Total Hip Arthroplasty

Functional Hip Anatomy
Hip Movements
Reasons for Hip Replacement
Procedures
Post-operative Rehabilitation

Articulation

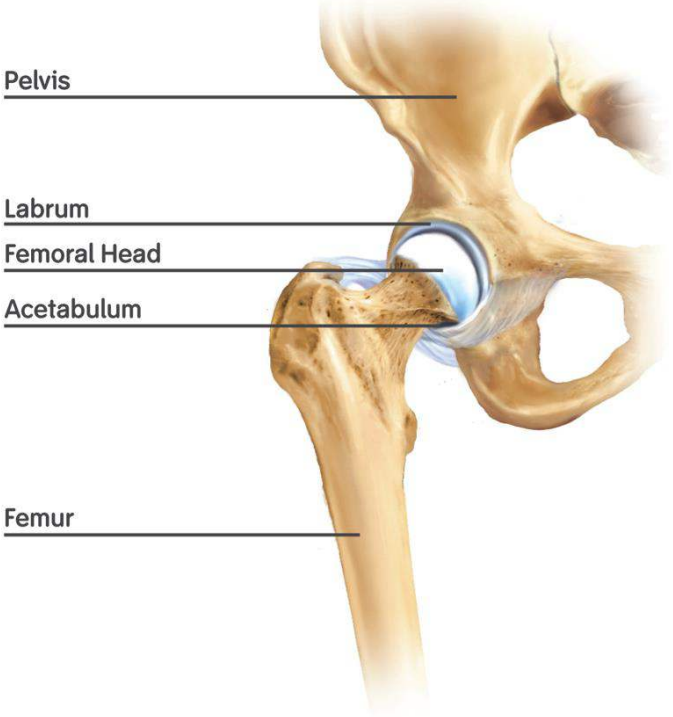
The hip joint is formed by the articulation of the rounded **head of the femur** and the cup-like **acetabulum** of the pelvis

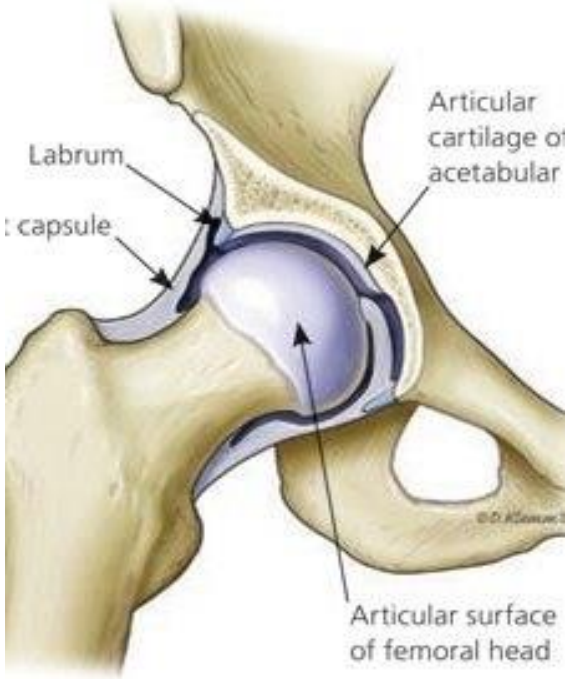
The cup-like acetabulum forms at the union of 3 pelvic bones: the **ilium**

the **pubis**

the **ischium**

Hip Joint


Pelvis
Labrum
Femoral Head
Acetabulum
Femur


Articular
cartilage o
acetabular
Labrum
capsule
Articular surface
of femoral head

