM: - 0-80
Fulcrum: - Lateral to the ulnar styloid process
Movable arm: - Dorsal aspect of the forearm, proximal to styloid process of radius

Fixed arm: - Anterior midline of humerus

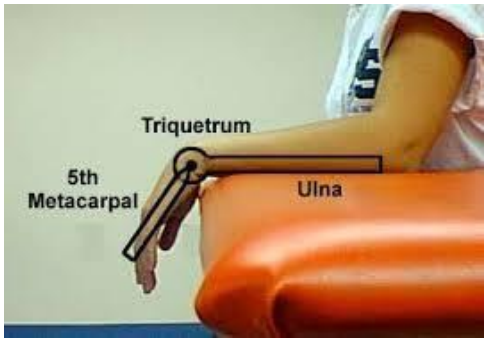
WRIST

1. Flexion

Recommended testing position: -Sitting next to a supporting surface and hand Facing the ground.

Normal ROM: -0-80
Fulcrum: -Lateral aspect of the wrist over the triquetrum

Movable arm: -Lateral midline of the fifth metacarpal
Fixed arm: -Lateral midline of the ulna

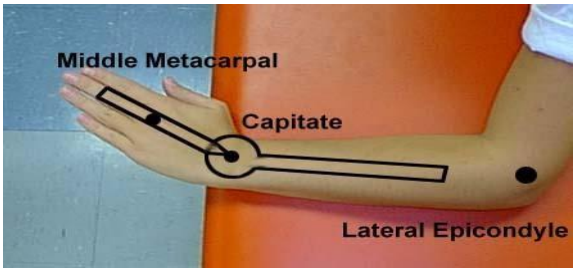


2. Extension

Recommended testing position:	-Sitting next to a supporting surface and hand facing the ground.
Normal ROM:	-0-70
Fulcrum:	-At the level of capitate
Movable arm:	-Volar midline of the third metacarpal
Fixed arm:	-Volar midline of the forearm

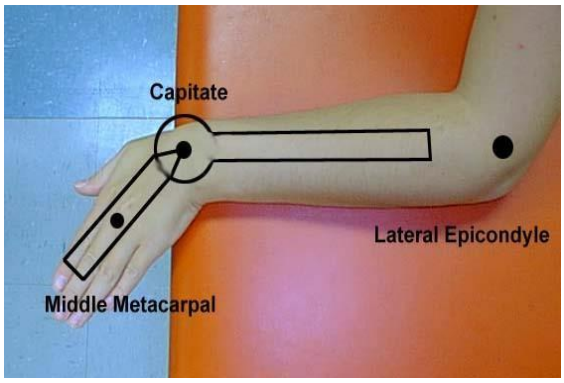
3. Radial deviation

Recommended testing position:	-Sitting next to a supporting surface and hand facing the ground.
Normal ROM:	-0-20
Fulcrum:	-At the level of capitate
Movable arm:	-Dorsal midline of the third metacarpal
Fixed arm:	-Dorsal midline of the humerus



4. Ulnar deviation:

Recommended testing position:	-Sitting next to a supporting surface and hand facing the ground.
Normal ROM:	-0-30
Fulcrum:	-At the level of capitate
Movable arm:	-Dorsal midline of the third metacarpal
Fixed arm:	-Dorsal midline of the humerus.



PRACTICAL 3

GONIOMETRY LOWER LIMB

Aim: To study the application of Goniometer for lower limb.

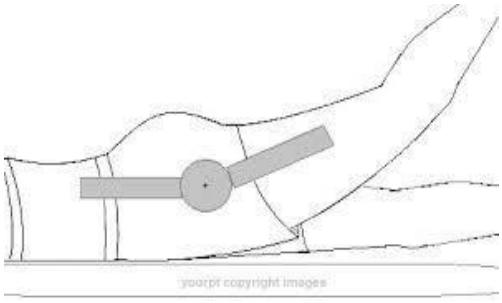
HIP JOINT

1. Flexion

Recommended testing position:	-Supine lying
Normal ROM:	-0-120
Fulcrum:	- Lateral aspect of the hip joint
Movable arm:	- Lateral midline of the femur
Fixed arm:	- Lateral midline of the pelvis

2. Extension

Recommended testing position:	- prone lying
Normal ROM:	-0-30
Fulcrum:	- Lateral aspect of the hip joint
Movable arm:	- Lateral midline of the femur
Fixed arm:	- Lateral midline of the pelvis



3. Abduction

Recommended testing position:	-Supine lying
Normal ROM:	-0-45
Fulcrum:	-Anterior superior iliac spine (ASIS) of the Extremity being measured
Movable arm:	-Anterior midline of the femur
Fixed arm:	-Horizontal line extending from one ASIS to Other ASIS.

