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STUDY OF OSTEOPOROTIC FRACTURES (V2)

Lower Extremity Joint Examination Protocol

I. Introduction:

The lower extremity joint examination is being performed to assess the risk of fracture associated with lower extremity joint dysfunction and abnormalities, and to provide data for studies of arthritis. This protocol is adapted from the HANES III examination by Jean Scott, RN, MPH, and Michael Nevitt, PhD, with the consultation of Marc Hochberg, MD, of Johns Hopkins University.

The joint examination will be performed in a systematic fashion. The following sequence will be followed: hip, knees, ankles, feet and toes. Each joint or group of joints will be examined for pain on passive motion and selected joints for tenderness on palpation. Examinations will be performed on both sides.

For purposes of recording, tenderness and pain on motion will be noted as present or absent and not scaled according to severity or grade if present.

Range of motion of hips, knees, and ankle joints will be measured in degrees using a goniometer. Goniometry is the measurement of angles, in our study the measurement in degrees of the range of motion of certain joints: the hip, knee, and ankle. The measurement is taken while the pivot of the goniometer is over the axis of motion of the joint. Since the axis of motion may shift somewhat when the joint is moved, care should be taken to be sure the pivot is as closely as possible over the axis when the measurement is taken. We will measure free and easy range of motion, which is defined as pain-free movement of the joint up to the point of increased resistance. For some participants this will mean moving the joint beyond the onset of mild discomfort.

For purposes of recording, the goniometer measurement will always be an angle between the arms of the goniometer ranging from 0° and 180°, read from the black numbered scale on the standard SOF goniometer. The 'stationary' arm of the goniometer is the arm attached to the circular dial calibrated in degrees. The moveable arm pivots around the circular dial.

II. Subject Preparation

Dress: The participant should be wearing slacks, sweatpants, or surgical pants that can be rolled up past the knee. Shoes, socks, stockings, and pantyhose should be removed.

"This part of the examination looks at the movement of your hips, knees, ankles, and toes, and any pain you may have during these motions. The movement of these joints is important for mobility and balance and is sometimes compromised by arthritis. I'll be making measurements on both sides using this instrument (show goniometer). I'll move each joint through its range and take measurements of the range of motion. I want you to tell me

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if any of these movements cause you any pain. I'll also be checking your knees, ankles, and feet for tenderness.

III. Examination and Measurement Procedures:

A. LIMB ABNORMALITY BY OBSERVATION

1) Before the participant gets on the exam table, ask whether she has had a hip or knee replacement and record the information.

"Have you ever had a total hip replacement? (If yes 'Which side?'
Have you ever had a total knee replacement? (If yes 'Which side?')"

2) Ask her to roll the legs of her slacks up above the knees.

"Stand with your feet and knees as close together as you can."

With the examinee standing and knees exposed, observe the knees for genu valgus (knock-kneed, Figure 1) and genu varum (bowlegged, Figure 2) deformity.

3) Observe and record lower limb paralysis, presence of a cast, or amputation.

B. HIP (SUPINE POSITION)

1) Assist the participant in lying down on the examination table.

"Let's start with the hip. I'll move it through its range of motion by lifting and turning. Tell me if you feel any pain in your hip during these movements."

Start with the left side. Movements of the hip are shown in Figure 3.

2) Hip Flexion.

a) With the examinee lying on her back, and both legs lying flat on the table, place your hand under her knee and cradle the heel in the other hand.

"I'm going to lift your leg and bring your knee toward your chest.

b) Gently lift the participant's leg, and move the knee toward the chest until the subject notes pain, winces, or grimaces, or until there is increased resistance to movement. Ask:

"Does this hurt?"

Note pain.

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c) With the subject's help (Figure 4), hold the hip at its maximum free and easy range and measure degrees of flexion.

"Please hold your leg there just like that. Put your hand on your shin to steady it while I make a measurement."

Place the stationary arm of the goniometer alongside and parallel to the long axis of the trunk and the moveable arm along the lateral midline of the femur, with the pivot point over the greater trochanter. Read the small angle of the goniometer (between 0° and 180° degrees). (Figure 5)

d) Record pain and degrees of motion.

e) Repeat procedures for right side.

3) Hip Abduction. DO NOT DO ON SIDE OF HIP REPLACEMENT DUE TO RISK OF DISLOCATON.

a) Palpate the anterior superior iliac spines (ASIS) (Figure 6) and mark each with a piece of tape.

b) Set the angle of the goniometer to about 140° and hold in the hand closer to the subject's head. Align the stationary arm of the goniometer on a line parallel with the two pieces of tape, with the pivot over the ASIS on the side to be measured. The moveable arm of the goniometer should be on top. Ask the participant to help hold the goniometer in place.

c) Standing by the side of the examinee, place the other hand under the examinee's heel. (Figure 7)

"Now I'm going to carry the weight of your leg while you move your leg as far sideways as possible. Keep your knee straight. Does this hurt?"

