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Rehabilitation post Total Hip joint Replacement Operation

Bachelor Thesis

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Preface

The main goal of the program of therapeutic rehabilitation for patients after operation of total hip joint replacement (THR), or any other orthopedic problem is to achieve motion and functionality of limbs without symptoms, restoration of disability and return of patient back to his/her normal life. World's Health Organization defines health as "***A state of complete physical, social and mental wellbeing and not merely the absence of disease or infirmity***". Health is a resource for everyday life, not the object of living. Furthermore, health is considered as a fundamental human right.

For the most effective application of therapeutic rehabilitation techniques and exercises on a patient, the therapist should have knowledge about the basic principles and effect of exercise in the musculoskeletal, neuromuscular, cardiovascular and respiratory systems. In addition, the therapist should be able to provide an efficient assessment of the patient (physically and psychologically), know the correlation of anatomy and kinesiology of the treated area and understand the condition of the injury, pathology or surgical approach as well as the possible rhythm of recovery, complication, prevention and contraindication.

With these criteria in mind, my thesis is divided into two sections. The first part is the general part; it explains the theoretical part with respect to subjects such as anatomy, kinesiology, and pathology and operation procedure. In the second part I will demonstrate plane & physical therapeutic rehabilitation of the patient. It contains anamnesis of the patient, assessment and rehabilitation within the two weeks practice on patient post hip arthroplasty.

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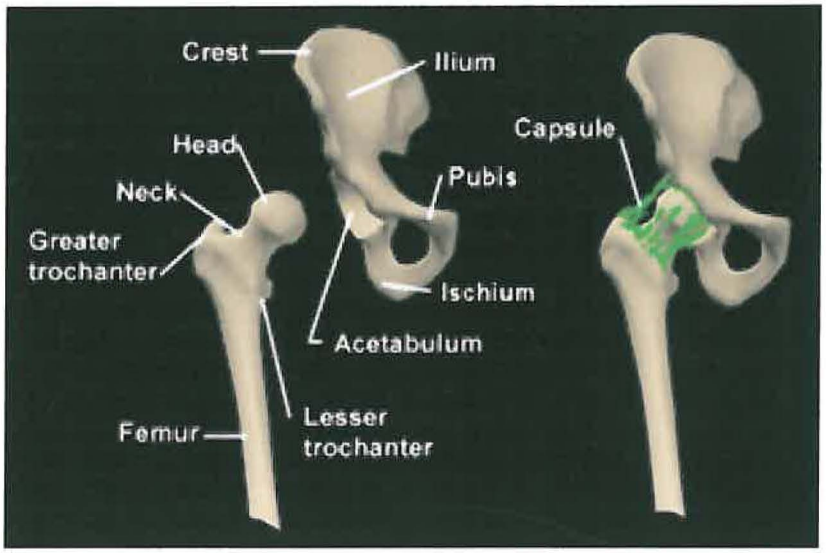
1. Anatomy of the hip joint

Articulation

The hip joint formed by the reception of the head of the femur into the cup-shaped cavity of the acetabulum (figure1). The articular cartilage on the head of the femur, thicker at the center than at the circumference, covers the entire surface with the exception of the fovea capitis femoris, to which the ligamentum teres is attached; that on the acetabulum forms an incomplete marginal ring, the lunate surface. Within the lunate surface there is a circular depression devoid of cartilage, occupied in the fresh state by a mass of fat, covered by synovial membrane.(7)

Figure 1 anatomy of hip. (18)

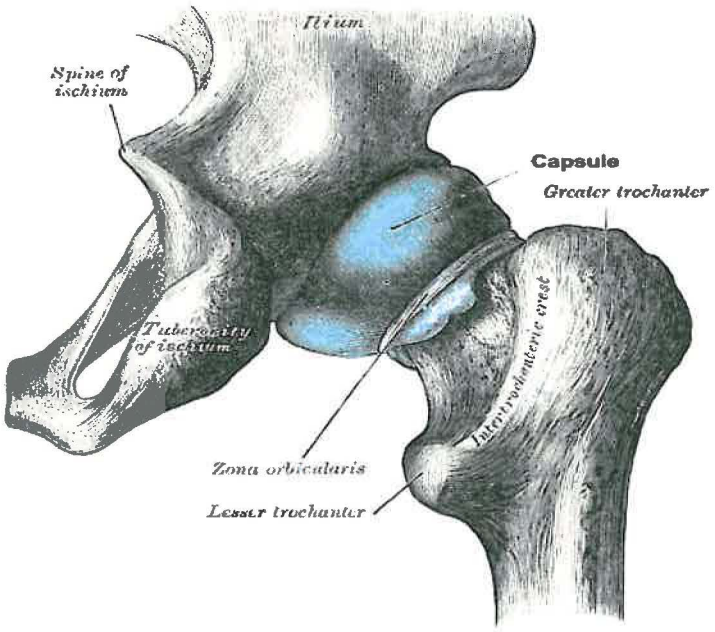


The hip joint capsule

Articular capsule is strong and dense (figure2). it is attached to the margin of the acetabulum 5 to 6 mm. beyond the glenoidal labrum behind; but in front, it is attached to the outer margin of the labrum, and, opposite to the notch where the margin of the cavity is deficient, it is connected to the transverse ligament, and by a few fibers to the edge of the obturator foramen. It surrounds the neck of the femur, and is attached, in front, to the intertrochanteric line; above, to the base of the neck; behind, to the neck, about 1.25 cm .Above the intertrochanteric crest; below, to the lower part of the neck, close to the lesser trochanter. From its femoral attachment some of the fibers are reflected upward along the neck as longitudinal bands, termed retinacula. The capsule is much thicker at the upper and forepart of the joint, where the greatest amount of resistance is required; behind and below, it is thin and loose. It consists of two sets of fibers, circular and longitudinal. The circular fibers, zona orbicularis, are most abundant at the lower and back part of the capsule, and form a sling or collar around the neck of the femur. Anteriorly they blend with the deep surface of the

iliofemoral ligament, and gain an attachment to the anterior inferior iliac spine. The longitudinal fibers are greatest in amount at the upper and front part of the capsule, where they are reinforced by distinct bands, or accessory ligaments, of which the most important is the iliofemoral ligament. The other accessory bands are known as the pubocapsular and the ischiocapsular ligaments. The external surface of the capsule is rough, covered by numerous muscles, and separated in front from the Psoas major and Iliacus by a bursa, which not infrequently communicates by a circular aperture with the cavity of the joint. (7)

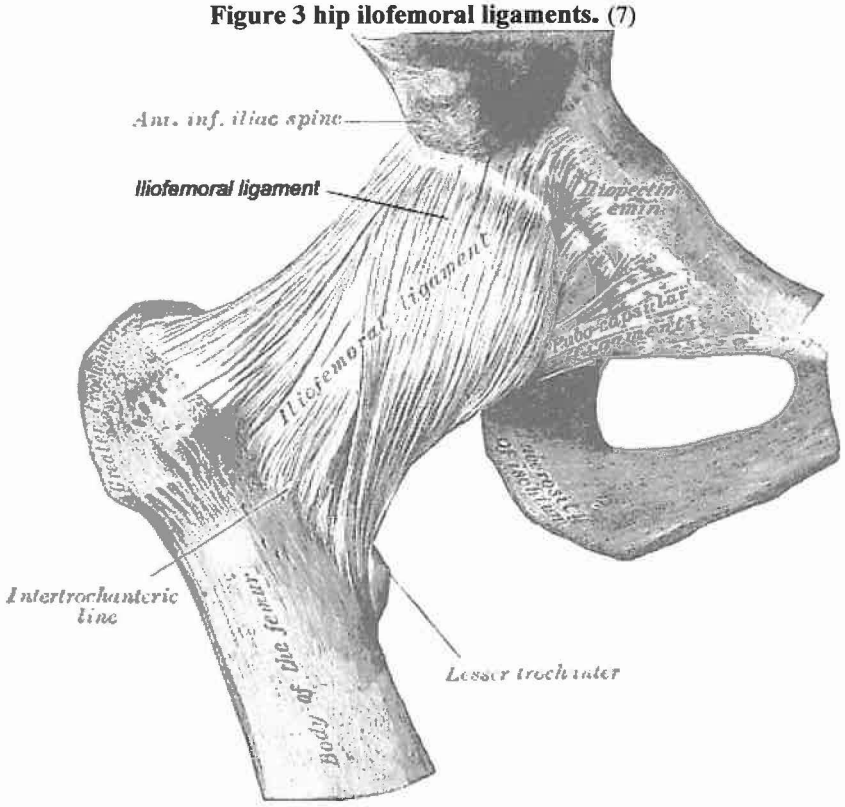
Figure 2 hip capsule. (7)



Hip joint ligaments

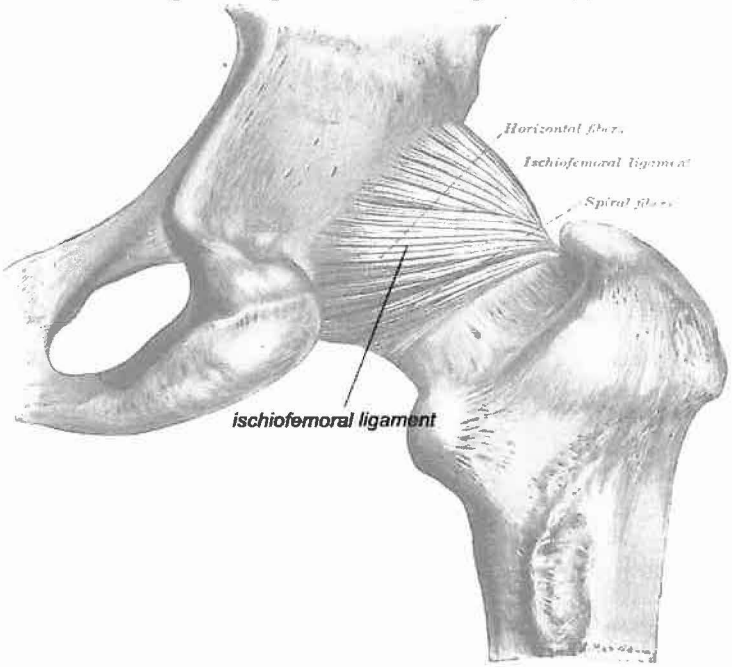
Iliofemoral ligament; the iliofemoral ligament (figure3) is a band of great strength which lies in front of the joint; it is intimately connected with the capsule, and serves to strengthen it in this situation. It is attached, above, to the lower part of the anterior inferior iliac spine; below, it divides into two bands, one of which passes downward and is fixed to the lower part of the intertrochanteric line; the other is directed downward and laterally and is attached to the upper part of the same line. Between the two bands is a thinner part of the capsule. In some cases there is no division, and the ligament spreads out into a flat triangular band which is attached to the whole length of the intertrochanteric line. This ligament is frequently called the Y-shaped ligament of Bigelow; and its upper band is sometimes named the iliotrochanteric ligament. (7)

Figure 3 hip ilofemoral ligaments. (7)



Pubofemoral ligament; this ligament is attached, above, to the obturator crest and the superior ramus of the pubis; below, it blends with the capsule and with the deep surface of the vertical band of the iliofemoral ligament. The ischiofemoral ligament; Ischiofemoral ligament (figure 4) consists of a triangular band of strong fibers, which spring from the ischium below and behind the acetabulum, and blend with the circular fibers of the capsule. (7)

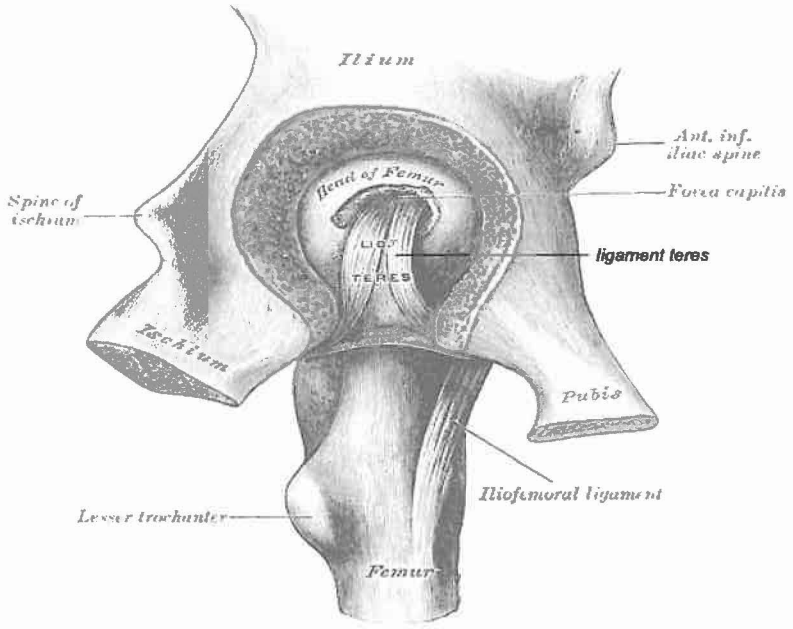
Figure 4 hip ischiofemoral ligament. (7)



The ligamentum teres femoris; ligamentum teres femoris is a triangular (figure 5), somewhat flattened band implanted by its apex into the antero-superior part of the fovea capitis femoris; its

base is attached by two bands, one into either side of the acetabular notch, and between these bony attachments it blends with the transverse ligament. It is ensheathed by the synovial membrane, and varies greatly in strength in different subjects; occasionally only the synovial fold exists, and in rare cases even this is absent. The ligament is made tense when the thigh is semiflexed and the limb then adducted or rotated outward; it is, on the other hand, relaxed when the limb is abducted. It has, however, but little influence as a ligament. (7)