4. Adduction

Recommended testing position:	-Supine lying
Normal ROM:	-0-30
Fulcrum:	-Anterior superior iliac spine (ASIS) of the Extremity being measured
Movable arm:	-Anterior midline of the femur
Fixed arm:	-Horizontal line extending from one ASIS to Other ASIS.

5. Medial rotation and Lateral rotation

Recommended testing position:	-Sitting on a supporting surface
Normal ROM:	-0-45
Fulcrum:	-Anterior of the patella
Movable arm:	-Anterior midline of lower leg
Fixed arm:	-Parallel to leg

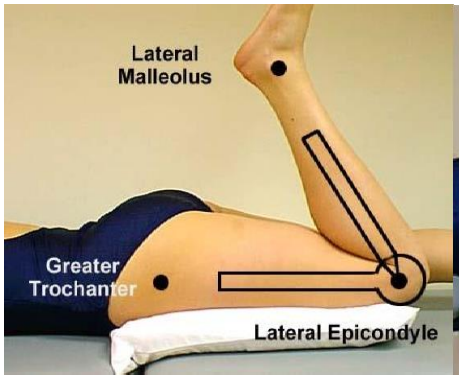
KNEE JOINT

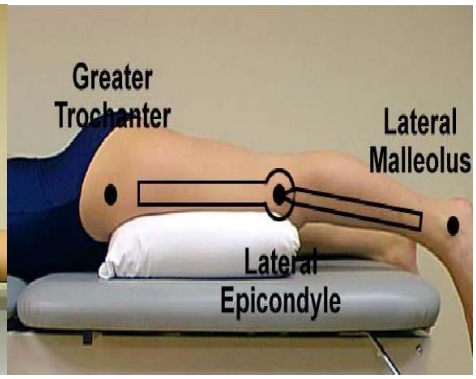
1. Flexion

Recommended testing position:	-Prone lying
Normal ROM:	-0-135
Fulcrum:	-Lateral epicondyle of the femur
Movable arm:	-Lateral midline of the femur
Fixed arm:	-Lateral midline of the fibula

2. Extension

Recommended testing position:	-Prone lying
Normal ROM:	-135-0
Fulcrum:	-Lateral epicondyle of the femur
Movable arm:	-Lateral midline of the femur
Fixed arm:	-Lateral midline of the fibula



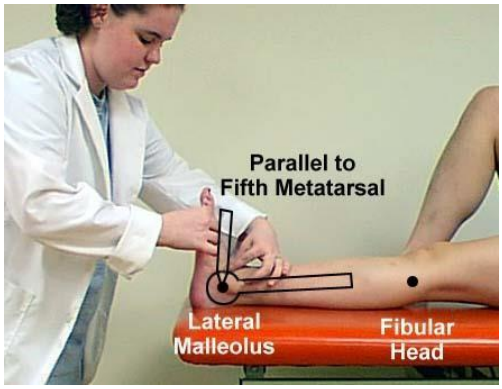


S

ANKLE JOINT

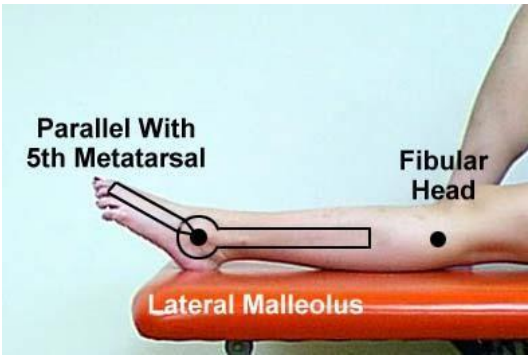
1. Dorsi flexion

Recommended testing position:	-Sitting or supine
Normal ROM:	-0-20
Fulcrum:	-Lateral aspect of lateral malleolus
Movable arm:	-Lateral aspect of fifth metatarsal
Fixed arm:	-Lateral midline of the fibula



2. Plantar flexion

Recommended testing position:	-Sitting or supine
Normal ROM:	-0-50
Fulcrum:	-Lateral aspect of lateral malleolus
Movable arm:	-Lateral aspect of fifth metatarsal
Fixed arm:	-Lateral midline of the fibula



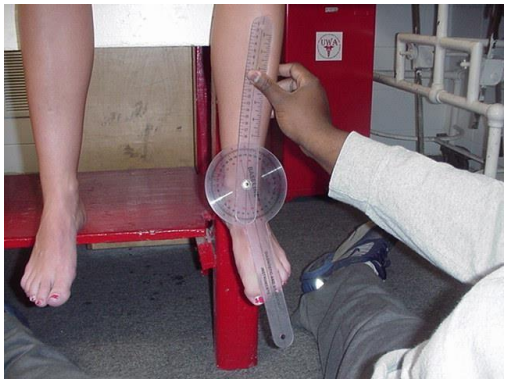
3. Inversion

Recommended testing position:	-Sitting with knee flexed to 90 and the lower Leg over the edge of supporting surface
Normal ROM:	-0-35
Fulcrum:	-Anterior aspect of the ankle midway Between the malleoli
Movable arm:	-Anterior midline of the second metatarsal
Fixed arm:	-Anterior midline of the lower leg