Lift the leg just off the table and then pull it away from the body until you feel resistance, or the subject notes pain, or grimaces, etc. Be careful not to rotate the leg as you move it outward. Keep the toe pointed toward the ceiling. Note pain.

d) With your thumb, align the movable arm of the goniometer along the midline of the femur, and then move the leg back to the starting position without changing the angle of the goniometer.

e) Read the small angle of the goniometer (less than 180°). (Figure 8)

f) Record pain and degrees of motion.

g) Repeat procedures for right side.

4) Internal and External Rotation of the Hip

NOTE: This measurement is taken with subject sitting on the edge of the table.

a) Have the participant sit with her legs over the side of the table and knees flexed to 90° , with her hands on her knees to help hold the goniometer and to keep buttocks on the table. Ask her to keep her "bottom on the table." Kneel, crouch, or sit in front of the participant.

b) Have the participant hold the goniometer with the pivot over the patella of the left knee and the stationary arm over the patella of the right knee. (Figure 10) (You may use an elastic strap around the calf to help hold the moveable arm in position parallel to the tibia.)

c) Internal Rotation. Hold the left leg at the shin. Making sure that she does not raise her hips or buttocks from the table and that the goniometer remains parallel to the table top, move her left leg (and the arm of the goniometer) to the outside through its free and easy range. If necessary, have the subject assist in moving the joint through its range. Ask "Does this hurt?"

Read the angle quickly and then return the leg to the starting position. Or, return the leg to its starting position without changing the angle of the goniometer and read the angle.

d) Read the small angle between the arms of the goniometer (between 90° and 180°)

e) Record pain and degrees of motion.

f) External Rotation. Grasp the leg at the shin and move the leg to the inside through its free and easy range. Ask "Does this hurt?"

Obtain the goniometer reading (small angle between 0° and 90°) and return the leg to starting position.

g) Record pain and degrees of motion. (Figure 10)

h) Repeat for the right leg. Align the stationary arm of the goniometer across the patellae of the knees and parallel to the tabletop, with the pivot over the right patella. The stationary arm should be pointing in the opposite direction as for the left leg measurement. Be sure to keep it parallel to the table top during rotation of the hip. The range of possible angles is the same as for the left leg.

C. KNEE (SUPINE POSITION)

1) With the bare knee exposed and extended and leg lying relaxed on the table:

a) Palpate the joint for tenderness.

"I'm going to put a little pressure on the area around your knee. Is that tender?"

i) Press firmly down on the patella. (Figure 11) Note any tenderness.

ii) Rest your left hand on the patella to stabilize the knee. With your right hand below the knee, press the medial and lateral joint spaces with your thumb and forefinger. (Figure 12) Note tenderness.

b) Record tenderness for each knee. NOTE: If subject has total knee arthroplasty, record 'unable to examine'.

2) Conduct ROM for left knee (OK to examine if total knee replacement)

a) Place your right hand under the examinee's knee and your left hand on the heel of the foot.

"I'm going to move your knee now by bringing your foot toward your thigh. Does this hurt your knee?"

b) Lift the leg so the heel is just off the table and bend the knee. Slowly move the foot back towards the buttocks until the participant notes pain, winces, grimaces, or until there is increased resistance to movement.. Note pain.

c) To measure degrees of knee flexion, ask the participant to help hold the leg in position. If necessary, use sandbags on the foot to maintain the position.

"Please try to hold your leg there just like that. Put your hand on your thigh to steady it while I make a measurement."

Place the stationary arm of the goniometer on a line from the lateral condyle of the femur to the greater trochanter. Place the moveable arm on a line with the lateral malleolus (ankle bone). The pivot point is over the lateral condyle of the femur. (Figure 13) Read the small angle between 0° and 180°.

d) Record pain and degrees of motion.

e) Repeat procedures for the right side.

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D. ANKLE (SUPINE POSITION)

1) Palpate the left ankle for tenderness by compression of the area just below the malleoli at the medio-lateral and anterior surface.

I'm going to apply pressure around your ankle. "Is this tender?"

Record tenderness.