Figure 5 hip ligament teres femoris. (7)



The glenoidal labrum; is a fibrocartilaginous rim attached to the margin of the acetabulum, the cavity of which it deepens; at the same time it protects the edge of the bone, and fills up the inequalities of its surface. It bridges over the notch as the transverse ligament, and thus forms a complete circle, which closely surrounds the head of the femur and assists in holding it in its place. It is triangular on section, its base being attached to the margin of the acetabulum, while its opposite edge is free and sharp. Its two surfaces are invested by synovial membrane, the external one being in contact with the capsule, the internal one being inclined inward so as to narrow the acetabulum, and embrace the cartilaginous surface of the head of the femur. It is much thicker above and behind than below and in front, and consists of compact fibers. Transverse ligament; is in reality a portion of the glenoidal labrum, though differing from it in having no cartilage cells among its fibers. It consists of strong, flattened fibers, which cross the acetabular notch, and convert it into a foramen through which the nutrient vessels enter the joint. *Synovial membrane* is very extensive. Commencing at the margin of the cartilaginous surface of the head of the femur, it covers the portion of the neck which is contained within the joint; from the neck it is reflected on the internal surface of the capsule, covers both surfaces of the glenoidal labrum and the mass of fat contained in the depression at the bottom of the acetabulum, and ensheathes the ligamentum teres

as far as the head of the femur. The joint cavity sometimes communicates through a hole in the capsule between the vertical band of the iliofemoral ligament and the pubocapsular ligament with a bursa situated on the deep surfaces of the Psoas major and Iliacus. (7)

Table 1 muscles which act on hip joint *(see figure 6,7)*

Muscles that contribute to hip flexion (16)	
Muscle	**Action**
Iliopsoas	Hip flexion
Rectus Femoris	Hip flexion, knee extension
Pectineus	Flexion , adduction, medial rotation of hip
Sartorius	Hip flexion, knee flexion , external rotation of hip
Tensor fascia latae	Flexion and abduction of hip (tends to internally rotate hip as it flexes)
Muscles that contribute to knee extension (16)	
Quadriceps Femoris	
-Rectus Femoris	Hip flexion, knee extension
-Vastus Lateralis	Knee extension
-Vastus Intermedius	Knee extension
Muscles that contribute to hip adduction	
Adductor magnus	Hip adduction, lateral rotation as hip adducts
Adductor brevis	Hip adduction, lateral rotation as hip adducts
Adductor longus	Hip adduction, lateral rotation as hip adducts
Gracilis	Hip adduction, knee flexion, medial rotation of hip
Muscles that contribute to hip abduction (16)	
Gluteus medius	Abducts thigh at hip joint and medially rotates thigh
Gluteus minimus	Abducts thigh at hip joint and medially rotates thigh
Tensor fasciae latae	Flexes and abducts thigh at hip joint
Piriformis	Laterally rotates and abducts thigh at hip
Obturator internus	Laterally rotates and abducts thigh at hip
Obturator externus	Laterally rotates and abducts thigh at hip
Superior gemellus	Laterally rotates and abducts thigh at hip
Inferior gemellus	Laterally rotates and abducts thigh at hip
Muscles that contribute to hip medial rotation (6)	
Gluteus medius	Abducts thigh at hip joint and medially rotates thigh
Gluteus minimus	Abducts thigh at hip joint and medially rotates thigh
Gracilis	hip adduction, knee flexion, medially rotation of hip
Pectineus	Flexion, adduction, medial rotation of hip
Muscles that contribute to hip lateral rotation (6)	
Piriformis	Laterally rotates and abducts thigh at hip

Obturator internus	Laterally rotates and abducts thigh at hip
Obturator externus	Laterally rotates and abducts thigh at hip
Inferior gemellus	Laterally rotates and abducts thigh at hip
Superior gemellus	Laterally rotates and abducts thigh at hip
Adductor magnus	hip adduction, lateral rotation as hip adducts
Adductor brevis	hip adduction, lateral rotation as hip adducts
Adductor longus	hip adduction, lateral rotation as hip adducts

Figure 1 muscles of the thigh (11)

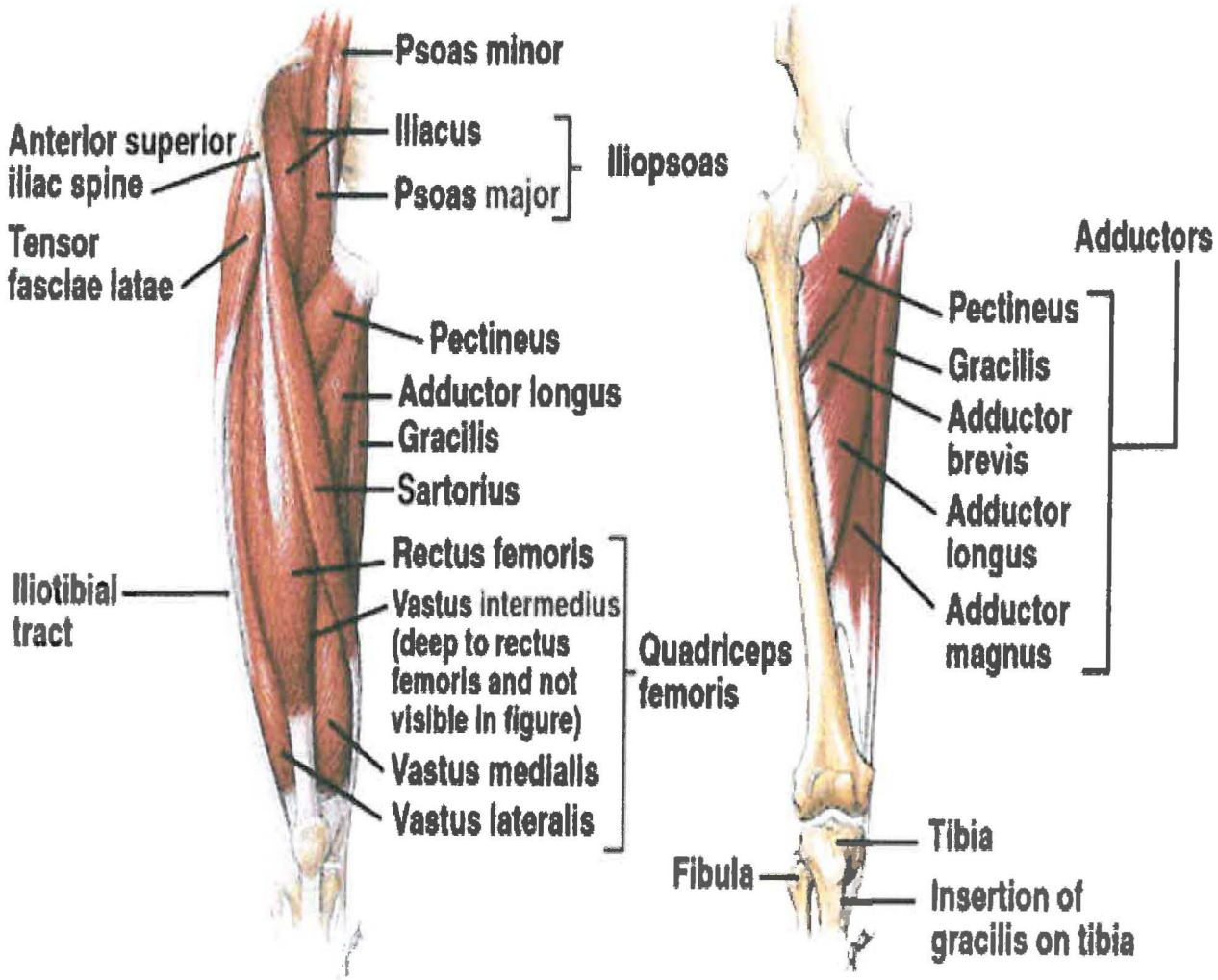
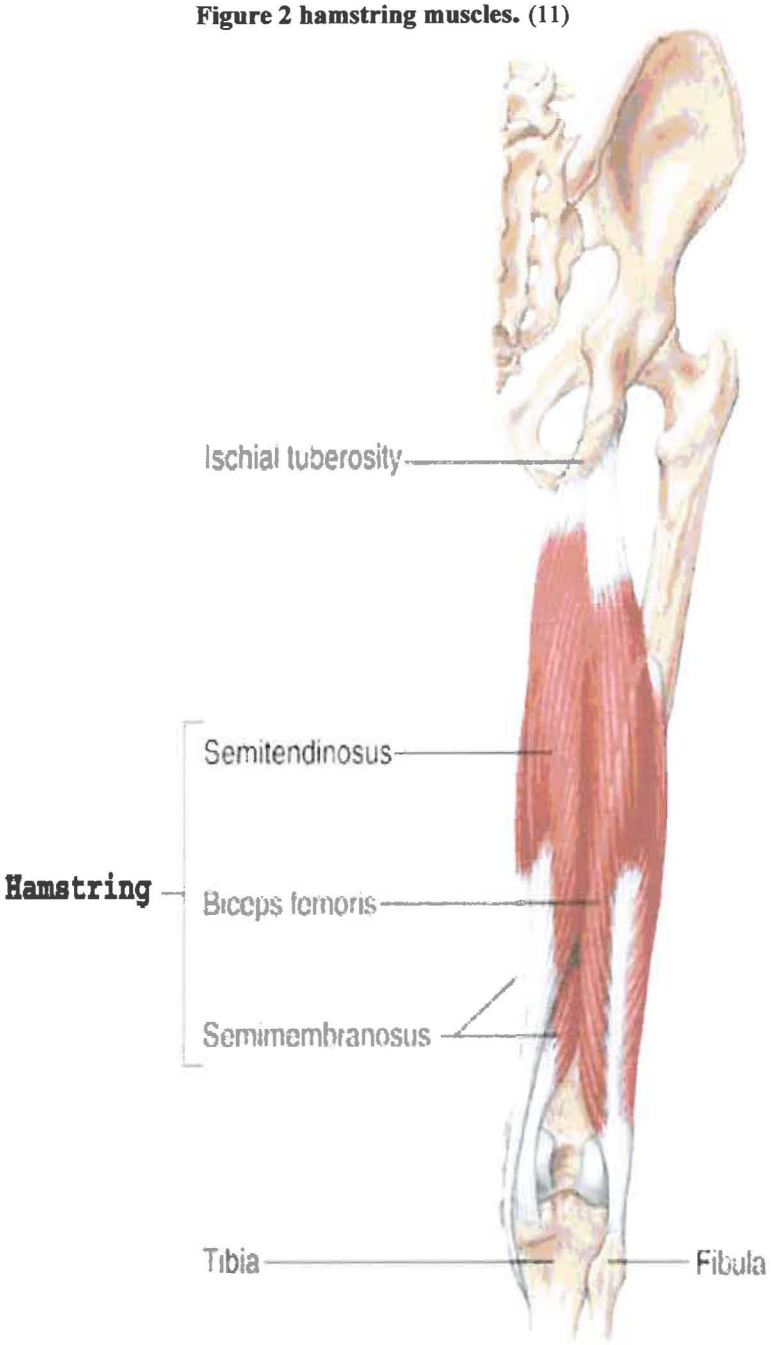


Figure 2 hamstring muscles. (11)



Arterial supply

Arterial supplies of the joint are derived from the obturator, medial femoral circumflex, and superior and inferior gluteal arteries. (6)

Nervous innervation

Articular branches from the sacral plexus, sciatic, obturator, accessory obturator nerves, and a filament from the branch of the femoral nerve innervating the Rectus femoris. (6)

2. Osteoarthritis of the hip joint (coxarthrosis)

Osteoarthritis of the hip or (coxarthrosis) is one of the commonest causes of disability in the Western world. The condition is essentially mechanical wearing out of the hip joint rather than a disease and can be the hip joint rather than a disease and can be caused by many things. Trauma, obesity and previous infection can all be followed by coxarthrosis but there is probably a genetic element as well. The disease is much less often seen in Asiatic races.