4. Eversion

Recommended testing position:	-Sitting with knee flexed to 90 and the lower Leg over the edge of supporting surface
Normal ROM:	-0-15
Fulcrum:	-Anterior aspect of the ankle midway Between the malleoli
Movable arm:	-Anterior midline of the second metatarsal

Fixed arm: -Anterior midline of the lower leg

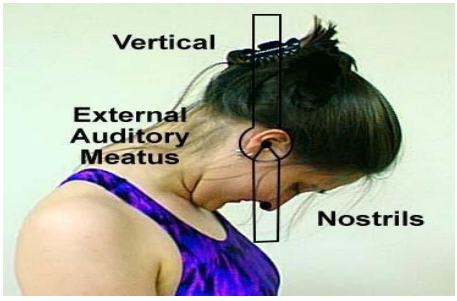


PRACTICAL 4

GONIOMETRY FOR CERVICAL SPINE

Aim: To study the application of Goniometer for cervical spine.

Cervical spine forward bending (flexion)

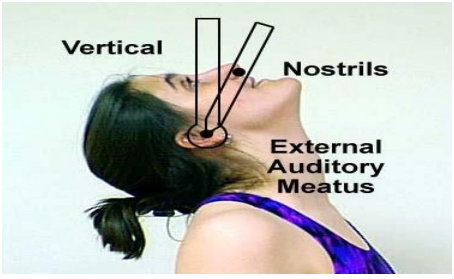


Test Position

- Subject sitting with lumbar and Thoracic spines supported
- Stabilize lumbar and thoracic spines
- Flex cervical spine

- **Goniometer Alignment**
- Axis – external auditory meatus
- Stationary arm – vertical
- Moving arm – aligned with nostrils

Cervical spine backward bending (extension)



Test Position

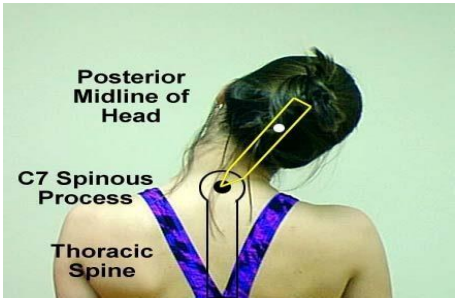
- Subject sitting with lumbar and Thoracic spines supported
- Stabilize lumbar and thoracic spines
- Mouth relaxed and slightly open
- Extend cervical spine

Goniometer Alignment

- Axis – external auditory meatus
- Stationary arm – vertical
- Moving arm – aligned with nostrils.

CERVICAL SPINE SIDE BENDING (lateral flexion)

- **Test Position**
- Subject sitting with lumbar and Thoracic spines supported
- Stabilize lumbar and thoracic spines
- Sideband cervical spine



- **Goniometer Alignment**
- Axis – spinous process of C7
- Stationary arm – spinous processes Of thoracic spine
- Moving arm – posterior midline of Head at occipital protuberance

CERVICAL SPINE ROTATION

- **Test Position**
- Subject sitting with lumbar and Thoracic spines supported
- Stabilize lumbar and thoracic spines
- Rotate cervical spine

Goniometer Alignment

- Axis – center of superior aspect of head
- Stationary arm – aligned with acromion processes
- Moving arm – aligned with tip of nose

PRACTICAL -05

Suspension Therapy - Introduction

Aim: To study the various components of Suspension therapy Apparatus

SUSPENSION

Suspension is the means whereby parts of the body are supported in slings and elevated by the use of variable length ropes fixed to a point above the body. Suspension frees the body from the friction of the material upon which body components may be resting and it permits free movement without resistance. For suspension we need:

- a fixed point (hook) above the relevant part of the body and
- a suspensory unit which consists of
  - a sling
  - a supporting adjustable rope
  - S- hook
  - Dog clip / Karabiner hook

The Fixed Point

- Stainless steel or plastic covered 5 cm metal mesh or free-standing frame around the area of a plinth. Hooks on the side of the frame allow lateral fixed points and can be used to keep the small apparatus near at hand.

Suspensory Unit

Consisting of a rope and a sling.

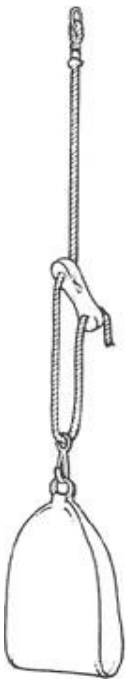
The Supporting Ropes

Ropes should be of 3-ply hemp so that they will not slip, and they can be of three arrangements:

- a single rope,
- a pulley rope or
- a double rope.