2) Conduct pain with ROM exam for the left ankle.

a) Dorsiflexion (Figure 14):

Hold the examinee's heel with your right hand (Figure 15), letting the sole of the foot rest against your forearm. Steady the shin with your left hand. Press your forearm against the ball of the foot, moving it back toward the leg through its range of motion. At the same time, pull on the heel. Ask "Does this hurt?" Note pain.

b) Plantar flexion (Figure 14):

Hold the ankle as for dorsiflexion (Figure 15). With your left hand, press against the top of the foot below the toes. Push down on the foot to point the toes, and at the same time, push against the heel to the limit. Ask "Does this hurt?" Note pain.

c) Record pain separately for plantar and dorsiflexion.

d) Repeat procedures for the right side.

E. JOINTS OF THE FOOT AND TOES (SUPINE POSITION)

1) Palpate the joints of the 2nd through 5th toes of the left foot as a unit for tenderness by applying pressure at the metatarsalphalangeal (MTP) joints (Figure 16).

"I'm going to apply pressure to your toes. Is this tender?"

Compress the joints between thumb and forefinger, with thumb and forefinger on the dorsal (top) and plantar (sole) surfaces of the foot. Apply pressure to all four joints (not necessarily all at the same time). Record tenderness.

2) Palpate the MTP and interphalangeal joints of the great toe.

a) Compress the MTP joint between thumb and forefinger in the same manner as for toes 2-5. Ask "Is this tender?"

b) Palpate the interphalangeal joint of the great toe (Figure 16) by applying lateral pressure between thumb and forefinger on the medio-lateral aspect of the joint. Ask "Is this tender?"

- c) Record tenderness for great toe.
- 3) Conduct ROM exam of toes of left foot.
- a) Move the 2nd through 5th toes as a unit by anchoring the toes at the MTP joint (Figure 16) with one hand and, with the other, gently extending and flexing the joints (as a unit) through their free and easy range (Figure 17). Note pain.
 - b) Move the great toe by anchoring the toe at the MTP joint (Figure 16) with one hand (grab the ball of the foot) and, with the other, gently extending and flexing the joint through its free and easy range (Figure 17). Note pain.
 - c) Record tenderness and pain on motion for 2nd through 5th toes. Record tenderness and pain on motion for great toe.
- 4) Repeat procedures for right side.

IV. Recording of Findings and Definitions

Limb Abnormality by Observation

Genu Valgus and Genu Varum: Deformity is as depicted in Figures 1 and 2. Marked Genu Varum is defined as ≥ 3 finger widths between the knees when ankles, heels, or lower legs are touching. Mild Genu Varum is defined as 2 finger widths. Less than two widths is absent.

Total hip and knee replacement: The right and left leg will be coded separately. If you check a "Yes" box, do as much of the examination as possible, recording where you are "unable to examine". This condition will limit the completeness of the examination and is important to record.

Paralysis: The right and left leg will be coded separately. Check the "Yes" box for right and/or left leg if the right and/or left leg is paralyzed. Otherwise, check "No". Paralysis for purposes of this study will be the loss or impairment of motor function in the leg. If you check a "Yes" box, do as much of the examination as possible, recording where you are "unable to examine". This condition will limit the completeness of the examination and is important to record.

Cast: Check the "Yes" box for the right and/or left leg if the right and/or left leg has a cast on it. A cast for purposes of this study will include a soft cast which cannot be removed or a stiff dressing or casing made of bandage impregnated with Plaster of Paris or other hardening material, used to immobilize the leg. If you check a "Yes" box, do as much of the examination as capable, recording where you are "unable to examine". This condition will limit the completeness of the examination and is important to record.

Amputee: The right and left leg will be coded separately. Check the "AK" box if the right and/or left leg has been amputated above the knee. Check the "BK" box if the right and/or left leg has been amputated below the knee. Otherwise, check the

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"No" box. If you check a "Yes" box, do as much of the examination as capable, recording where you are "unable to examine". This condition will limit the completeness of the examination and is important to record.

Joints - Tenderness, Range of Motion, and Pain

Tender on Palpation: The examinee's response is an indication of the inflammation in the joint and the degree of response roughly correlates with the severity of the inflammation. Other variables may influence the examination, such as: amount of pressure applied by the examiner, pain tolerance of the examinee, other deficits, and to some degree which joint is being palpated. While applying pressure to each site, the examiner should ask "Is this tender?" For purposes of this study tender on palpation will include any of the following:

- a) a complaint of tenderness;
- b) a complaint of tenderness and wincing;
- c) wincing and an attempt to withdraw.

Any of the above mean tenderness is present.