The characteristic symptoms of the diseases are:

1. Deformity at the hip joint which lead to loss hip movements.
2. Abnormal walking and gait.
3. Hip joint pain.

The pain is worse on weight bearing and movements of the hip but also occurs at rest and disturbs sleep. The pain is dull and aching in character at first but becomes sharper as the disease progresses. Pain is usually felt in the groin but pain down the outer side of the thigh is also its common. Some patients also have pain low in the thigh, around the knee, and become convinced that the trouble lays in the knee not the hip. Referred pain of this type is a well known diagnostic pitfall but still confound unsuspecting. Also movement is lost because osteophytes form around the joint and change the shape of the Joint surfaces. As the movement is lost flexion, adduction and external rotation deformity develops. The flexion deformity is compensated for by hyperextension of the lumbar spine and this can cause backache. The adduction deformity causes apparent shortening of the leg and patients often complain that "my leg is getting shorter!" The stiffness makes it difficult to tie shoe-laces, put on socks or cut toenails. The walking are affected due to the restriction at the hip joint, pain, and partly to an analgesic gait which that patient is trying to walk avoiding the load of body weight on the hip joint this great abnormal gait which has biomechanical disturbance . (2)

Pathology

Osteoarthritis of the hip begins with fibrillation of the articular surface and formation of wear particles (figure 8) and (figure9). Wear particles are swept to the side of the joint where they irritate the synovium and are responsible for some of the patient's pain and the formation of osteophytes. As the disease progresses articular cartilage is lost, subchondral bone is exposed and the bone surfaces become irregular. The grooves form in the joint surfaces and the hip is gradually converted from a ball and socket into a roller bearing. Later, cysts form in the bone and the femoral head may collapse untreated, the hip becomes fixed in flexion , adduction and external rotation, a position which interferes seriously with mobility.(2)

Figure 8 hip joint osteoarthritis (coxarthrosis). (14)

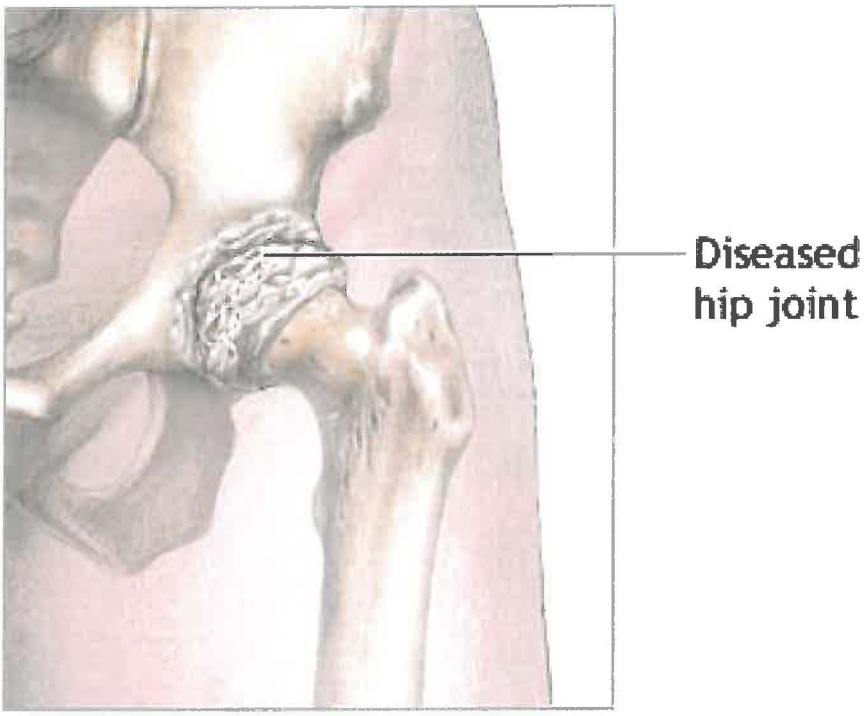
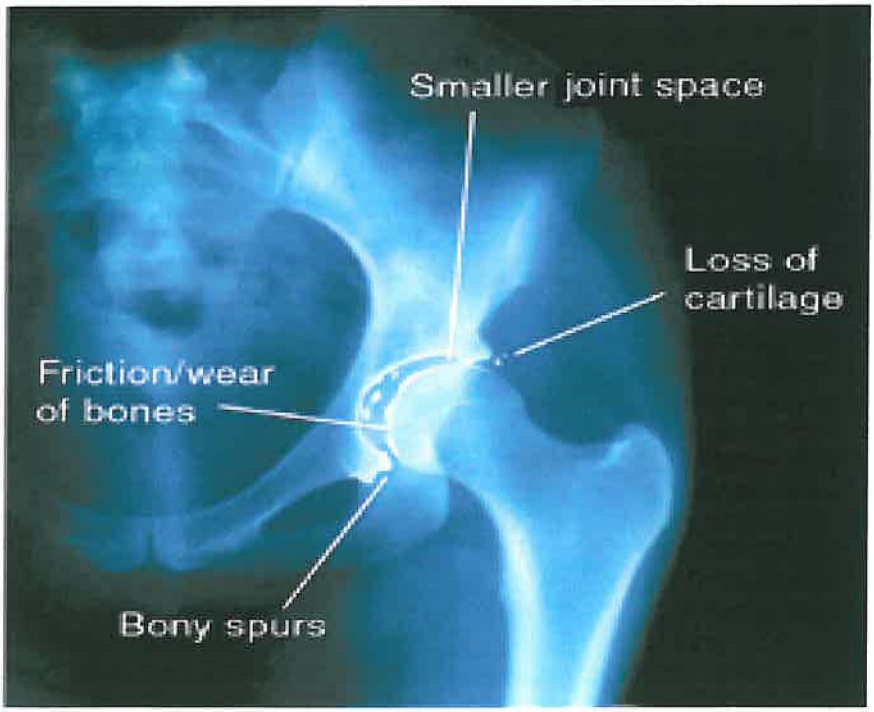


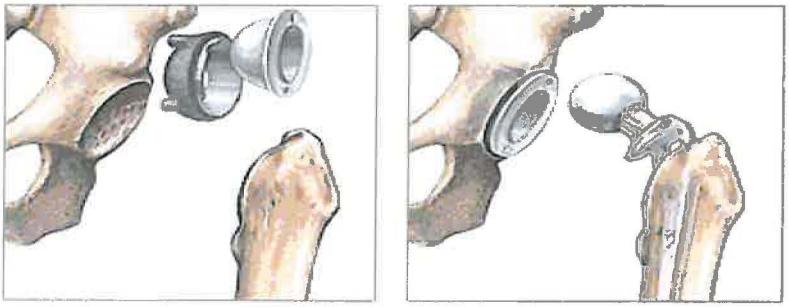
Figure 9 x-ray image of hip joint osteoarthritis (3)



3. Operation of total hip joint replacement

Total hip replacement (THR) is the most popular operation for osteoarthritis of the hip and consists of replacing both surfaces of the joint with artificial materials the acetabulum is reamed out to take a cup and the femoral head replace with a metal ball attached to a stem inserted in the Femoral shaft (figure 9). There are many types of hip replacement but most have a femoral component made either of stainless steel or a chrome cobalt molybdenum alloy and a cup made of high density polyethylene. Both components are usually fixed to the skeleton with cold medicinal acrylic cement. Some prostheses are now inserted without cement fixation relying on bone growing in to irregularities on the surface of the component. The size and shape of the pore in to which bone can grow is critical in securing fixation. Ceramic components are also used and new designs are continually being introduced. It is performed on patients aged 30-40 years. (2)

Figure 10 hip joint arthroplasty. (14)



Types of artificial hip replacement

There are two major types of artificial hip prosthetic:

- Cemented prosthesis.
- Uncemented prosthesis.

A cemented prosthesis (figure 10) is held in place by a type of epoxy cement that attaches the metal to the bone. An uncemented prosthesis (figure 11) bears a fine mesh of holes on the surface that allows bone to grow into the mesh and attach the prosthesis to the bone. Both are still widely used. In some cases a combination of the two types is used in which the ball portion of the prosthesis is cemented into place, and the socket not cemented. The decision about whether to use a cemented or uncemented artificial hip is usually made by the surgeon based on age and lifestyle, and the surgeon's experience. (1)

Figure 11 cemented prosthesis. (1)

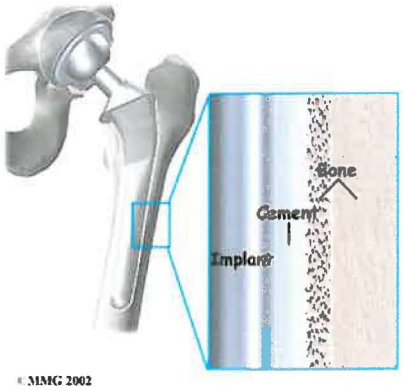
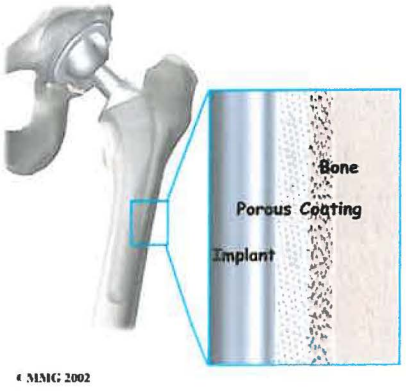


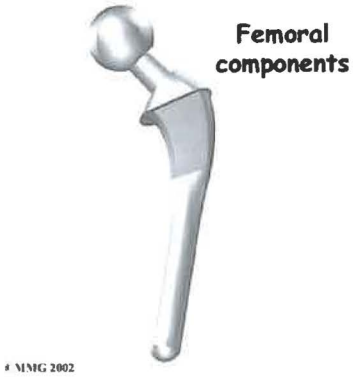
Figure 12 uncemented prosthesis. (1)



Each prosthesis is made of two main parts. The acetabular component (socket) replaces the acetabulum. The acetabular component (figure 12) is made of a metal shell with a plastic inner liner that provides the bearing surface. The plastic used is so tough and slick the femoral component (figure 13) (stem and ball) replaces the femoral head. The femoral component is made of metal. Sometimes, the metal stem is attached to a ceramic ball. (1)

Figure13 acetabular component. (1)

Figure 14 femoral components. (1)



Indications of Total hip replacement operation

Hip joint replacement is a major yet commonplace orthopedic procedure. The two main pathologies that lead to replacement surgery are osteoarthritis and rheumatoid arthritis, although other indications include congenital dislocation of the hip, trauma, necrosis of femoral head, and infection. An increasing number of patients are requiring revision surgery owing to implant failure from wear .The minimum life of a joint replacement should be 10 years m and many hip replacements can last over 20 years. (12)

The ideal patient for total hip replacement is a lightweight elderly lady who has severe pain and places few demands on her hip. The most unsuitable is a young, heavy, active man who wants to play football and return to heavy work. Between these two extremes the degree of pain and disability is weighed against the patient's age and physical requirements but in General total hip

Replacement should not be offered to the following types of patient:

- Those under the age of 60
- Those who are obese
- Those involved in physically demanding activities. (2)

Technique of the THR operation

The operation can be done in several ways and through several approaches.

The anterolateral approach, between tensor fasciae latae and the glutei, the posterior approach through the posterior capsule and the charnley approach with detachment of the greater trochanter detachment of the glutei and a portion of the vastus lateralis muscle. With all those approaches the principle is the same. The acetabular surface is prepared by removing all debris and soft tissue and the femoral head is removed. The acetabulum is then replaced with a prosthetic component which is fixed either mechanically or with bone cement the femoral head is then replaced and similarly secured. (2)

Prevention of infection after THR operation

Infection in a prosthetic hip is a disaster and great care must be taken to prevent it occurring during operation by the following measures:

- Careful asepsis during operation.
- Prophylactic antibiotics.
- Combination of the two.

Aseptic techniques; careful asepsis during operating enclosure with ultra-clean air changed continuously and impervious operating gowns with individual exhaust systems for expired air, can reduce the infection rate to 0.2%, but the operations may also be done in a standard operating theatre. Prophylactic antibiotics used in a standard operating theatre will produce a similar Infection rate to the operating enclosure. A regimen of flucloxacillin 500 mg started with the premedication and continued for three doses is effective. If the patient is allergic to penicillin, either erythromycin 400 mg or cephradine 500 mg four times daily may be used. Combining antibiotics with a clean air enclosure can reduce the infection rate still further. Inserting catheters immediately after operation runs the risk of infection. If it cannot be avoided catheterization should be done gently with complete sterility and covered with an appropriate antibacterial drug. Clean joint replacements should not be nursed in the same ward as abscesses, colostomies or patients with open infection avoiding cross-infection. (2)

Results of implantations of hip joint arthroplasty

The results of total hip replacement are spectacular with good or excellent results in approximately 98% of patients. The operation is most successful in relieving pain but some restoration of movement and an improved gait can also be expected. The results are so good that the operation has revolutionized hip joint surgery and brought Treatment too many who would otherwise have been untreatable. (2)

The complications operation of total hip joint replacement

No surgery can be totally effective and joint arthroplasty is no exception. In particular an artificial prosthesis has a finite lifespan. One of the studies examined the causes of failure 1151 Charnley low-friction total hip joint arthroplasty performed as primary procedures. The results:

- Hip revision 13%.
- Cup revision 8%.
- Radiographic femoral loosening 13%.
- Radiographic cup loosening 49%. (12)

Table 2 lists other complications and their possible solutions. (12)

Complication	Caused by	solution
Anesthetic risk (chest, heart)	General anesthetic	Careful preoperative anesthetic assessment, spinal anesthetic /epidural if necessary Appropriate respiratory physiotherapy
Infection	Open surgery	Prophylactic antibiotics post operation. Operate in a Charnley tent
Dislocation	Difficult surgery, poor surgical technique complex case, inherently unstable	Abduction wedge, no adduction/flex beyond 90 degrees, special restraining acetabulum may be used in cases of previous dislocation
Deep vein thrombosis or (DVT)	Pelvic surgery , immobility	Prophylactic anticoagulants, early mobilization by physiotherapists, release leg periodically during surgery to restore blood flow
Anemia	Blood loss during /post surgery	Transfuse if hemoglobin (Hp) below 10

Swollen ankle	ineffective muscle pump	Reassure , walk little and often, frequent rest in bed, compression stockings may help
Back pain	Unequal leg length or perceived by pelvis as unequal leg length	Reassure
Arm pain	Crutch walking	Time
Neck pain	Neck trauma due to neck being held in an extended position during the intubation	Time
Stiffness after immobility	Inflammatory exudates at rest	Reassure, walk little and often

Postoperative care

Some surgeons prefer to hold the hip in abduction by placing a wedge-shaped pillow between the patient's thighs for 2 days. This is particularly helpful if a Charnley hip Prosthesis with a small femoral head has been used. The suction drains are usually removed after 2 days when the patient may sit out of bed. They should not sit in a low chair because this flexes the hips beyond 90 degrees and can, in some circumstances, cause the hip to dislocate. Most patients are able to walk using elbow crutches within 4 or 5 days and can be discharged approximately 10 days after operation. By then the patients should be able to climb stairs using elbow crutches and Have a full range of normal activities of daily living. Between 6 and 12 weeds after operation most patients have little pain from their hip and an improved range of motion that allows then to resume normal activities. Heavy work, especially lifting and jumping, should be avoided indefinitely in case it stresses the bone-Cement interface. (12)

4. Examination of the hip joint

Obtaining the patient's history, 'anamnesis' is the first step of the examination. This will provide significant insight into the nature of the disorder. It is particularly important to inquire about the type, location and time of occurrence of the complaint. The clinical examination consists of observation , palpation , measuring leg length, the circumference of the muscles at standardized measuring points, assessing active and passive ranges of motion , observing gait with functional tests providing further information in certain lines of the inquiry. (4)

Patient anamnesis and history

The patient's history can provide helpful information about the presence and possible causes of the hip disorder. The history provides and will help with the diagnostic anamnesis, location of pain, time, duration of pain and pain intensity as well as giving us the patient's age. (4)

Observation

The patient is observed standing up or lying down *as in the case after the operation of total hip joint replacment.* If the patient cannot stand up, we can observe him at lying position this can provide important information about posture.