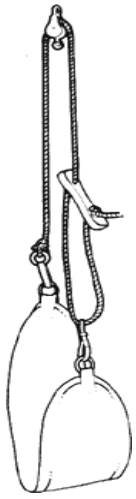
Single Rope

A single rope has a ring fixed at one end, by which it is hung up. The other end of the rope passes through one end of a wooden cleat, through the ring of a dog clip and through the other end of the cleat and is then knotted with a half-hitch. The cleat is for altering the length of the rope and should be held horizontally for movement and pulled oblique when supporting. The rope then 'holds' on the cleat by frictional resistance. The dog clip should be on a pivot to allow adjustments in position with minimum discomfort when the slings are attached. The total length of rope required is 1.5 m.



Pulley Rope

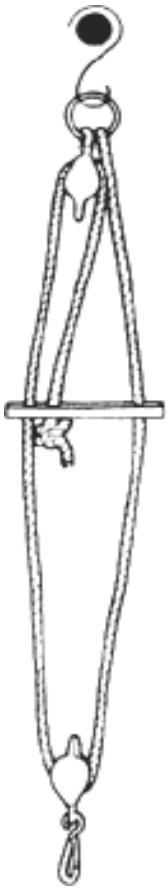
A pulley rope has a dog clip attached to one end of the rope which then passes over the wheel of a pulley. The rope then passes through the cleat and a second dog clip. Like the single rope this rope is 1.5 m long. This arrangement is used for reciprocal pulley circuits; with one sling supporting a limb, and the ends of the sling attached to the two dog clips, it is used for three-dimensional movements of a limb, i.e. abduction or adduction with flexion or extension and medial or lateral rotation (combined, oblique, rotatory movements).



Double Rope

A double rope consists of a ring and clip from which the rope is hung. The rope then passes through one side of a cleat, round a pulley wheel at the lower end, to the case of which is

attached a dog clip, through the other end of the cleat and over the wheel of an upper pulley which is attached to the compensating device. The rope then passes down again through a centre hole in the cleat where it is knotted. This device gives a mechanical advantage of two as two pulleys are used. The rope is shortened by pushing the cleat down, allowing the lifter to move with gravity at the same time as it offers a mechanical advantage of two. Such a rope is used to suspend the heavy parts of the body – the pelvis, thorax or heavy thighs when these are to be supported together.



TYPES OF SUSPENSION :

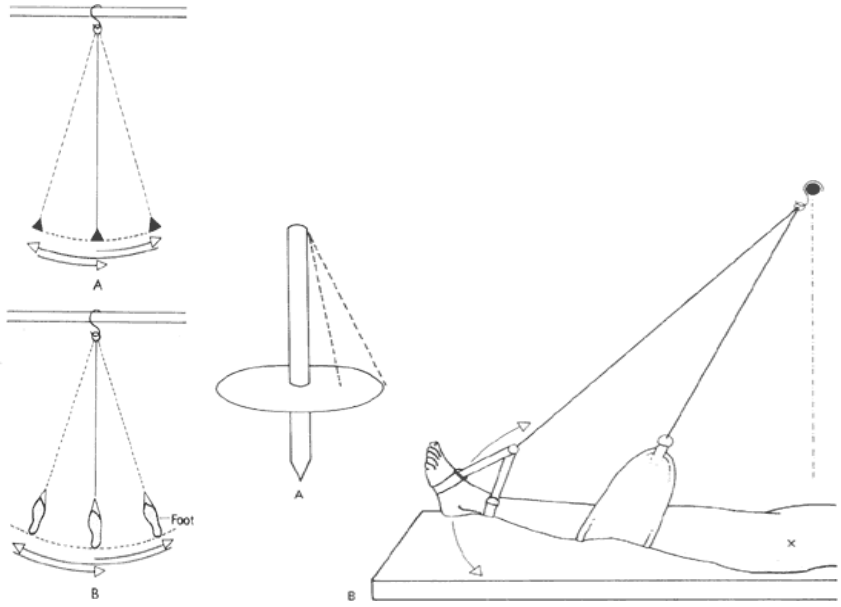
Vertical Fixation

- The rope is fixed so that it hangs ***vertically above the centre of gravity*** of the part to be suspended. The centre of gravity of each part of the body is, on the whole, at the junction of the upper and middle third.
- Used for support as it tends to limit the movement of the part to a ***small-range pendular movement*** on each side of the central resting point.

- Vertical fixation is ***used primarily to support***, e.g. the abducted upper limb when the elbow is to be moved

<u>Axial Fixation</u>

- When all the ropes supporting a part are attached to one 'S' hook which is fixed to a point immediately ***above the centre of the joint*** which is to be moved.
- When such fixation is set up the movement of the limb will be on a flat plane level with the floor. In this way ***pure angular movements*** are obtained.