Pain on Passive Motion is the degree of a patient's discomfort when a joint is moved passively through its free and easy range of motion. Thickened, inflamed synovial tissue or a tense joint effusion will limit the free and easy range of motion and result in pain. The patient's response is used as an indicator of inflammation in the joint and the degree of response will roughly correlate with the severity of the inflammation. Other variables, however, may influence this examination, including attempts to move the joint beyond the normal extremes of range of motion, the pain tolerance of the examinee, other diseases and joint incongruity and/or malalignment. At the point of resistance for each joint, or when the participant grimaces, the examiner should ask "Does that hurt?" For purposes of this study joint pain on motion will include any of the following:

- a) complaint of pain;
- b) complaint of pain with wincing;
- c) wincing and attempt to withdraw.

Free and Easy Motion - Each diarthrodial joint can be moved passively through one of several arcs of motion. Joint limitation of motion or loss of motion is a reduction in the arc or arcs of normal motion of joint due to pathological processes. The participant may experience pain before the examiner notes any resistance to movement. Move the joint to the point where resistance to movement is first noted, or where the participant notes pain, winces, grimaces, etc. The joint should be moved beyond mild discomfort. This will not cause injury to the participant.

Hip Joint (right and left coded separately)

Pain on Passive Motion: True hip pain is usually localized to the groin or may radiate to the anterior thigh. Check the "Yes" box if the examinee exhibits pain on passive motion in the hip joint on flexion, rotation and /or abduction. Check the "No" box if there is no pain on passive motion.

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Passive Free and Easy Range of Motion - The hip joints will be coded separately for degrees of passive range of motion for flexion, abduction, internal rotation, and external rotation.

Knee Joint (right and left coded separately)

Tenderness on Palpation: Check the "Yes" box if there is tenderness in the knee joint during either compression of the patella or compression of the medio-lateral joint space. Check the "No" box if there is no tenderness.

Pain on Passive Motion: Check the "Yes" box if the examinee exhibits pain on passive flexion of the knee joint. Check the "No" box if there is no pain on passive flexion.

Passive Free and Easy Range of Motion - The right and left knee joints will be coded separately for degrees of passive range of flexion.

Ankle Joint (right and left coded separately)

Tenderness on Palpation: Check the "Yes" box if there is tenderness in the ankle joint on palpation. Check the "No" box if there is no tenderness.

Pain on Passive Motion: Check the "Yes" box if the examinee exhibits pain on passive motion in the ankle joint, separately for dorsiflexion and plantar flexion. Check the "No" box if there is no pain on passive motion.

Feet and toes (right and left coded separately)

Tenderness on Palpation: If any of the 2nd through 5th toes of the foot exhibit tenderness on palpation, check the "Yes" box, if not, check the "No" box. If the great toe exhibits tenderness on either palpation of the MTP joint or palpation of the interphalangeal joint, check the "Yes" box. If not, check "No."

Pain on Passive Motion: If any of the 2nd through 5th toes of the foot exhibit pain on passive motion, check the "Yes" box, if not, check the "No" box. If the MTP joint of the great toe of the right or left foot exhibits pain on passive motion, check the "Yes" box for great toe, if not, check the "No" box

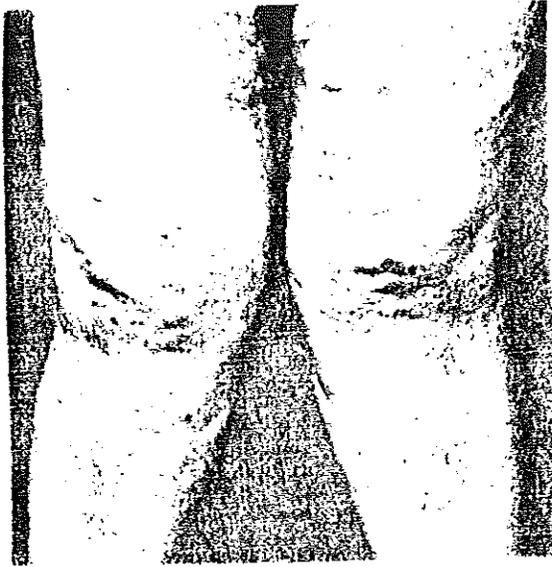


FIGURE 1
Genu valgus deformity
(knock knees)

FIGURE 2
Marked genu varum
(varus deformity; bow legs)