We observe:

- The orientation of the pelvis (pelvic obliquity, pelvis tilt, flexion contracture of the hip).
- Deviation of the axis of the legs (genu valgum, genu varum).
- Rotation of the legs.
- Foot deformities.
- Structure of the spinal column (scoliosis, tilt).
- Shape of the scar, swelling and erythema.
- Muscle contour asymmetry.
- Muscle atrophy. (4)

Palpation

To palpate the hip, first is to locate the origins and insertion of the hip muscles to evaluate tendon disorders involving the muscular insertions. Muscle hypertonus in the Iliopsoas often occur after the operation we can palpate this muscle going deep under the abdominal muscles and feel the tonicity or spasm of this muscle if present. (4)

Measurement of lower extremity lengths

Leg lengths are measured during the preoperative phase, measurement can be performed radiologically and clinically by measuring the actual leg lengths. However, during the operative process, leg lengths can change, depending on how the prosthesis was fixed or stabilized or depending on how much bone needed to be removed, among other surgical considerations. In the postoperative phase, it is important, therefore, to correct any leg-length discrepancy by using appropriate orthoses or heel lift. Correction of any discrepancies has a direct impact on the gait pattern, as well as on the development of low back pain.

Apparent *(functional)* leg length discrepancy is measured from the xiphoid of the sternum or umbilicus to the tip of the medial malleolus.

True leg length discrepancy is measured, from the anterior superior iliac spine to medial malleolus. A difference in leg length of up to 1-2 cm is considered normal by some clinicians. (12)

Measuring of circumference of the muscles of thighs

- Quadriceps femoris circumference is measure above the patella 15 cm.
- Vastus medialis circumference is measure above the patella 10 cm.
- Circumference of the calf is measure at the higher curve of calf.

Ranges of joint motion

Typical normal values for hip:

- Flexion: 120°.
- Extension: 10–20°.
- Abduction: 45°.
- Adduction: 25°.
- External rotation 45°
- Internal rotation 45°(12)

Muscles power test (9)

- Quadriceps femoris

Position: sitting with knees over side of table holding on to table.

Motion: extension of the knee joint without rotation of the thigh.

Pressure: against the leg above the ankle in the direction of flexion.

- Gluteus maximus

Position: prone with knee flexed 90° or more with stabilizing the pelvis and trunk by the therapist hand.

Pressure: against the lower part of the posterior thigh in the direction of hip flexion.

- Gluteus medius:

Position: side lying.

Motion: abduction of the hip.

Pressure: against the leg in the direction of adduction.

- Hip Abduction

Position: side laying the contralateral leg is bent at the knee and the patient grasps the table with the ipsilateral hand to provide stabilization and to prevent rolling.

Motion: The leg to be tested is raised about 12 inches off the table and the examiner.

Pressure: downward.

Examination of muscles shorting and hypertonicity (10)

- Quadriceps femoris: the quadriceps is more commonly weak than it is tight. Often rectus femoris tightness is mistaken for quadriceps tightness. To test this muscle rectus femoris patient lay prone position we flex the leg at the knee joint and feel the barrier or if present restriction.
- Gastrocnemius: patient lays in supine we provide passive dorsal flexion at ankle without allowing the knee to bend of the foot with the special fork finger method for grasping of the Achilles tendon and we feel the barrier normal range is 10° dorsal flexion.
- Soleus: patient lays in supine we provide passive dorsal flexion at ankle with knee flexion we feel the barrier normal rang is 20° dorsal flexion.
- Iliopsoas: we apply the examination with modification of the position in more comfortable way for the patient and without risk of dislocation we put a pillow under lumbar spine and we feel if there is present restriction or that that the leg is not reaching the horizontal line *(We can also examine Iliopsoas by palpation).*
- Adductors: the patient lays in supine first we stabilize the contralateral superior anterior iliac spin then we abduct thigh with knee extended for to joint adductor muscles and flexed knee for on joint adductor muscles normal range is 40 ° .

Gait Evaluation

Gait evaluation is very closely related to the Posture Evaluation and should be following in the patient's examination order. Observing the gait from the front, back, side and assessing the patient with and without a walking whilst observing:

- Stride length symmetry
- The time spent on the single leg support phase on each leg
- Corresponding factors of pain, stiffness and/or weakness during the cycle. (12)

5. Physiotherapeutic methods post operation total hip joint replacement

Soft Techniques

Free mobility of fascia is essential for normal muscles and joint function where we can apply a soft technique which includes massages and stretching for skin, subcutaneous tissues and fascia.

- Stretching of soft tissue can be applied on the patient for stretching subcutaneous tissues and fascia around the thigh. We can use the shifting techniques to provide stretching for fasciae over the tensor fasciae latae (iliotibial tract) and gluteus fascia. For stretching of the gluteus fascia we use respiratory synkinesis to improve the stretching.
- Massage for the muscles of the thigh, quadriceps femoris, adductors, and hamstrings.
- We can start the management of the scar when the stitches are removed, by applying soft massage and by (S) shape shifting.

  -Aims:

  - The aim of applying soft tissue techniques is to improve the fascia elasticity, therefore improving the function of the muscles and joints.
  - Improving the blood circulation which will help fast recovery and healing for the patient. (10)

Passive, assisted and active exercises

When performing active, assisted or passive exercises we have to be aware of contraindicated movements, to prevent dislocation of the hip arthroplasty.

Contraindicated movements after the operation are:

- Crossed-legged position = operated legs should not cross the body axis
- External rotation and adduction of operated leg.
- Flexion of more than 90°. (2)

Passive movements: is created entirely by an external force with the absence of voluntary muscle activity on behalf of the patient. This external force may be applied by the physiotherapist or by a machine e.g. *continuous passive motion (CPM)*. Passive exercises are typically employed in the early stages of rehabilitation.

Aims for applying passive movement are:

- Prevent thromboembolism and improve blood circulation.
- Protection and improving range of motion.

Figure 15 hip and knee flexion. (17)

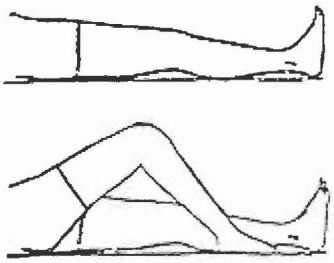


Figure 16 active abduction. (17)

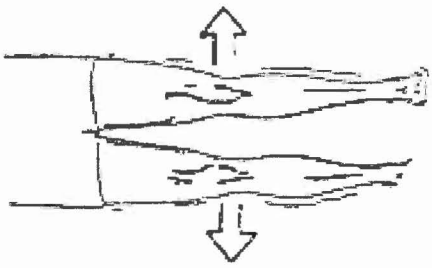


Figure 17 Knee extensions. (17)

Figure 18 quadriceps contraction. (17)

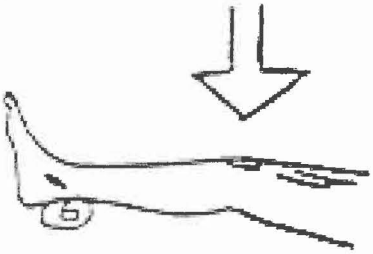
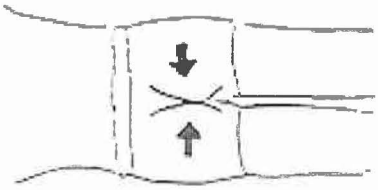


Figure 19 gluteus contractions. (17)



Post isometric relaxation (PIR)

The technique relieves muscle spasm, stiffness and muscles hypertonicity. In the case after total hip joint replacement operation, usually Iliopsoas, tensor fasciae latae, adductors, and hamstrings muscles get hypertonic. We apply PIR with modification of the position to make it more comfortable with the patient and without risk of dislocation. E.g. while applying PIR for iliopsoas we put a pillow under the lumbar spine and we use breathing with the help of gravity to stretch the muscle. (10)

Balancing training and sensory motor stimulation

The principle of sensory motor stimulation based on the concept of motor learning. By applying a new motor program to stimulate and re-educate proprioceptive system and extraproceptive system circuits that play an important role in stability and equilibrium of posture. Receptors from the sole can be stimulated in different ways e.g., by stimulation of skin receptors or more effectively by forming the so called short or small foot activation of intrinsic muscles. We can apply sensory stimulation on foot by brushing and stimulating skin receptors, activating intrinsic foot muscles and

we can provide balance training using balance balls that are efficient for kinesthetic stimulation. Rolls from polyester can be used to help activate the trunk muscles in general. (10) These rolls are used mostly while the patient is supine and they do not overstress the spine, trunk and hip and are ideal to use after total hip joint replacement operation.

Aims of sensory motor stimulation

- Provide early afferent input to a joint.
- Restore reflex stability.
- Restore normal neuromuscular coordination.
- Enhance the neuromuscular response. (12)

Proprioceptive neuromuscular facilitation (PNF)

These techniques are used to facilitate or train an inhibited or weak muscle. The therapist provides the resistance with precise patient positioning and movement which gives the therapist full control to a degree not possible with machines or free exercises. Manual contact also allows for proprioceptive stimulation to facilitate an inhibited muscle during active resistance

Aims:

- Increase muscle strength
- Improve coordination (10)

Note: some therapists say that PNF cannot be applied as a proper technique after hip arthroplasty due to the fact that it has contraindicated motion components. It can be applied on patients with modifications in the technique and components by adding slight isometric resistance from the foot to the hip while the lower limb remains in the starting position. This can give the desired aim to the patients. (8)

Physical therapy

After total hip joint replacement operation, it is fine to use some physical therapy to enhance the rehabilitation program and speed up healing process. Diadynamic current is a proper physical agent used to increase the muscle power, reduce the pain and increase the blood supply around the operated area. Another physical agent we can use after the operation is low power laser for management of the scar and the speeding up of healing.

Daily living activities (D L A) post total hip joint replacement operation.

The patient may be issued with crutches and advised him to gradually increase weight-bearing over the next 6 weeks. A long-term rule is to avoid high impact activities as sudden high pressures cause the most wear to the plastic. Plastic particulates have an exponential wear action that involves the alloy head and the cement mantle bone interface. Further exercises may be required following

clinic review and the appropriate referral can made. Some centers offer outpatient rehabilitation programmes. (12)

It is recommended to give some Instruction to the patient on what he should do or not do:

- To change the position from supine to prone position patient should put a pillow between the legs when he is turning.
- To sit from supine, the patient should support the operated leg with the healthy leg and move them out of the bed and then put the operated leg down the bed.
- To stand from sitting the patient should use crutches; in sitting the patient should not flex the hip more than 90 ° (figure 20); this includes sitting on soft couch and driving a car.
- Patient should not move his operated hip towards his chest (flexion) any more than a right angle of 90°.
- Patient should not sit on a chair without arms he must support his arms (figure 21).
- Patient should not cross his operated legs across the midline of the body (in towards the other leg) (figure 22). (17)

Figure 20 sitting position. (17)

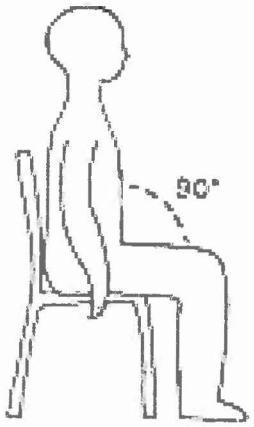


Figure 21 chair without arms. (17)

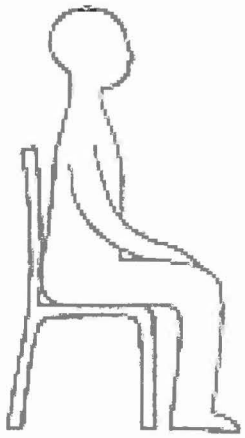
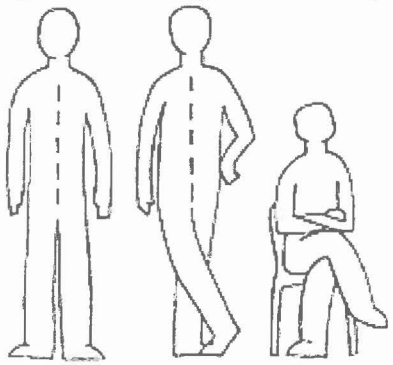


Figure 22 cross leg over midline. (17)



6. Patient anamnesis and history

Name: M, Miloš

Year of birth: 1938

Diagnosis: primary osteoarthritis of left hip joint (coxarthrosis).