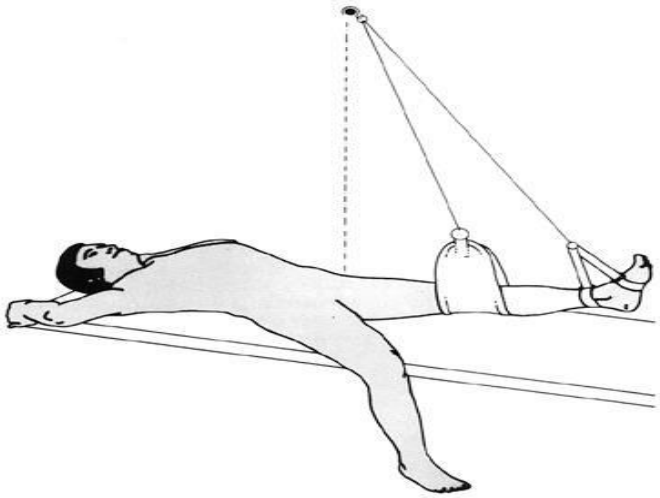
PRACTICAL -06

SUSPENSION FOR THE LOWER EXTREMITY

Aim: To study the application of suspension bed for lower extremity

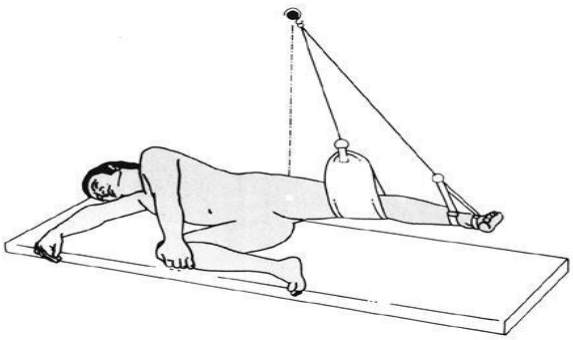
Abduction and Adduction of HIP

- ***Position of the subject***: lying with the opposite leg abducted to its limit.
- ***Fixation point:*** Immediately above the hip joint. One sling is put under the lower thigh and one three-ring sling on the foot and ankle; each is attached to a rope hung from the fixation point. The limb is lifted just clear of the plinth.
- Hip may be mobilized in abduction and adduction or the abductor or adductor muscles may be especially worked with or without manual resistance



Flexion and Extension of HIP

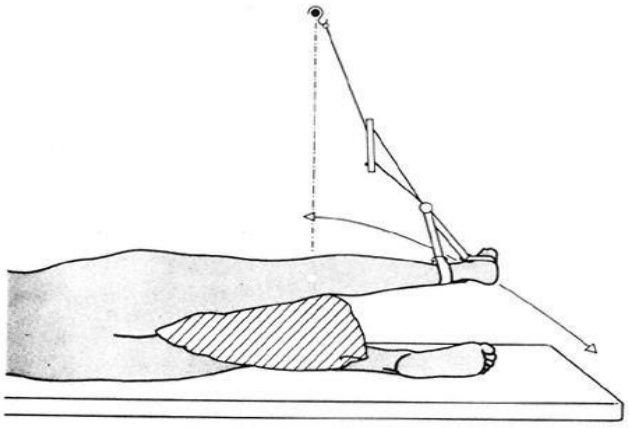
- Position of the subject: side lying with the underneath leg flexed as far as possible.
- Fixation point: Over the hip joint, single sling is attached to the thigh and one is a three-ring sling applied to the ankle and foot.
- During flexion both the hip and knee should be flexed together to overcome passive insufficiency of hamstring muscle.
- When extension is performed the knee should be extended to overcome the active insufficiency of hamstring muscle



THE KNEE

Flexion and Extension of KNEE

- Position of the subject: side lying with one or two pillows between the slightly flexed thighs.
- Fixation point: Over the knee joint, single sling is attached to the thigh and one is a three-ring sling applied to the ankle and foot.
- By keeping the hip slightly flexed on the trunk the foot can be seen each time the knee is extended and part of the arc of movement is thus observed by the subject.
- This position may be used to mobilize the knee joint or to work the flexors or extensors of the knee.



PRACTICAL -07

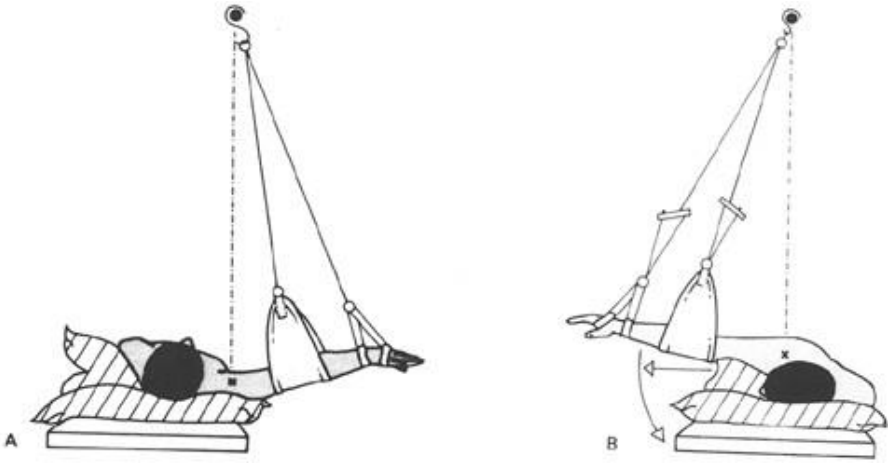
SUSPENSION FOR THE UPPER EXTREMITY

Aim: To study the application of suspension bed for upper extremity.