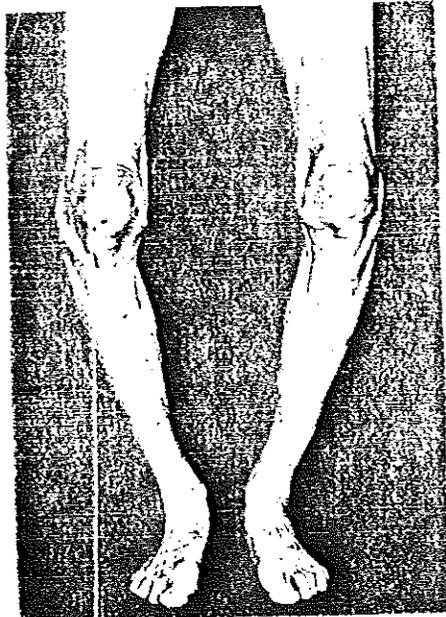
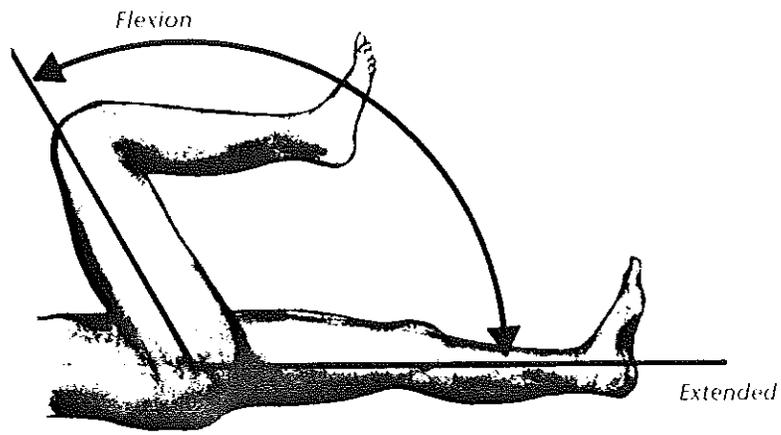
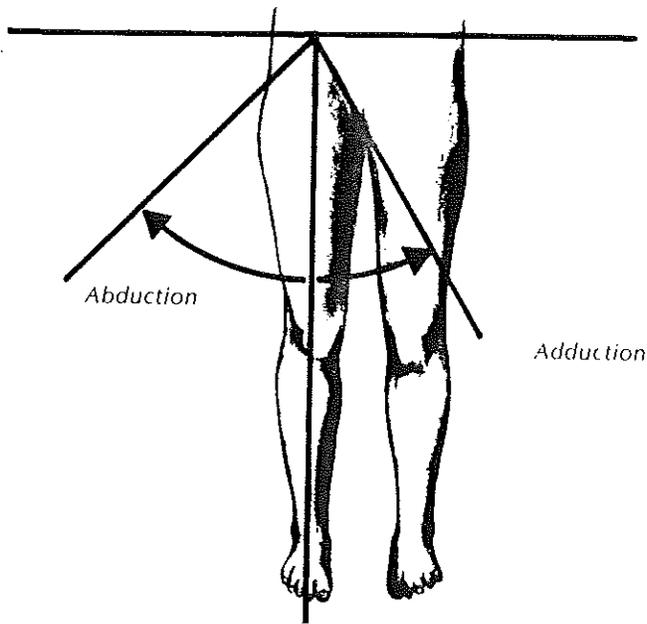