Hospitalization: From 22.1.2004 to 6.2.2004

Anamnesis:

- *FA*: Father died when he was 68 year's old after ischemic heart disease; mother died when she was 78 year's old after ischemic heart disease.
- *PA*: common children's' diseases only; Chicken pox, mumps, measles.
- Injury: 0.
- Operation: 0.
- Hypertension: patient on medication, he is normal with Moduretic 1\2 in morning.
- Other disease: thrombophlebitis.
- *AA:* allergic to dust and chlorine.
- *PH A*: Moduretic, analgesics.
- *SA*: lives with wife.
- Diet: 0.

History of the disease: The disease started 15 year's ago, the pain progressed in the last 2 years. For the last 4- 5 months the patient had great pain in the hip. He was taking analgesics, had spa therapy and was recommended for artificial implantation of the effected hip joint; Total hip replacement (THR) of the left hip joint.

X-RAY*: Left Hip joint*; the cartilage practically does not exist; many bone calcifications in the left hip joint, and there was deformity of the head of femur.

Present State pre operation: Medical report showed that patient had much pain at the left hip joint and lower back; the pain characteristic was dull and sharp; the patient had his left lower limb adducted, external rotated and slight flexed at the hip joint; the pain increases when patient walks, or move the left limb and he had more pain when he makes internal rotation at the left hip joint. The patient was medically observed continuously, well oriented, he had no heart problems breathing was symmetrical and calm, cardiopulmonary compensated, he was without sign of acute infection, pupils were isochronally reacting to light, throat was normal, lymph nodes were of normal size , the aortic artery was regular. If palpated patient had Painful Iliopsoas, rectus femoris; other findings of stomach was soft and without any resistance of the liver and spleen was normal percussion: bilateral findings were negative.

Theoretical consideration

Pre operatively, the leg was short due to a typical position of the hip joint coxarthrosis. The effected leg had adduction with external rotation and flexion at hip joint which is biomechanically disturbing *(e.g. some pelvofemoral muscles becomes short like Iliopsoas or/and adductors muscles)*. The surgery corrects the length by elongation the short pelvofemoral muscles but if there are no changing to new adaptive parameters post operation the hypertonicity and elongated muscles will be a source of pain, the physiotherapist aiming to stop this pain by muscle relaxation techniques, stretching techniques and exercises. (5)

During the operational procedure there will be damage to the connective tissue, pelvofemoral muscles, stabilizing muscles, ligaments and femoral fascia.

Post operatively, the stability of the arthroplasty depends on the association of the artificial femur with the acetabulum. This stability depends on four factors:

1. The surgical fixing position of hip joint arthroplasty, artificial femur and cup.
2. The suture of the iliotibial tract and femur *(the suture should be very strong)*.
3. The strength of the anti luxation muscles *(e.g. the gluteal muscles)*.
4. The stability of the new hip joint arthroplasty is much better when the healing process starts to take place. (5)

Exercising anti luxation and pelvofemoral muscle groups will improve the stability function of new hip joint arthroplasty these muscles are: gluteal muscles, Iliopsoas and quadriceps femoris.

The danger of luxation of the total hip joint replacement is decreased by the elimination of forbidden movements, mainly external rotation, and adduction, flexion of 90 ° and hyperextension of the lower limb at the hip joint. (5)

7. Pre rehabilitation Initial kinesiological examination

The operation day was at Friday 23.1.2004

Present state: post operation after the surgery of total hip joint replacement at day 0 *of the rehabilitation program*, the patient was hospitalized in the unit of intensive care in the orthopedic department. The patient was connected by monitors controlling the blood presser, heart rate and breathing frequency. Patient received intravenous droops containing analgetic, anti- thrombosis drugs, compensated several intravenous lines in place to provide fluids and nutrition. The intravenous droops will remain in its place until patient will be able to drink adequate amounts of fluids. After total anesthesia the patient experienced moderate to severe pain at the operated area. He had vertigo, he was afebrile, cardiopulmonary compensated, good bled skin and patient had no other complications. The operative area was covered by a sterile bandage and large dressing on the hip area and a small drainage tubs were placed during surgery to help drain excrete fluids out from the joint area.

The Initial kinesiological examination was done post operation on day 1 of the rehabilitation program Monday 26 .1.2004 at orthopedic department in Motol hospital.

The patient at this day was moved from the unit of intensive care to a stable ward in the same orthopedic department, the monitors were removed, he had intravenous droops containing fluids and nutrition solution also containing analgetic. The patient was psychologically calm, he was tired and fatigued, but he was reactant and cooperative. Patient was afebrile, cardiopulmonary compensated, the patient had moderate pain at the operated area, the operative area was covered by a sterile bandage and large dressing on the hip joint area and a small drainage tubes were excreting fluids from the joint area. At this day the initial kinesiological examination started and examination included:

Examination of posture by inspection

After surgery the patient couldn't stand still, posture inspection was in the lying position in *supine*

He had slight abducted left limb, had swelling around the left operated hip joint and thigh muscle was atrophied mainly the quadriceps femoris.

Palpation

- The left hip area was swollen.
- The left thigh muscles were atrophied and hypotonic mainly quadriceps femoris and gluteal muscles.

Anthropometry

-Height: 198cm Weight: 110kg

-Lower extremity length:

- Functional length: right 105cm, left 102cm
- Anatomical length: right 91cm, left 93cm

-Circumference of the thigh:

- Quadriceps femoris (15cm above patella): right 59cm, left 55cm.
- Vastus medialis (10cm above patella): right 49cm, left 49cm.

Ranges of motion of hip joints

Assessment of the patient hip joints ranges of motion. These assessment was done after the surgery, the patient was lying on his back it was modified than the normal typical assessment to be suitable and comfortable for the patient also it avoided the contraindicated movements *(see table3)*.

Table 3 hip joint range of motion measurement

Hip Joint Flexion	**Right**	**Left**
Patient position:	Supine, knee in flexion.	Supine, knee in flexion
Goniometer axis position:	Greater trochanter (the intersection of the thigh and trunk).	Greater trochanter (the intersection of the thigh and trunk).
Goniometer stationary arm position:	Horizontal body axis (along the side of the trunk).	Horizontal body axis (along the side of the trunk).
Goniometer moveable arm:	Greater trochanter to knee joint (along the lateral aspect of the thigh).	Greater trochanter to knee joint (along the lateral aspect of the thigh).
Type of making the movement :	Passive hip joint flexion.	Passive hip joint flexion.
Degrees:	90°	70°
Hip joint Extension	**Right**	**Left**
Patient position:	Prone, knee in extension.	Prone, knee in extension.
Goniometer axis position:	Greater trochanter (the intersection of the thigh and trunk).	Greater trochanter (the intersection of the thigh and trunk).
Goniometerstationary arm position:	Horizontal body axis (along the side of the trunk).	Horizontal body axis (along the side of the trunk).
Goniometer moveable arm:	Greater trochanter to knee joint (along the lateral aspect of the thigh).	Greater trochanter to knee joint (along the lateral aspect of the thigh).
Type of making the movement :	Passive hip joint extension.	Passive hip extension.
Degrees:	17°	5°

Hip joint Abduction	**Right**	**Left**
Patient position:	Supine, knee in extension.	Supine, knee in extension.
Goniometer axis position:	Ipsilateral anterior superior iliac spine.	Ipsilateral anterior superior iliac spine.
Goniometer stationary arm position:	Toward the contralateral anterior superior iliac spine.	Toward the contralateral anterior superior iliac spine.
Goniometer moveable arm:	Moveable arm in the thigh midline.	Moveable arm in the thigh midline.
Type of making the movement :	Passive hip joint abduction.	Passive hip joint abduction.
Degrees:	45°	20°
Hip joint Adduction	**Right**	**Left**
Patient position:	Supine, knee in extension.	Were not measured because are contraindicated post operation. Due to the risk of arthroplasty hip joint luxation.
Goniometer axis position:	Ipsilateral anterior superior iliac spine.	
Goniometer stationary arm position:	Toward the contralateral anterior superior iliac spine.	
Goniometer moveable arm:	Moveable arm in the thigh midline.	
Type of making the movement :	Passive hip joint abduction.	
Degrees:	20°	
Hip joint External Rotation	**Right**	**Left**
Patient position:	Supine, leg in flexion 90° at knee and hip joint.	Were not measured because are contraindicated post operation. Due to the risk of arthroplasty hip joint luxation.
Goniometer axis position:	Anterior aspect of the knee joint (middle of the patella).	
Goniometer stationary arm position:	The stationary arm is horizontal Parallel to body midline axis.	
Goniometer moveable arm:	Moves with lower leg.	
Type of making the movement :	Passive external rotation.	
Degrees:	40°	
Hip joint Internal Rotation	**Right**	**Left**
Patient position:	Supine, leg flexion 90° at knee and hip joint.	Supine, knee in extension.
Goniometer axis position:	Anterior aspect of the knee joint (middle of the patella).	Heel
Goniometer stationary arm position:	The stationary arm is horizontal Parallel to body midline axis.	The stationary arm Parallel to the floor.

ıeter moveable arm:	Moves with lower leg.	Moves with big toe.
f making the	Passive external rotation.	Passive internal rotation..
ıent :		
ːs:	40°	20°

ːle power test

ː tests provide an overview on strength of some muscles of the lower extremities these tests applied with some modification in the position caring the patient condition after surgery, the ıt was lying on his back. The tests were modified than the normal typical test to be suitable ːomfortable for the patient, also it avoided the contraindicated movements therefore it were in the supine position *(see table 4)*.

ː **4 muscle power test** (9)

ɜluteus maximus Muscles	**Right**	**Left**
nt position:	Supine, knee in extension.	Supine, knee in extension.
.imal fixation:	One therapist hand fixate ipsilateral posterior superior iliac spine.	One therapist hand fixate ipsilateral posterior superior iliac spine.
movement:	Leg extension at hip joint.	Leg extension at hip joint.
'apist resistant:	Other hand give resistant against leg extension at hip joint.	No resistant.
.ling:	3 fair	2 poor
Gluteus medius	**Right**	**Left**
ːnt position:	Supine, knee in extension.	Supine, knee in extension.
ɑimal fixation:	One therapist hand fixate Ipsilateral superior anterior iliac spine.	One therapist hand fixate Ipsilateral superior anterior iliac spine.
ɨ movement:	Leg abduction at hip joint.	Leg abduction at hip joint.
rapist resistant:	Other hand give resistant against leg abduction at hip joint.	No resistant.
ıding:	3 fair	2 poor
Adductors	**Right**	**Left**
tient position:	Supine, knee in extension.	Were not measured because are contraindicated post operation. Due to the risk of arthroplasty hip joint luxation.
ɔximal fixation:	One therapist hand fixate contralateral anterior superior iliac spine.	
ˈɜt movement:	Leg adduction at hip joint.	
erapist resistant:	Other hand give resistant against leg adduction at hip joint.	
ading:	3 fair.	

Quadriceps_femoris	Right	Left
Patient position:	Supine, leg flexion at hip and knee joint 90°.	Supine, semiflexion leg at hip joint.
Proximal fixation:	One therapist hand holds patient thigh anterior aspect.	One therapist hand hold patient thigh posterior aspect (patient hangs his leg on therapist hand).
Test movement:	Leg extension at knee joint.	Leg Extension at knee joint
Therapist resistant:	Other hand give resistant against leg extension at knee joint.	No resistant
Grading:	4 good	3 fair
Hamstrings	**Right**	**Left**
Patient position:	Supine, leg flexion at hip and knee joint 90°.	Supine, leg semiflexion at hip joint, knee in extension.
Proximal fixation:	One therapist hand holds patient thigh anterior aspect.	One therapist hand hold patient thigh posterior aspect (leg hangs on therapist hand).
Test movement:	Leg flexion at knee joint.	Leg flexion at knee joint
Therapist resistant:	Other hand give resistant against leg flexion at knee joint.	No resistant
Grading:	4 good	3- fair
Ankle plantar flexors	**Right**	**Left**
Patient position:	Supine, knee in extension.	Supine, knee in extension.
Test movement:	Planter flexion Foot at ankle.	Planter flexion Foot at ankle.
Proximal fixation:	One therapist hand fixates Achilles tendon and Calcaneus.	One therapist hand fixates Achilles tendon and Calcaneus.
Therapist resistant:	Other hand give resistant against planter flexion foot at ankle.	Other hand give resistant against planter flexion foot at ankle.
Grading:	4 good	4 good
Soleus	**Right**	**Left**
Patient position:	Supine, Leg flexion at hip and knee 90°.	Spine, leg semiflexion at hip joint.
Proximal fixation:	One therapist hand fixates medial, lateral malleolus and Calcaneus.	One therapist hand fixates medial, lateral malleolus and Calcaneus.
Test movement:	Planter flexion foot at ankle joint.	Planter flexion foot at ankle joint.
Therapist resistant:	Other hand give resistant against planter flexion foot at ankle joint.	Other hand give resistant against planter flexion foot at ankle joint.
Grading	4 good	4 good

Tibialis anterior	Right	Left
Patient position:	Supine, knee in extension.	Supine, knee in extension.
Test movement:	Dorsal flexion foot at ankle joint and extension of big toe.	Dorsal flexion foot at ankle joint and extension of big toe.
Proximal fixation:	One therapist hand fixates anterior medial aspect of tibia.	One therapist hand fixates anterior medial aspect of tibia.
Therapist resistant:	Other hand give resistant against foot dorsal flexion and extension of big toe.	Other hand give resistant against foot dorsal flexion and extension of big toe.
Grading:	4- good	3 fair

Examination of muscles shorting and hypertonicity

These examinations provide an overview on tightness and hypertonicity of some muscles of the lower extremities these tests were applied with some modification in the position caring the patient condition after surgery, the patient was lying on his back. The examination was modified than the normal typical test to be suitable and comfortable also it avoided the contraindicated movement therefore it was done in the supine position *(see Table 5)*.