THE SHOULDER

Abduction and Adduction of Shoulder

- Position of the subject: supine lying, quarter turned towards the arm which is to be moved. Alternatively, the starting position is prone lying, quarter turned towards side lying with a pillow under the trunk on the side of the arm which is to be moved.
- Fixation point: Over the shoulder joint, single sling is attached to the elbow and one is a three-ring sling applied to the wrist and hand.



Shoulder abduction and adduction.
A: Quarter 15° turned from lying. B: Quarter 15° turned from prone lying.

THE ELBOW

- Position of the subject: sitting on a low backed chair.

Fixation point: A single sling and rope supports the arm in vertical fixation, and a three-ring sling and single rope fixed to point above the elbow joint

PRACTICAL-08

FUNDAMENTAL AND DERVID POSITION

Aim: To study the Fundamental and Derived positions.

Movement can be initiated from a wide variety of Starting positions or static positions. These position are maintained by static contraction of the muscles which stabilize the joints and by support of apparatus. There are five basic or fundamental positions, standing, sitting, kneeling, lying and hanging positions. All other positions that are used are modified from these five basic positions and are known as derived positions.

Starting positions

- Position is assumed by the body and take movement to come in an equilibrium.
- Posture Follows movements like a shadow.
- Every movements begin with posture and end with posture
- Posture is an attitude either with support or without support.
- The movement may be either by active or passive.

Importance of Starting position:

1. Equilibrium and stability is maintained in these positions by a balance of force acting upon it.
2. When our body use the force of muscular contraction the fundamental position initiate the contraction of isometric.
3. Strength and distribution 0f contraction 0f muscle is normally controlled by the postural reflex

Fundamental positions:

There are five types of starting position that is known as Fundamental position. These are-

1. Standing
2. Kneeling
3. Sitting
4. Lying and
5. Hanging

1. Standing

This is the most difficult of the fundamental positions to maintain, as the whole body must be balanced and stabilized in correct alignment on a small base by the coordinated work of many muscle groups. The position may be described as follows:

Heels: The heels are together and on the same line, the toes slightly apart
Knees: The knees are together and straight.
Hips: The hips are extended and laterally rotated slightly**.**
Pelvis: The pelvis is balanced on the femoral heads
Spine: The spine is stretched to its maximum length.
Vertex: The vertex is thrust upwards and the
Ears: The ears are level
Eyes: The eyes look straight forwards
Shoulder: The shoulders are down and back.
Arms: The arms hang loosely to the sides
Palm: The palms facing inwards towards the body

MUSCLE WORK:

Intrinsic Muscles of the Feet: Stabilization
Dorsi flexors of the ankle: Counter balance plantar flexors and support the medial longitudinal arch.
Plantar flexors of the ankle: Balance the lower leg.
The evertors: Press the ball of the greater toe and to press the greater toe to the ground.
Extensors of the knee: Works slidely
Extensors of the hip: Maintain Hip extension
Extensors of the spine: Keep upright the trunk and maintain the curvatures of the spine upright the trunk and maintain
Flexors and extensor of the atlantooccipital joint: Balance the head
Retractor of scapula: Back the shoulder
Lateral rotator of the shoulder: Relax the arm in the correct position

Effect and Uses:
• Relatively small base
• High COG
• State of equilibrium- less stable
• A tending and holding the posture with minimal muscle work, reduce fatigue and also postural reflex.

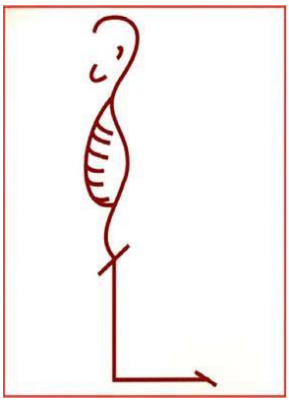
2. **KNEELING**

The body is supported on knees which may be together or slightly apart. The lower leg rest on the floor with the feet plantar flexed or if a plinth is used the feet may be in the mid position over the edge.
The rest of the body is held in standing.

MUSCLE WORK:

Flexor and extensor of knee- To balance knee
Extensors of hip- Maintain the correct angle of pelvic.
Lumbar flexion of spine- Maintain the pelvic tilt
Lumbar flexion of spine- Increase the extensor of spine.
Rectus femoris- Maintain the position of thigh.