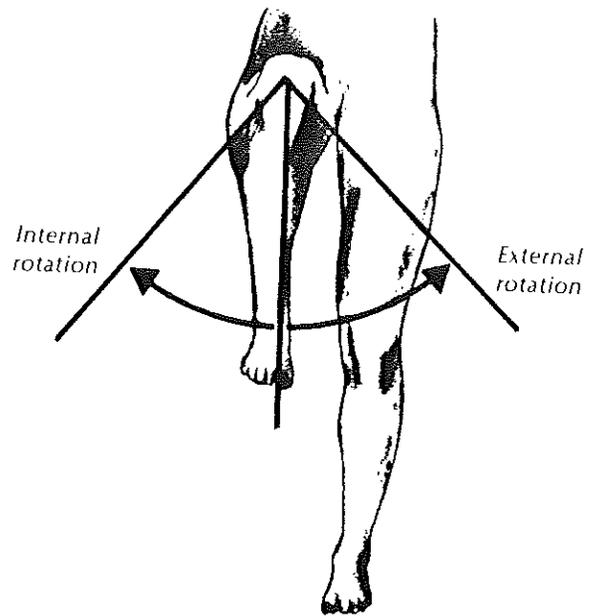
FIGURE 3
Movements of the hip



Flexion



Abduction



Internal and external rotation

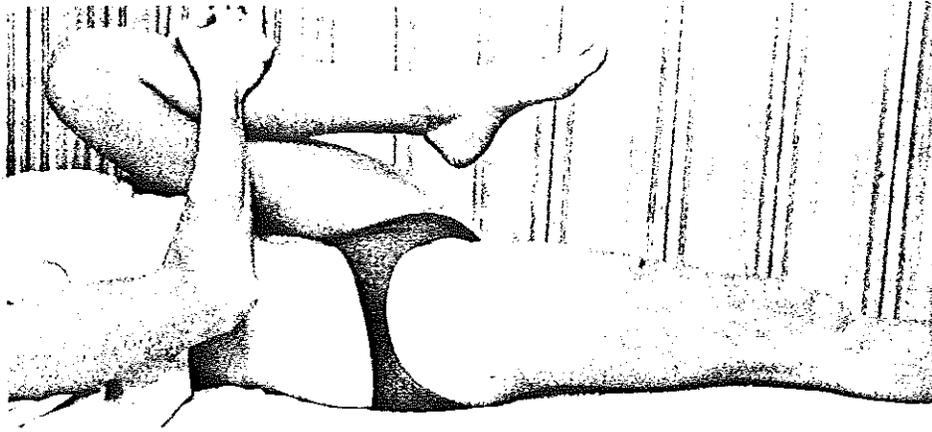


FIGURE 4
Holding hip in flexed position

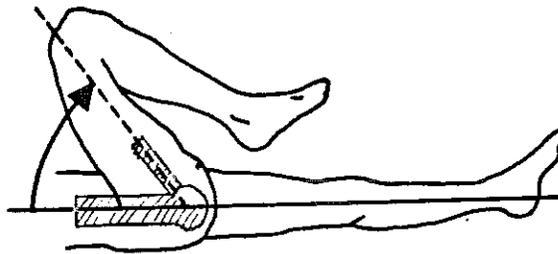


FIGURE 5
Goniometer placement for hip flexion

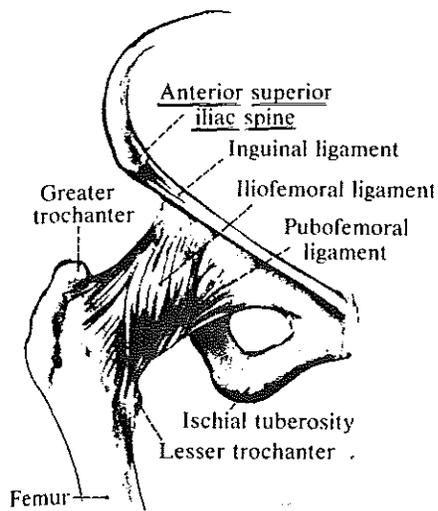


FIGURE 6
Anterior iliac spine

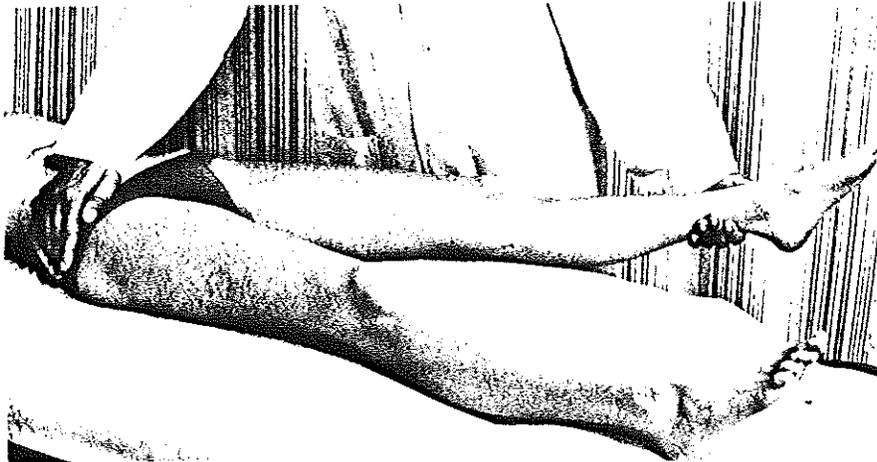


FIGURE 7