Table 5 Examination of muscles shorting and hypertonicity (10)

Iliopsoas Muscles	Right	Left
Test:	*Modified Thomas test.*	*Modified Thomas test.*
Patient position:	Supine, patient close to the side of the bed. Patient hangs his leg out the bed *(the thigh not out of bed)* maintaining flexion at knee joint. The opposite leg *(operated leg)* in semiflexion at hip and knee joint.	Supine, patient close to the side of the bed. Patients hang his leg out the bed *(the thigh not out of bed)* maintaining flexion at knee joint. Patient pulls opposite leg to his chest.
Proximal fixation:	We place pillow under pelvic and sacrum to stabilize the pelvic. One therapist hand fixate ipsilateral superior anterior iliac spine.	One therapist hand fixate ipsilateral superior anterior iliac spine.
Evaluation for muscle shorting:	Positive test if thigh rises over the horizontal axis or/and has restricted end felling felt by therapist other hand.	Positive test if thigh rises over the horizontal axis or/and has restricted end felling felt by therapist other hand.
Grading:	Level 0 muscle was normal.	Level 1 muscle had restricted end feeling.

Quadriceps femoris	**Right**	**Left**
Test:	*Modified Thomas test.*	*Modified Thomas test.*
Patient position:	Supine, patient close to the side of the bed. Patient hangs his leg out the bed *(the thigh is not out of bed)* maintaining flexion at knee joint. The opposite leg (operated leg) in semiflexion at hip and knee joint.	Supine, patient close to the side of the bed. Patient hangs his leg out the bed *(the thigh is not out of bed)* maintaining flexion at knee joint. Patient pulls opposite leg to his chest.
Proximal fixation:	We place pillow under pelvic and sacrum to stabilize the pelvic. One therapist hand fixate ipsilateral superior anterior iliac spine.	One therapist hand fixate ipsilateral superior anterior iliac spine.
Evaluation for muscle shorting:	Positive test if lower leg don't reach vertical axis line *knee flexion less than 100°- 105°* or/and restricted end feeling felt with therapist other hand.	Positive test if lower leg don't reach vertical axis line *knee flexion less than 100°- 105°* or/and restricted end feeling felt with therapist other hand.
Grading:	Level 0 muscle was normal.	Level 2 leg didn't reach vertical axis and had restricted end feeling.
Hamstrings muscles	**Right**	**Left**
Test:	*Straight leg rising.*	Were not measured because are contraindicated post operation. Due to the risk of arthroplasty hip joint luxation.
Patient position:	Supine, knee in extension.	
Proximal fixation:	One therapist hand fixate anterior superior iliac spine.	
Evaluation for muscle shorting:	Other hand makes passive flexion at hip joint *Straight leg rising.* Positive test if leg has less than 80° and/or restricting end feeling should be felt by therapist.	
Grading:	Level 2 patient had less than 70° *(when knee extended)* flexion at hip and had restricted end feeling.	
Adductors muscles	**Right**	**Left**
Patient Position:	Supine, knee in extension.	Were not measured because are contraindicated post operation. Due to the risk of arthroplasty hip joint luxation.
Proximal fixation:	One therapist hand fixate ipsilateral superior anterior iliac spine.	

Evaluation for muscle shorting: Grading:	Other therapist hand makes passive leg abduction at hip joint. Positive test if abduction at hip joint less than 40° and/or restriction end feeling. Level 1 patient had restricted end feeling.	
Gastrocnemius muscle	**Right**	**Left**
Patient position: Proximal fixation: Evaluation for muscle shorting: Grading:	Supine, knee in extension. One therapist hand fixates Achilles tendon and Calcaneus. Other therapist hand makes passive dorsiflexion foot at ankle. Positive test if foot has less than 10° dorsiflexion at ankle and/or restricted end feeling. Level 1 patient had restricted end feeling.	Supine, knee in extension. One therapist hand fixate Achilles tendon and Calcaneus Other therapist hand makes passive dorsiflexion foot at ankle. Positive test if foot has less than 10° dorsiflexion at ankle and /or restricted end feeling. Level 1 patient had restricted end feeling.
Soleus muscle	**Right**	**Left**
Patient Position: Proximal fixation: Evaluation for muscle shorting: Grading:	Supine, leg flexion 90° at hip and knee. One therapist hand fixates Achilles tendon and Calcaneus. Other therapist hand makes passive dorsiflexion foot at ankle. Positive test if foot has less than 20° dorsiflexion at ankle and /or restricted end feeling. Level 1 patient had restricted end feeling.	Supine, leg semiflexion at hip and knee. One therapist hand fixate Achilles tendon and Calcaneus Other therapist hand makes passive dorsiflexion foot at ankle. Positive test if foot has less than 20° dorsiflexion at ankle and /or restricted end feeling. Level 1 patient had restricted end feeling.

8. Short-term and long-term rehabilitation program aims

Prior to the operation, it is helpful for the physiotherapist to explain the postoperative program and aims to the patient to enable him to regain a confident post operation

1. The main post operation rehabilitation aims are:
    - Patient verticalisation.
    - Learning the patient to walking and gait by using arm crutches without pressure on the operated limb in the beginning of the rehabilitation.
    - To restore full function of walking without stressing the operated limb.
    - To restore patient self service and activity of daily living. (5)
2. Short term rehabilitation aims are:
    - Regain general blood circulation.
    - Increase the range of motion at hip joints.
    - To relieve painful spasms and hypertonicity of affected lower extremity muscles.
    - To regain movement and muscle strength.
    - To reclaim the patient confidence.
    - To advise the patient on what to expect, how to avoid contraindicated movements.
3. Long term rehabilitation aims are achieved with the short-term rehabilitation plan the patient have to continue what he learned at the hospital to do it after he leave the hospital and at home:
    - Regain muscle power and exercises.
    - Advises for activity of daily living and self service with avoiding contraindicated movement. (15)

<u>Contraindicated movements after total hip joint replacement operation:</u>

- Crossed-legged position = operated legs should not cross the body axis
- External rotation and adduction of operated leg.
- Flexion of more than 90°. (2)

9. Rehabilitation program post operation total hip joint replacement

The rehabilitation program started post operation from Monday 26.1.2004 to Friday 6.2.2004 for 12 days.

Day 1 Monday 26 June

At this day the patient was moved from the unit of intensive care to a stable ward in the same orthopedic department , the monitors were removed , he had intravenous droops containing fluids and nutrition solution also containing analgetic. The patient was psychologically calm, he was tired and fatigued, but he was reactant and cooperative. Patient was afebrile, cardiopulmonary compensated, the patient had moderate pain at the operated area, the operative area was covered by a sterile bandage and large dressing on the hip joint area and a small drainage tubes were excreting fluids from the joint area.

At this day we started straight after initial kinsological examination *(see page 29)*, the rehabilitation program achieving the rehabilitation program aims *(see page 37)* by:

1. Beginning breathing exercises. (5) This includes deep breathing and abdominal breathing when the patient in supine position.

2. Conditional exercises to the non operated hip joint. (5) Also conditional exercises for arms and leg included: *Passive movements* and *active movements*.

A. Patient position was supine and therapist made a passive movements:

- Flexion, extension, abduction and adduction of arms at shoulder joint.
- Flexion and extension leg at knee joint and at hip joint of the non operated limb. (13)

B. Patient position was supine and he made an active movement:

- Flexion and extension of arm at shoulder joint.
- Circulation movement of arm at shoulder joint.
- Dorsal flexion and planter flexion of foot at ankle joint.
- Circulation movement of foot at ankle joint. (13)

3. Conditional exercises with emphasis on exercises of the triceps muscle because the patient will walk on crutches and he need to support his body. (5) The patient position was supine arms flexed at shoulder joint 90°, he made extension of arms at elbows bringing arms up ward, *(patient can do this exercises using light weight)* and this exercises repeated several time.

4. The operated limb had isometric exercises focused at the gluteal and quadriceps femoris muscles. (5)

While the patient was in supine he made an isometric contraction included:

- Contracting abdominal muscles for 10-15 sec.

- Contraction of gluteal muscles for 10-15 sec.
- Contraction quadriceps femoris for 10-15 sec.
- Simultaneously contracting gluteal muscles, abdominal muscles and quadriceps for 10-15 sec. (13)

Day 2 Tuesday 27 June:

At this day patient was psychologically calm he was still tired after surgery but he was reactant and cooperative. Patient was afebrile, cardiopulmonary compensated; patient had moderate pain at the operated area; the operative area was covered by a sterile bandage and large dressing on the hip joint area and a small drainage tubes were excreting fluids out from the hip joint area.

At this day we continued the rehabilitation program by adding:

1. Soft Techniques:
   - Stretching of soft tissue applied on the patient operated limb for stretching subcutaneous tissues and fascia around the thigh.
   - Massage both muscles of the thighs, quadriceps femoris, adductors, and hamstrings.
2. Assistance active exercises to the operated hip joint; patient position in supine with assistant of physiotherapist he made:
   - Assistance flexion of leg not above 90° at operated hip joint.
   - Assistance abduction of leg at operated hip joint.
   - Assistance internal rotation for both lower extremities at hip joint *(the patient attempted to provide internal rotation at hip by rotating his foots inward the medial line)*.(5)
3. Post isometric relaxation PIR for left Iliopsoas, by using a pillow placed under the lumbar spine a using breathing with the help of gravity to stretch and relax the muscle.
4. PIR for Hamstring muscles:
   - Patient supine, knees extended.
   - Therapist passively flexes leg at hip joint.
   - Reaches to barrier.
   - Asks patient to push his leg against his hand, breath in and holds it for 10sec
   - Then patient breathe out and relax.
   - Therapist sets new barrier. (10)
5. PIR for right adductors muscle:
   - Patient supine, knees extended.
   - Therapist passively abducts leg at hip joint.
   - Reaches to barrier.

- Asks patient to push his leg against his hand toward adduction, breath in and holds it for 10sec.
- Then patient breathe out and relax.
- Therapist sets new barrier. (10)

Day 3 Wednesday 28 June

At this day patient was psychologically calm, more physically comfortable, reactant and cooperative. Patient was afebrile, cardiopulmonary compensated. The intravenous droops were removed the patient felt less pain at the operated area; the operated area was covered by a sterile bandage and large dressing on the hip joint area which is changed regularly. The wound was stable and dry and it had no secretion the sutures were strongly held and drainage tubes were removed.

This day we continued post operation rehabilitation program adding:

1. Practicing sitting on the bed. (5) The patient practiced how to sit from supine position to sitting position he had to support the operated limb by the non operated lower limb placing the non operated lower limb under his operated limb avoiding adduction and external rotation of operated limb bringing it to the side of the bed, out side the bed and down.
2. Commencement of verticalisation of his body in sitting position. (5)
3. Active Exercises in the sitting position. (5)

Included:

- Both leg flexions at knee joint.
- Dorsal flexion and planter flexion of foot at ankle.

4. We started practicing standing from sitting position by using forearm crutches. (5)
5. Commencement of verticalisation of his body in standing position by the support of elbow crutches*(the patient might feel dizzy and its highly recommended that he sit back for few minute and try to repeat verticalisation)*. (5)
6. We started to Practice walking 3 steps using arm crutches, walking started with stimulation of foot in contact with the floor applying a minimal load to the operated leg. (5)
7. Patient started to walk using forearm crutches and the gait was corrected from the very beginning, the physiotherapist support patient during early stag of walking. *(see table 6)*. (5)

- The patient should feel that the weight is distributed comfortably between crutches and feet without stressing the operated leg.
- Shoes should be supportive.
- Confidence was built up with the physiotherapist.
- To walk forward with crutches the sequences of foot and crutches are important and must be told to the patient *(table 6)*.

- The physiotherapist should correct the patient pelvis position during walking *(common wrong pelvis position is pelvis retro version pelvis lateral tilt).*

Table 6. Walking Forward

The order of walking	**physiotherapist support position**
1st Crutches	
2nd Diseased leg	Physiotherapist stands in front of the patient.
3rd Healthy leg	In front of the patient and a little to side.

Note:

- We can use forearm crutch or an axillary crutch for support; forearm crutch unload 50% of bodyweight and an axillary crutch can unload 75%. But normally we use the forearm crutch as they are convenient and acceptable to the patient. (5)
- During walking function of the gluteal muscles is important. Post operation, when the patient is standing and during walking, these muscles are functioning to stabilize laterally the pelvis; when the gluteal muscles are weak, the pelvis will develop a lateral tilt. (5)

- During walking or standing, the weak gluteal muscles become better but there is an overloading effect to lumbar spine and lumbosacral region resulting in pain. This situation can be resolved with crutches and careful practice of walking as during walking the gluteal muscles are active. (5)

Day 4 Thursday 29 June

At this day the patient was psychologically calm, physically comfortable, reactant, cooperative and glad that he was able to walk to the toilet and around his room. Patient was afebrile and cardiopulmonary compensated. Patient felt remarkable less of pain; the operated area was covered by a sterile bandage on the wound which was changed regularly. The wound was stable, dry and the sutures were strongly held.