Effect and Uses:
• The COG of the body is relatively lower than in standing position.
• It is more slightly stable but is uncomfortable for most people.
• It is used as a starting position for backward movement in sagittal plane.
• To train the control of the hip joint and lower trunks in preparation for the standing position by which the feet press the flex by the extensor of the knee and dorsiflexors.
• By this position lower leg act as a bracket



3. **SITTING**

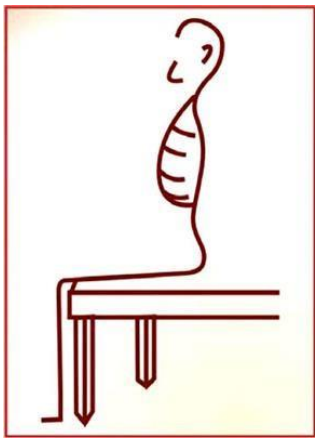
In this position the body rests on the tuberosity of the ischium but the back of the thigh should also be supported and the feet should rest upon the floor. The hip, knee and ankle joint should all for right angle (90degree).

MUSCLE WORK:

This position does not need much of work to be done by the legs to hold on to the position. Flexors of hip work to maintain a right angle and prevent the tendency of slump (forward bend).

Effect and Uses:

•Most comfortable and stable position.
•Rotation of the spine is limited.
•More suitable position for no weight bearing exercises.
•More suitable posture for correct alignment of spine.



4. **LYING**
    - Lying is the easiest fundamental position.
    - Most of us spend few hours as in sleeping or relaxing.
    - It is as stable as possible.
    - In this position the whole body is in contact with the mattress or hard surface.

MUSCLE WORK
• At lying position minimum muscle work.
• No much movement present.
• Soft mattress give way to contours of body but hard surface, head can roll to either side.
• Head rotators- to stabilize the head.
• Extensors of hip and flexors of lumbar spine- to hollow the back.
• Medial rotators of hip- keep legs in neutral position.

Effect and Uses:
• It provide maximum relaxation to spine.
• Because of it, it is more preferably position for all type of exercise.
•It is more comfortable position to correct the spinal deformity but unsuitable for respiratory as well as cardiac patient due to increased abdomen pressure.

5. **HANGING**

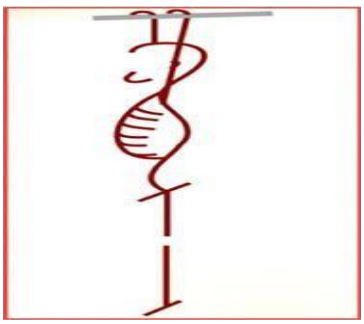
The body is suspended by grasping over a horizontal bar. The forearm being frontal. The arm straight and shoulder atleast width apart. Head is held by high and scapula are drawn down. Neck appears as long, trunk and legs straight, foot plantar flexed.

MUSCLE WORK

- **Flexors of finger**- To grasp strongly.
- **All the muscle of wrist**- To act as synergist and fixators.
- **Flexor of elbow**- To reduce the strain.
- **Latissimus dorsi and pectoralis major**- Help to lift the body.
- **Depressors of scapula and medial rotators**- Fix the scapula.
- **Flexors of lumbar spine and extensors of hip**-To maintain the posture and help to balance the back.
- **Adductors of hip**-To keep the leg together.
- **Extensors of knee**-Maintain the knee in extension.
- **Plantar flexion of ankle**-To maintain the ankle and foot in neutral position.

Effects and Uses:

- As the muscle work of the arm and upper back is extensive and strong. The position is only suitable for those person whose muscular strength and body weight are well balanced.
- Spine and legs are elongated.
- This posture is unsuitable for weak person.
- Difficulty in breathing is increased at this posture.
- This posture is used by gymnastics.



Derived Positions

Derived positions are positions used by modification of the arms, Legs or trunk in each of Fundamental position, to modify the effect of the positions, or of the exercises which are performed from them.

The aims of derived positions are to:

- Increase or decrease the base of support.
- Rise or lower the center of gravity.
- Gain local on general relaxation.
- Gain fixation and good control of specific area.
- Increase or decrease the muscle work required to maintain the position.
- Increase or decrease the leverage.

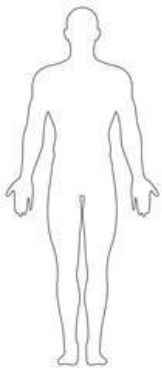
Positions Derived From Standing:

By alternation of the legs –

- **Toe standing:** The heels are pressed together and raised from the floor.

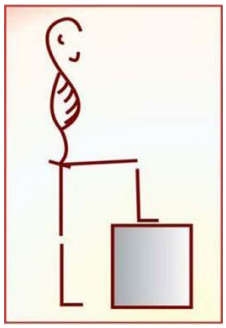
Muscle work: Plantar Flexors at ankle joint.

- **Close standing:** The legs are rotated inwards at the hip so that the medial borders of the feet are adjacent.