Hand placement for hip abduction

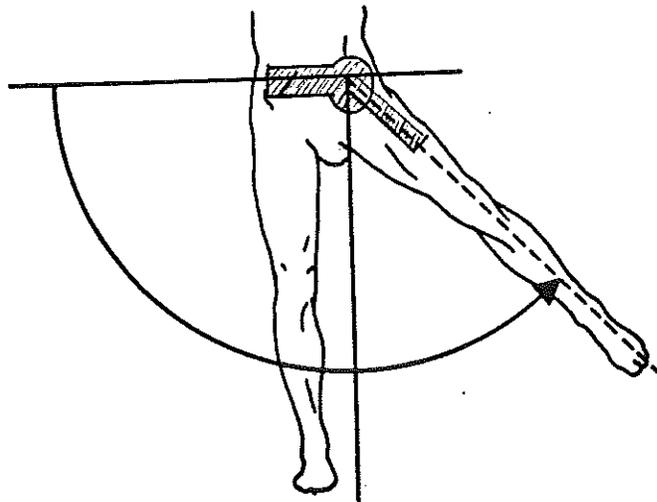


FIGURE 8
Goniometer placement for hip abduction

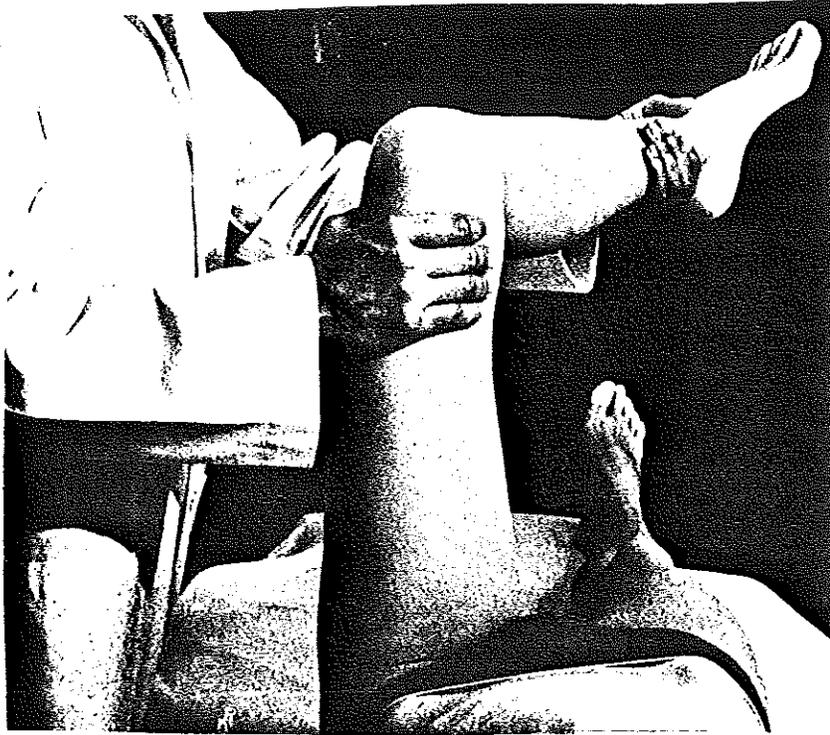


FIGURE 9
Hand Position for internal and external rotation

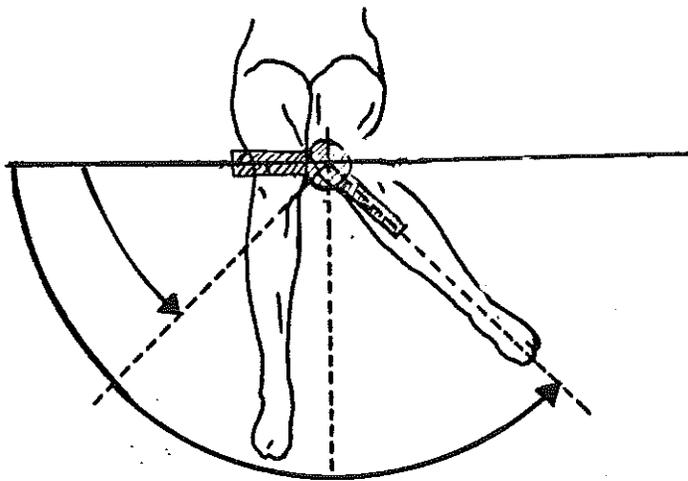


FIGURE 10
Goniometer placement for internal and external rotation
of hip with subject sitting

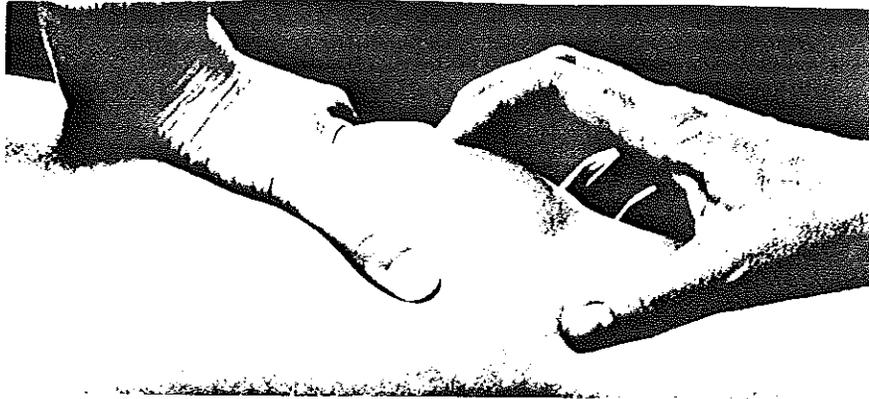
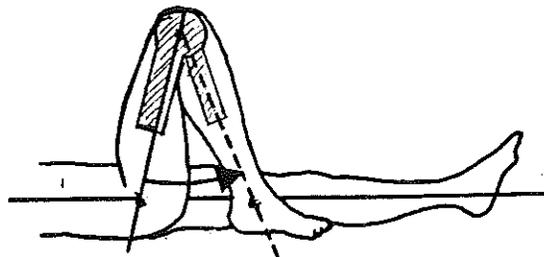