This day we continued post operation rehabilitation program adding:

1. Assistant active exercises for the operated limb in side lying, the patient laid on the healthy side, we placed a pillow between his legs so when he turns from supine to his side he prevent luxation of the arthroplasty hip joint not allowing adduction and external rotation. In this position he will relieve back pain while he wills strength gluteal and quadriceps femoris muscles, with the help and asset of physiotherapist patient made assistant active exercises included:

- Flexion of the operated leg at knee joint.
- Flexion of the operated leg at hip joint not more than 90°.
- Minimal leg extension of the operated limb at hip joint.(5)

2. Isometric exercises for operated limb. (5)

We used small ball while patient was supine to:

- Exercise the gluteus maximus muscle and hamstrings of the operated leg by placing the ball under the heel; patient knee is in extension he contracted gluteus muscles by pushing to the ball. (13)

3. Active exercises in supine position. (5)

- Patient should abduct operated limb to the side to strength the abductor muscles.
- Patient extends the legs at the knee joint strength knees extensor muscles Quadriceps femoris while placed ball under his knees.

4. PIR for left Quadriceps femoris:

- Patient prone flexes leg at knee joint.
- Therapist passively flexes leg at knee joint.
- Reaches to barrier.
- Asks patient to breath in for 10sec
- Then asks patient to breathe out and then relax.
- Therapist sets new barrier. (10)

Day 5 Friday 30 June

At this day, the patient was psychologically calm, physically comfortable, reactant, cooperative. Patient was afebrile and cardiopulmonary compensated. Patient felt remarkable less of pain; the operated area was covered by a sterile bandage on the wound which was changed regularly. The wound was stable and dry and the sutures were strongly held.

This day we continued post operation rehabilitation program adding:

1. Isometric exercises focused on gluteal and Quadriceps femoris. (5)

Patient position was prone; using small gymnastic ball placed under dorsal side of foot patient contracted:

- quadriceps femoris muscles for 10-15 sec by pushing his leg to the ball
- Gluteal muscles for 10-15 sec.
- Simultaneously he contract gluteal muscles, abdominal muscles, and quadriceps for 10-15 sec.

2. Active exercises in prone position involving leg flexion and extension at knee joint.

3. In sitting position at the edge of the bed The patient started to train internal rotation at both hip joint when the legs is in flexion 90 at knee join , the foots is contacting the floor and the patient attempted internal rotation at hip by moving his foots inward middle line. (5)

Day 6-7 Saturday 31 June and Sunday 1 February (weekend)

At the weekend the patient Mr. miloeš continued post operation rehabilitation program by continuing movements, exercising and muscles training aiding his independence to what he learned so far which included:

1. Breathing exercises; deep breathing and abdominal breathing.

2. Conditional exercises of the non operated hip joint, arms and leg; this included: *Passive movements* and *active movements*

A. Patient position in supine, he made a Passive movement included:

- Flexion, extension, abduction and adduction arms at shoulder joint.
- Flexion and extension leg at knee joint and hip joint of the non operated limb.

B. Patient position in supine, he made an active movement included:

- Flexion and extension of arm at shoulder joint.
- Circulation movement of arm at shoulder joint.
- Dorsal flexion and planter flexion of foot at ankle.

3. Active exercises for the triceps muscles because the patient walking on crutches and he needed to support his body; in this exercises patient was in supine position he had arms flexed at shoulder 90°, he made extension of arms at elbows bringing arms up ward , *(patient can do this exercises using light weight)* this exercises repeated several time.

4. Isometric muscles contraction to strength the gluteal, quadriceps femoris and abdominal muscles; this were done in *supine* and *prone* position:

A. In supine position he made isometric contractions included:

- Contraction of abdominal muscles for 10-15 sec.
- Contraction of gluteal muscles for 10-15 sec.
- Contraction quadriceps femoris for 10-15 sec.
- Simultaneously contracting gluteal muscles, abdominal muscles and quadriceps for 10-15 sec.

B. In prone position, using small gymnastic ball placed under dorsal side of foot patient made isometric contractions included:

- Contraction quadriceps femoris muscles for 10-15 sec by pushing his leg to the ball.
- Contraction Gluteal muscles for 10-15 sec.
- Contraction Quadriceps femoris muscles for 10-15 sec.
- Simultaneously he contract gluteal muscles, abdominal muscles and quadriceps for 10-15 sec.

5. In supine position patient attempted to made active exercises to the operated hip joint included:

- Active flexion of leg not above 90° at operated hip joint.
- Active abduction of leg at operated hip joint, patient should abduct legs to the side.
- Active legs internal rotation at hip joint *(patient attempted to makes internal rotation when his knees in extension).*

6. Active Exercises in the sitting position includes:

- Leg flexion at knee joint for both legs.
- Dorsal flexion and planter flexion of foot at ankle for both foots.
- Internal rotation in sitting position at the edge of the bed; both legs is in flexion 90° at knee joint, foots is contacting the floor and the patient trained internal rotation at hip joint by attempting moving foots inward middle line.

7. Patient kept on practicing walking with arm crutches.

Day 8 Monday 2 February

At this day, the patient was psychologically calm, physically comfortable, reactant, cooperative. Patient was afebrile and cardiopulmonary compensated. Patient felt almost no pain, the bandage was removed. The wound was stable and dry and the sutures are strongly held.

This day we continued post operation rehabilitation program adding:

1. Practicing walking up the stairs and downstairs, during this practice physiotherapist observed the patient correcting any wrong steps thoroughly observing the right steps sequences of the forearm crutches and legs going up and down the stairs *(Table 7)*; physiotherapist he must support the patient when he walk upstairs by standing behind patient back and when the patient walk downstairs he must stand in front of him. (13)

Table 7 walking stairs using crutches

walking upstairs	Walking downstairs
1st Healthy leg	1st Crutches
2nd Operated leg	2nd Operated leg
3rd Crutches	3rd Healthy leg

Day 9 Tuesday 3 February

At this day, the patient was psychologically calm, physically comfortable, reactant and cooperative. Patient was afebrile and cardiopulmonary compensated. Patient felt almost no pain. The wound was stable and dry and the sutures were strongly held.

This day we continued post operation rehabilitation program adding:

1. Active exercises for the operated leg in standing position included:

- Patient stands facing the wall and performs leg flexion at knee joint.

- Patient stands facing the wall and performs abduction at the hip joint. (13)

Day 10-11 Wednesday 4 to Thursday 5 of February

At these days patient was reactant, cooperative, he was psychologically calm and he was physically comfortable, patient felt bored from staying in hospital and he looks forward to leave back home . The patient was afebrile and cardiopulmonary compensated, the patient felt almost no pain. The wound was stable and dry and the sutures were removed.

These days we continued post operation rehabilitation program adding:

1. Scare therapy: soft massaging and stretching soft tissue around scare area.
2. The patient continued to relearn movements, exercising and training we had done so far aiding his independence includes practicing walking on flat and irregular ground and sitting on a chair. (5)

Day 12 Friday 6 of February

At this day, the patient was physically comfortable, reactant, cooperative and he was exited that he was going to leave the hospital. Patient was afebrile and cardiopulmonary compensated. Patient felt almost no pain. The wound was stable.

At this day before the patient was discharged from hospital, final kinesiological examination was done *(see page 47)* to evaluate his prognosis, also he was educated about regimes for food and any indications for activity of daily living, correct sitting on a chair, sitting on a toilet, taking a bath and wearing shoes using an assistant aid.

10. Post rehabilitation final kinesiological examination

The examination was on 6.2.2004 before the patient was discharged to home.

Examination of posture

- The patient was able to stand using forearm crutches; patient shoulder was in slight elevation due to the support of his weight on crutches, he could stand vertically with good support of his body on the crutches.
- The operated joint area and left thigh had no swelling.
- He was not pressing on the operated limb much by trying to elevate the operated limb slightly so he created slight pelvic tilt to right side of healthy lower limb.

Gait evaluation

- Patient had been walking in right Stride sequences using forearm crutches and he had good coordination without stressing the operated hip joint.
- The pelvis had almost no horizontal rotation because he feared to move his pelvis normally avoiding pelvis rotation; patient had normal pelvis side tilting when walking.

Palpation

- Left lower extremity muscles were healthy, more bulbed and had normal tonus.
- The scar was in good condition; dried, healed and blood circulated.

Anthropometry

-Height: 198cm -Weight: 110kg

-Lower limb length

- Functional length: right 101cm, left 102cm
- Anatomical length: right 91cm, left 93cm

-Circumference of the thigh

- Quadriceps (15cm above patella): right 63cm, left 55cm.
- Vastus medialis (10cm above patella): right 59cm, left 50cm.

Range of motion of hip joint

Assessment of the patient hip joints ranges of motion. These assessment was done post rehabilitation before the patient discharged from hospital, it was modified than the normal typical assessment to be suitable and comfortable for the patient also it avoided the contraindicated movement *(see table 8)*.

Table 8 hip joint range of motion measurement

Hip Joint Flexion	Right	Left
Patient position:	Supine, knee in flexion.	Supine, knee in flexion.
Goniometer axis position:	Greater trochanter (the intersection of the thigh and trunk).	Greater trochanter (the intersection of the thigh and trunk).
Goniometer stationary arm position:	Horizontal body axis (along the side of the trunk).	Horizontal body axis (along the side of the trunk).
Goniometer moveable arm:	Greater trochanter to knee joint (along the lateral aspect of the thigh).	Greater trochanter to knee joint (along the lateral aspect of the thigh).
Type of making movement :	Active hip joint flexion.	Active hip joint flexion.
Degrees:	110°	90°
Extension	**Right**	**Left**
Patient position:	Prone, knee in extension.	Prone, knee in extension.
Goniometer axis position:	Greater trochanter (the intersection of the thigh and trunk).	Greater trochanter (the intersection of the thigh and trunk)
Goniometer stationary arm position:	Horizontal body axis (along the side of the trunk).	Horizontal body axis (along the side of the trunk).
Goniometer moveable arm:	Greater trochanter to knee joint (along the lateral aspect of the thigh)	Greater trochanter to knee joint (along the lateral aspect of the thigh)
Type of making the movement :	Active hip joint extension.	Active hip extension, patient did compensatory pelvis elevation.
Degrees:	27°	10°
Abduction	**Right**	**Left**
Patient position:	Supine, knee in extension.	Supine, knee in extension.
Goniometer axis position:	Ipsilateral anterior superior iliac spine.	Ipsilateral anterior superior iliac spine.
Goniometer stationary arm position:	Toward the contralateral anterior superior iliac spine.	Toward the contralateral anterior superior iliac spine.
Goniometer moveable arm:	Moveable arm in the thigh midline.	Moveable arm in the thigh midline.
Type of making the movement :	Active hip joint abduction.	Active hip joint abduction.
Degrees:	45°	20°
Adduction	**Right**	**Left**
Patient position:	Supine	Were not measured because are contraindicated post operation. Due to the risk of arthroplasty hip joint luxation.
Goniometer axis position:	Ipsilateral anterior superior iliac spine.	
Goniometer stationary arm	Toward the contralateral anterior	

position: Goniometer moveable arm: Type of making the movement : Degrees:	superior iliac spine. Moveable arm in the thigh midline. Active hip joint abduction. 23°	
External Rotation	**Right**	**Left**
Patient position: Goniometer axis position: Goniometer stationary arm position: Goniometer moveable arm: Type of making movement : Degrees:	Sitting at the edge of the bed. Anterior aspect of the knee joint (middle of the patella). The stationary axis is vertical to the floor. Moves with lower leg. Active external rotation. 45°	Were not measured because are contraindicated post operation. Due to the risk of arthroplasty hip joint luxation.
Internal Rotation	**Right**	**Left**
Patient position: Goniometer axis position: Goniometer stationary arm position: Goniometer moveable arm: Type of making the movement : Degrees:	Sitting at the edge of the bed. Anterior aspect of the knee joint (middle of the patella). The stationary axis is vertical to the floor. Moves with lower leg. Active internal rotation. 43°	Sitting at the edge of the bed. Anterior aspect of the knee joint (middle of the patella). The stationary axis is vertical to the floor. Moves with lower leg. Active internal rotation. 40°

Muscle power test

These tests provide an overview on strength of some muscles of the lower extremities these tests were applied with some modification in the position caring the patient condition .the tests were modified than the normal typical tests to be suitable and comfortable for the patient, also it avoided the contraindicated movements *(see table 9)*.

Table 9 muscle power test. (9)

Gluteus maximus Muscles	**Right**	**Left**
Patient position: Proximal fixation: Test movement: Therapist resistant:	Prone, knee in extension. One therapist hand fixate ipsilateral posterior superior iliac spine. Leg extension at hip joint. Other hand give resistant against leg hip extension.	Supine, knee in extension. One therapist hand fixate ipsilateral posterior superior iliac spine. Leg extension at hip joint. No resistant.