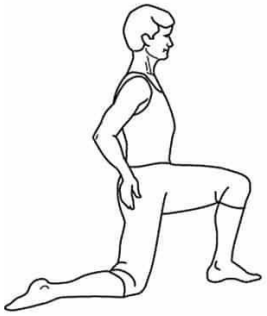
- **Half Standing:** The whole weight of the body is supported on one legs; the other may be free or supported in a variety of position

- **Step Standing:** Standing with one foot on a higher level than the other. Used for teaching weight transference before walking upstairs.



Positions Derived From Kneeling:

- **Half kneeling:** One knee supports most of the body weight and the other leg is bent to a right angle at hip, knee and ankle so that the Foot is supported on the ground in a forward direction.



- **Kneel sitting :**
  (a) The knees and hip are flexed so that the patient sits on his heels.

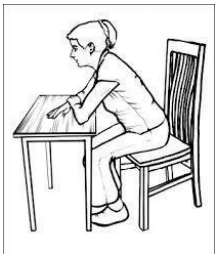
(b) The position is some time used for small children, but most people find it very uncomfortable.

- **Side Sitting:** From the kneel sitting the buttocks are moved sideways so that the one or both buttocks rest on the floor.

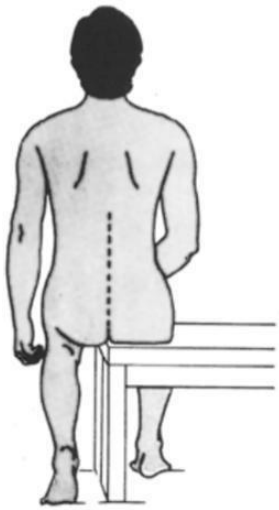
- **Prone Kneeling:** The trunk is horizontal, supported under the shoulders by the arms, and at the pelvis by the thighs, which must be held vertical. The head is held in line with the trunk.

Positions Derived From Sitting:

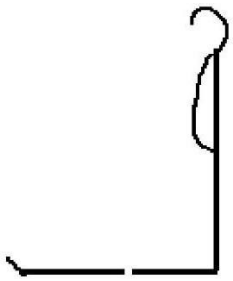
- **Forward Lean Sitting:** The trunk is inclined forwards and the head is supported on pillows on a table at the front.



- **Half Sitting:** Sitting on the side of a seat so that only one buttock is supported. The leg on the side of the unsupported buttock is usually bent at the knee as this position is used when the hip is stiff in extension or for lower limb above knee amputees to allow exercise of the stump.



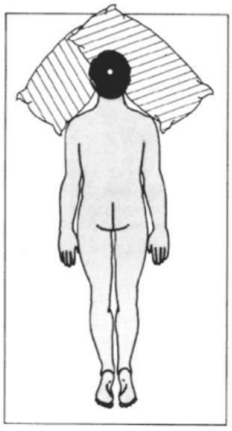
- **Long Sitting:** The legs are stretched out in front, Knees straight. The trunk is upright and this position is an uncomfortable one to maintain.



Positions Derived from Lying:

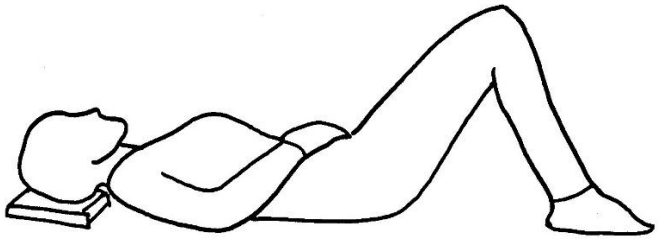
- **Side lying:** This position is rarely used as turning onto the side with the under arm by the side and legs Straight is very difficult both to perform and to maintain.
  The base is small and rounded and the position is one through which the body passes in turning movements or is modified by bending the under arm and leg forwards while the upper arm and leg either rest in straight position or are flexed slightly.

- **Prone Lying:** The body face down with arms by the side and Legs straight. In order to rest comfortably to pillows should be crossed to support the force head or the head allowed to turn the side of the patient's choice.



- **Quarter Turn:** The body is turned through 45° from either lying, side lying or prone lying and supported by pillows down the raised side of the trunk. The direction of the l/4 turn is indicated by Starting the Starting position and direction.

- **Half Lying:** The body is bent at the hips and the trunk is raised from lying to any angle up to 90°.This is the standard position in which most sick people are propped up in bed. More comfortably the legs may be slightly raised or lowered from the horizontal and the knees bent.



- **Side Half Lying:** The trunk and head are turned to one side so that the patient rests on one buttock and leg and that side of the trunk.

Positions Derived From Hanging:

- **Arch Hanging:** The starting position tor forward and backward swinging of the trunk or for bar somersaults.

- **Half Hanging:** Hanging by one arm. The position achieved during lateral travel on the beam.