FIGURE 11
Palpating the patella of the knee



FIGURE 12
Palpating the joint line of knee

FIGURE 13
Goniometer placement for
knee flexion



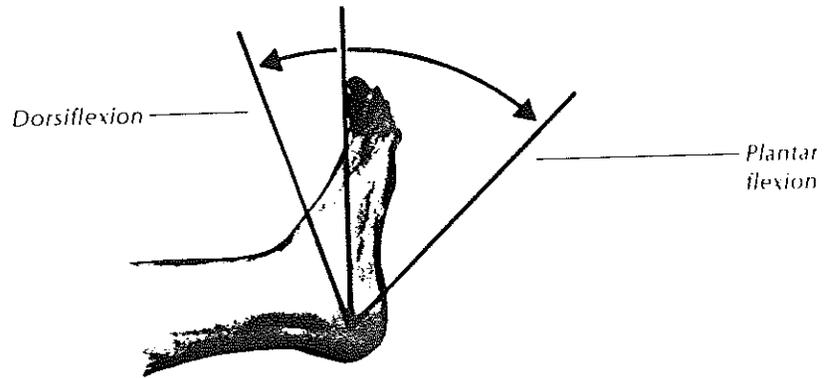


FIGURE 14
Plantar and dorsiflexion of ankle

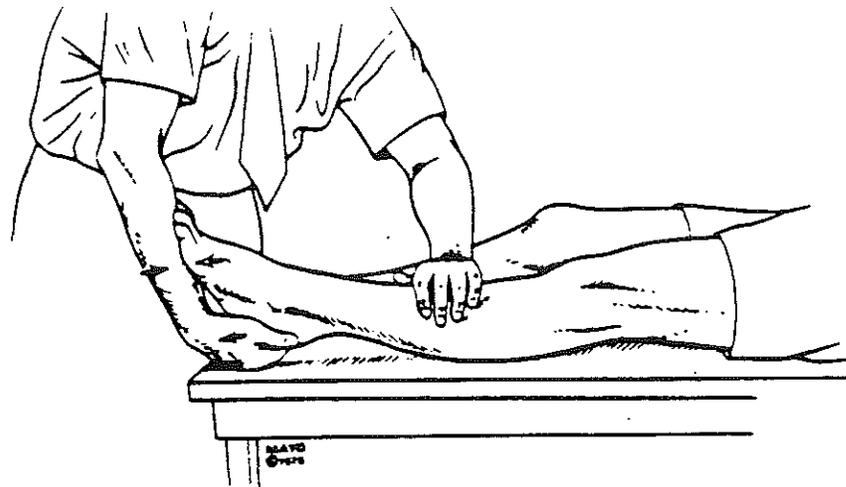


FIGURE 15
Hand position for
Plantar and dorsiflexion of ankle

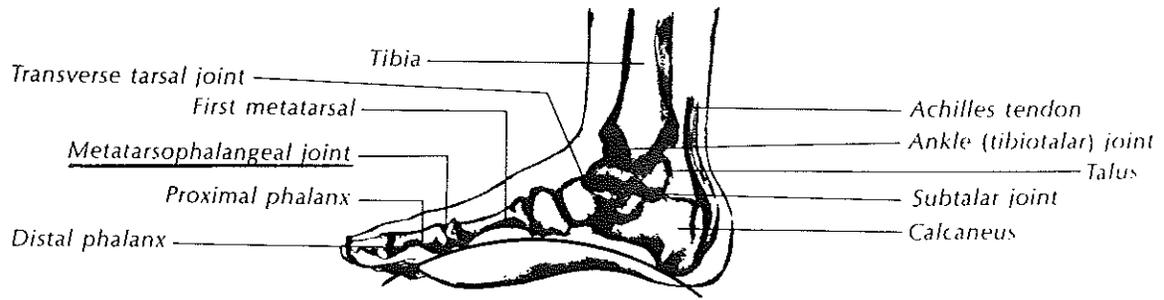


FIGURE 16
Joints of foot and toes

FIGURE 17
Normal ROM of MTP joints of toes