Grading:	4 good	3 fair
Gluteus medius	**Right**	**Left**
Patient position: Proximal fixation: Test movement: Therapist resistant: Grading:	Supine, knee in extension. One therapist hand fixate ipsilateral superior anterior iliac spine. Leg abduction at hip joint. Other hand give resistant against leg abduction at hip joint. 4 good	Supine, knee in extension. One therapist hand fixate ipsilateral superior anterior iliac spine. Leg abduction at hip joint. Other hand give slight resistant against leg abduction at hip joint. 3 fair
Adductors	**Right**	**Left**
Position: Proximal fixation: Test movement: Therapist resistant: Grading:	Supine, knee in extension. One therapist hand fixate contralateral anterior superior iliac spine. Leg adduction at hip joint. Other hand give resistant against leg adduction at hip joint. 5 normal.	Were not measured because are One therapist hand fixate contraindicated post operation. Due to the risk of arthroplasty hip joint luxation.
Quadriceps femoris	**Right**	**Left**
Position: Proximal fixation: Test movement: Therapist resistant: Grading:	Sitting, knee in flexion 90°. One therapist hand hold Patient thigh anterior aspect. Leg extension at knee joint. Other hand give resistant against leg extension at knee joint. 5 normal	Sitting, knee in flexion not above 90°. One therapist hand hold Patient thigh anterior aspect. Leg extension at knee joint Other hand give slight resistant against leg extension at knee joint. 4 good
Hamstrings	**Right**	**Left**
Position: Proximal fixation: Test movement: Therapist resistant: Grading:	Prone, knee in extension. One therapist hand holds patient thigh posterior aspect. Leg flexion at knee joint. Other hand give resistant against leg flexion at knee joint. 4 good	Prone, knee in extension. One therapist hand holds patient thigh posterior aspect. Leg flexion at knee joint Other hand give slight resistant against leg flexion. 4 good

Ankle plantar flexors	Right	Left
Position:	Supine, knee in extension.	Supine, knee in extension.
Test movement:	Planter flexion Foot at ankle.	Planter flexion Foot at ankle.
Proximal fixation:	One therapist hand fixates Achilles tendon and Calcaneus.	One therapist hand fixates Achilles tendon and Calcaneus.
Therapist resistant:	Other hand give resistant against planter flexion foot at ankle.	Other hand give resistant against planter flexion foot at ankle.
Grading:	5 normal	5 normal
Soleus	**Right**	**Left**
Position:	Supine, Leg flexion at hip and knee 90°	Spine, leg flexion at hip and knee joint not above 90° at hip joint.
Proximal fixation:	One therapist hand fixate Medial, lateral malleolus and Calcaneus.	One therapist hand fixate Medial, lateral malleolus and Calcaneus.
Test movement:	Planter flexion foot at ankle joint.	Planter flexion foot at ankle joint.
Therapist resistant	Other hand give resistant against planter flexion foot at ankle joint.	Other hand give resistant against planter flexion foot at ankle joint.
Grading	5 normal	5 normal
Tibialis anterior	**Right**	**Left**
position:	Supine.	Supine.
Test movement:	Dorsal flexion foot at ankle joint and extension of big toe.	Dorsal flexion foot at ankle joint and extension of big toe.
Proximal fixation:	One therapist hand fixates Anterior medial aspect of tibia.	One therapist hand fixates Anterior medial aspect of tibia.
Therapist resistant:	Other hand give resistant against foot dorsal flexion and extension of big toe.	Other hand give resistant against foot dorsal flexion and extension of big toe.
Grading:	5 normal	4 good

Examination of muscles shorting and hypertonicity *(table 10)*

These examinations provide an overview on tightness and hypertonicity of some muscles of the lower extremities these tests were applied with some modification in the position caring the patient condition, it was modified than the normal typical examination to be suitable and comfortable for the patient also it avoided the contraindicated movements.

Table 10 Examination of muscles shorting and hypertonicity. (10)

Muscle Iliopsoas	Right	Left
Test:	*Prone Iliopsoas*	*Modified Thomas test.*
Patient Position:	prone	Supine, patient close to the side of the bed.

		Patients hang his leg out the bed *(the thigh is not out bed)* maintaining flexion at knee joint.
Proximal fixation:	One therapist hand fixates ipsilateral posterior superior iliac spine and lower back.	Patient pulls opposite leg to his chest. One therapist hand fixate ipsilateral superior anterior iliac spine with.
Evaluation for muscle shorting:	Other therapist hand elevate thigh making extension at hip joint. Positive test if extension at hip joint has restricted end feeling	Positive test if thigh rises over the horizontal axis and/or has restricted end felling felt by therapist other hand.
Grading:	Level 0 muscle was normal.	Level 0 muscle was normal.
Quadriceps femoris	**Right**	**Left**
Test:	*Prone quadriceps.*	*Prone quadriceps*
Patient Position:	Prone.	Prone.
Evaluation for muscle shorting:	Therapist makes passive flexion leg at knee joint. Positive test if flexion has restricted end feeling.	Therapist makes passive flexion leg at knee joint. Positive test if flexion has restricted end feeling.
Grading	Level 0 muscles were normal.	Level 0 muscles were normal.
Hamstrings	**Right**	**Left**
Test:	*Straight leg rising.*	Were not measured because are contraindicated post operation. Due to the risk of arthroplasty hip joint luxation.
Patient Position:	Supine, knees in extension.	
Proximal fixation:	One therapist hand fixate ipsilateral anterior superior iliac spine.	
Evaluation for muscle shorting:	Other hand make passive flexion at hip joint (*Straight leg rising).* Positive test if leg has less than 80° and/or restricting end feeling should be felt by therapist.	
Grading	Level 1 patient had almost 80 but he had restricted end feeling.	
Adductors muscles	**Right**	**Left**
Patient Position:	Supine , knees in extension	Were not measured because are contraindicated post operation. Due to the risk of arthroplasty hip joint luxation.
Proximal fixation:	One therapist hand fixate superior contralateral anterior iliac spine.	
Evaluation for muscle shorting:	Other therapist hand makes passive leg abduction at hip joint.	

Grading:	Positive test if abduction at hip joint less than 40° and/or restriction end feeling. Level 0 muscles were normal	
Gastrocnemius muscle	**Right**	**Left**
Patient position: Proximal fixation: Evaluation for muscle shorting: Grading:	Supine, knee in extension. One therapist hand fixates Achilles tendon and Calcaneus. Other therapist hand makes passive dorsiflexion foot at ankle. Positive test if foot has less than 10° dorsiflexion at ankle and /or restricted end feeling. Level 1 patient had restricted end feeling	Supine, knee in extension. One therapist hand fixates Achilles tendon and Calcaneus. Other therapist hand makes passive dorsiflexion foot at ankle. Positive test if foot has less than 10° dorsiflexion at ankle and /or restricted end feeling. Level 1 patient had restricted end feeling
Soleus	**Right**	**Left**
Patient position: Proximal fixation: Evaluation for muscle shorting: Grading:	Supine, leg flexion 90° at hip and knee. One therapist hand fixates Achilles tendon and Calcaneus. Other therapist hand makes passive dorsiflexion foot at ankle. Positive test if foot has less than 20° dorsiflexion at ankle and /or restricted end feeling. Level 1 patient had restricted end feeling	Supine, leg semiflexion at hip and knee. One therapist hand fixates Achilles tendon and Calcaneus. Other therapist hand makes passive dorsiflexion foot at ankle. Positive test if foot has less than 20° dorsiflexion at ankle and /or restricted end feeling. Level 1 patient had restricted end feeling

11. Therapy effect evaluation, prognosis and plan after discharge

After the end of the therapy objective findings showed a great improvement and the goals and aims *(see page 37)* that were set were achieved. There were an increase in the range of motion namely *abduction, extension, flexion and internal rotation* at the hip joint, increase in the muscle power of the weak muscles of the lower extremities, also some tight muscles was source of pain and during rehabilitation it was relieved from spasm and hyper tonicity *e.g. Iliopsoas muscle (see table 11)*.the swelling disappeared which means the area of the left hip joint increased blood supply circulation due to the therapy. The patient declared that he is more flexible and he was able to walk stable a great distance, up and down stairs with support of forearm crutches. Also he could perform his activities of daily living more comfortably; generally the patient's state was good.

Table 11 Examination findings comparison between pre rehabilitation and post rehabilitation.

Anthropometry	**pre rehabilitation**	**post rehabilitation**
Height	198cm.	198cm.
Weight	110kg	110kg.
Lower limb length		
• Functional length:	Right 105cm. Left 102cm.	Right105cm. Left 105cm.
• Anatomical length:	Right 91cm. Left 93cm.	Right 91cm. Left 92cm.
Circumference of the thigh		
• Quadriceps (15cm above patella):	Right 59cm. Left 55cm.	Right 60cm. Left 58cm.
• Vastus medialis (10cm above patella):	Right 49cm. Left 49cm.	Right 59cm. Left 55cm.
Examination	**pre rehabilitation**	**post rehabilitation**
Palpation	The left hip area was swollen and felt warm. The left thigh muscles were atrophied and hypotonic mainly quadriceps femoris and gluteal muscles.	Left lower extremity muscles were healthy, more bulbed and had normal tonus. The scar was in good condition; dried, healed and blood circulated.
Inspection	**pre rehabilitation**	**post rehabilitation**
Posture	After surgery the patient couldn't stand. He had swelling around the left operated hip joint.	The patient was able to stand using forearm crutches; he could stand vertically with good support of his body on the crutches. The operated joint area and left thigh

		had no swelling.
Inspection	**pre rehabilitation**	**post rehabilitation**
Gait evaluation	After surgery the patient couldn't walk.	Patient had been walking in right Stride sequences using forearm crutches and he had good coordination without stressing the operated hip joint.
Comparison of hip joint range of motion pre rehabilitation and post rehabilitation		
Motion	**Pre rehabilitation**	**Post rehabilitation**
Hip Joint Flexion	Right: Passive hip joint flexion 90°. Left: Passive hip joint flexion 70°.	Right: Active hip joint flexion 110. Left: Active hip joint flexion 90°.
Hip joint Extension	Right: Passive hip joint extension 17 °. Left: Passive hip extension 5 °.	Right: Active hip joint extension 27°. Left: Active hip extension 10 °.
Hip joint Abduction	Right: Passive hip joint abduction 45°. Left: Passive hip joint abduction 20°.	Right: Active hip joint abduction 45°. Left: Active hip joint abduction 20°.
Hip joint Adduction	Right: Passive hip joint adduction 20°. Left: Were not measured.	Right: Active hip joint adduction 23°. Left: Were not measured.
Hip joint External Rotation	Right: Passive external rotation 40°. Left Were not measured.	Right: Active external rotation 43°. Left Were not measured.
Hip joint Internal Rotation	Right: Passive internal rotation 40° Left: Passive internal rotation 20°.	Right: Active internal rotation 40°. Left: Active internal rotation 30°.
Comparison between muscles power pre rehabilitation and post rehabilitation		
Muscles	**Pre rehabilitation**	**Post rehabilitation**
Gluteus maximus Muscles	Right: 3 fair. Left: 2 poor.	Right: 4 good. Left: 3 fair.
Gluteus medius	Right: 3 fair. Left: 2 poor.	Right: 4 good. Left: 3 fair.
Adductors	Right: 3 fair. Left not measured.	Right: 5 normal. Left not measured.
Quadriceps_femoris	Right 4 good. Left 3 fair.	Right: 5 normal. Left: 4 good.
Hamstrings	Right: 4 good. Left: 3- fair.	Right: 5 normal. Left: 4 good.
Ankle plantar flexors	Right: 4 good.	Right: 5 normal.

	Left: 4 good.	Left: 5 normal.
Soleus	Right: 4 good. Left: 4 good.	Right: 5 normal. Left: 5 normal.
Tibialis anterior	Right: 4- good. Left: 3 fair.	Right: 5 normal. Left: 5 normal.
Comparison between muscles shorting and hypertonicity pre rehabilitation and post rehabilitation		
Muscles	**Pre rehabilitation**	**Post rehabilitation**
Iliopsoas Muscles	Right: Level 0 muscle was normal. Left: Level 1 muscle had restricted end feeling.	Right: Level 0 muscle was normal. Left: Level 0 muscle was normal.
Quadriceps femoris	Right: Level 0 muscles were normal. Left: Level 2 leg didn't reach vertical axis and had restricted end feeling.	Right: Level 0 muscles were normal. Left: Level 0 muscles were normal.
Hamstrings muscles	Right: Level 2 patient had less than 70° flexion at hip and had restricted end feeling. Left: Not measured.	Right: Level 1 patient had almost 80° but he had restricted end feeling. Left: Not measured.
Adductors muscles	Right: Level 1 patient had restricted end feeling. Left: Not measured.	Right: Level 0 muscles were normal Left: Not measured.
Gastrocnemius muscle	Right: Level 1 patient had restricted end feeling. Left: Level 1 patient had restricted end feeling.	Right: Level 1 patient had restricted end feeling. Left: Level 1 patient had restricted end feeling.
Soleus muscle	Right: Level 1 patient had restricted end feeling. Left: Level 1 patient had restricted end feeling.	Right: Level 1 patient had restricted end feeling. Left: Level 1 patient had restricted end feeling.

After discharge

After the patient is discharged from the hospital, he must develop self confidence and walk without any help. The pelvis must be able to support 30% of his bodyweight. The patient should exercise individually at home performing the same active exercises, isometric contraction and movements as performed at the hospital. (5)

After 6 weeks post operation, the patient must have a clinical and an x-ray examination. After 3 months, again he must have a clinical examination and the examiner should write an evaluation report. Depending on the results, the patient can stop using crutches and be confident in walking. (5)

12. Conclusion

During my practice it became more obvious that the psychology of the patient is very important and can affect the rehabilitation progress in a positive or negative way. The therapist must use this important factor to improve the beneficence of the treatment. It is also very important to use this in relation to improving the state of the patient so that they may heal faster and return to normal life with confidence. I learnt many things through the treatment of Mr. Miloš and saw many changes in him over the process. The opportunity has inspired me to maintain a psychological bond with the patient, to empathize with their state of mind as well as physical state, and to promote, to the best of my ability, physical therapy, using the many different disciplines it incorporates.

List of short-forms

ADL: Activity of daily living.
THR: Total hip replacement.
PIR: Post isometric relaxation.
PNF: Proprioceptive neuromuscular facilitation.

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