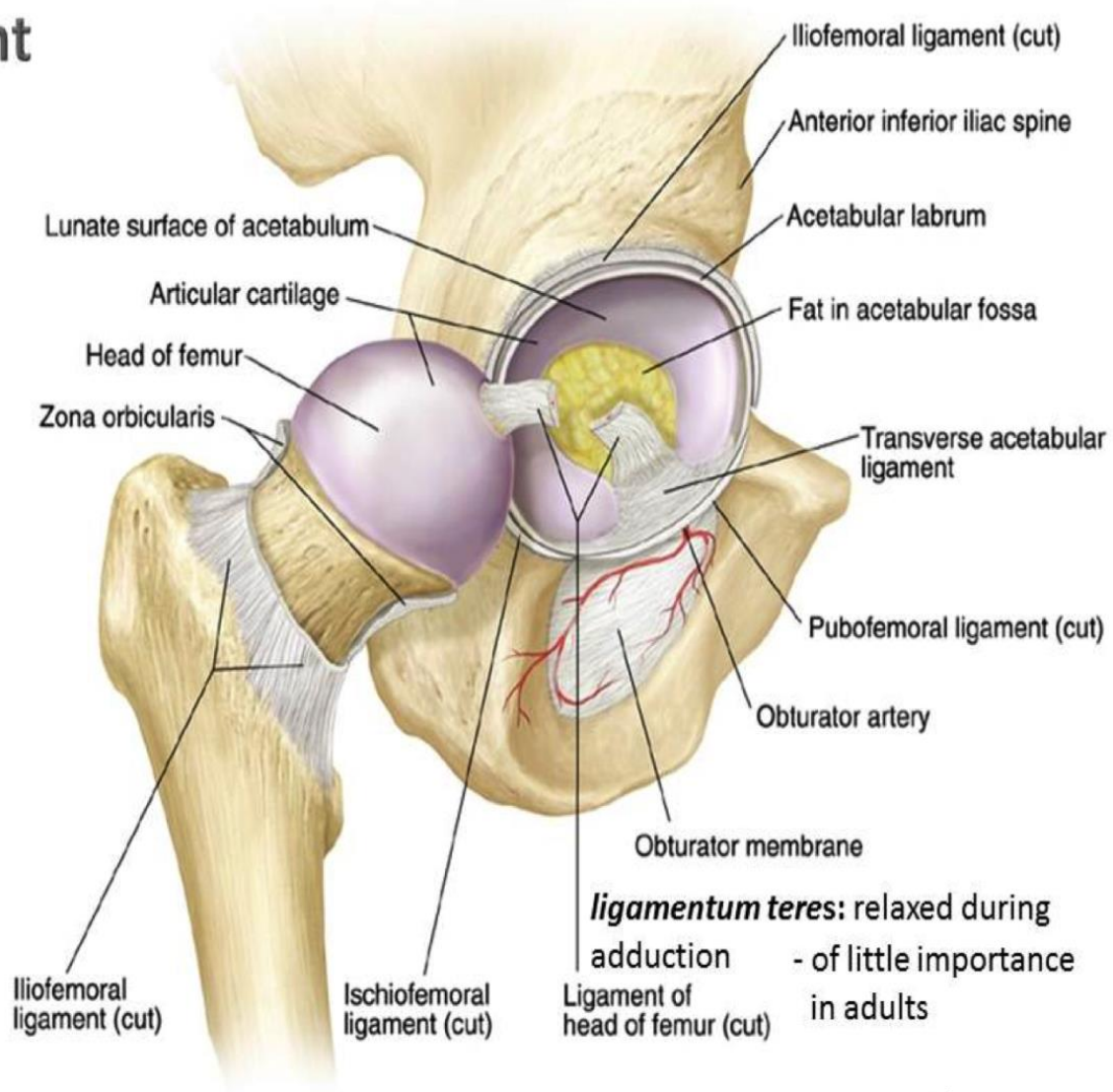
Structure

The hip is a synovial, **ball and socket** joint.

The spherical ball is largely contained in the acetabulum. The acetabulum grasps almost **half** of the femoral ball, a grip augmented by a ring-shaped fibro-cartilaginous lip, the **labrum.**

Both the ball and the cup are covered with a strong, but lubricated layer called articular **hyaline cartilage.**

Hip Joint



***ligamentum teres*:** relaxed during adduction - of little importance in adults

Plate 3-55

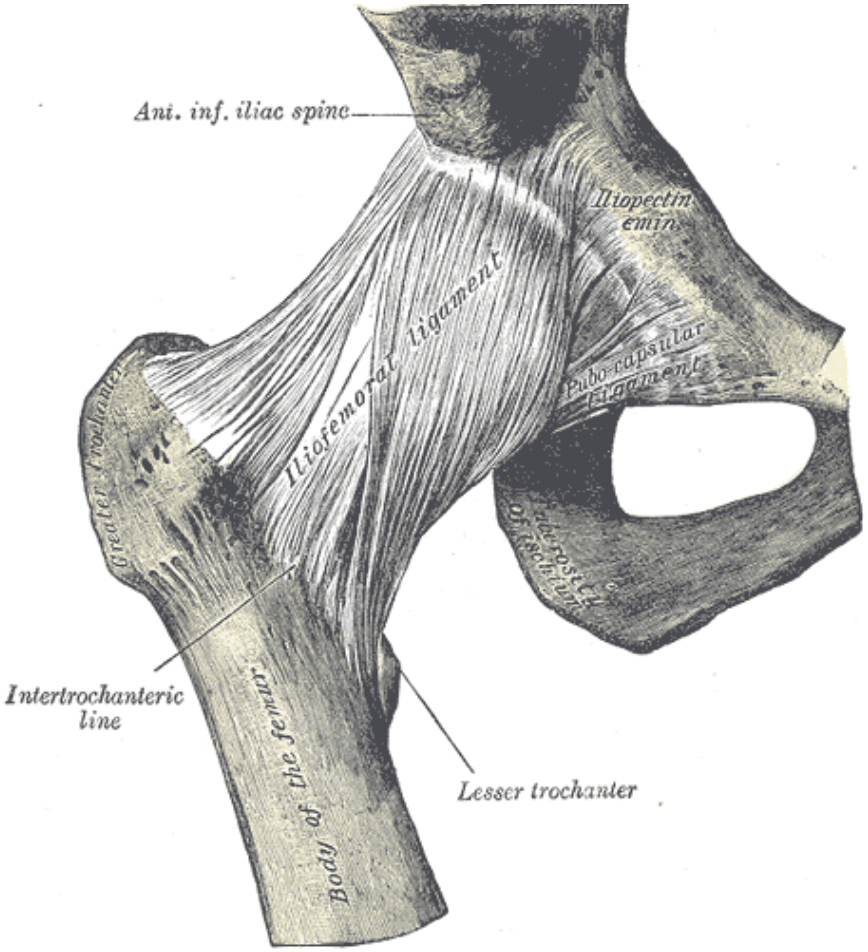
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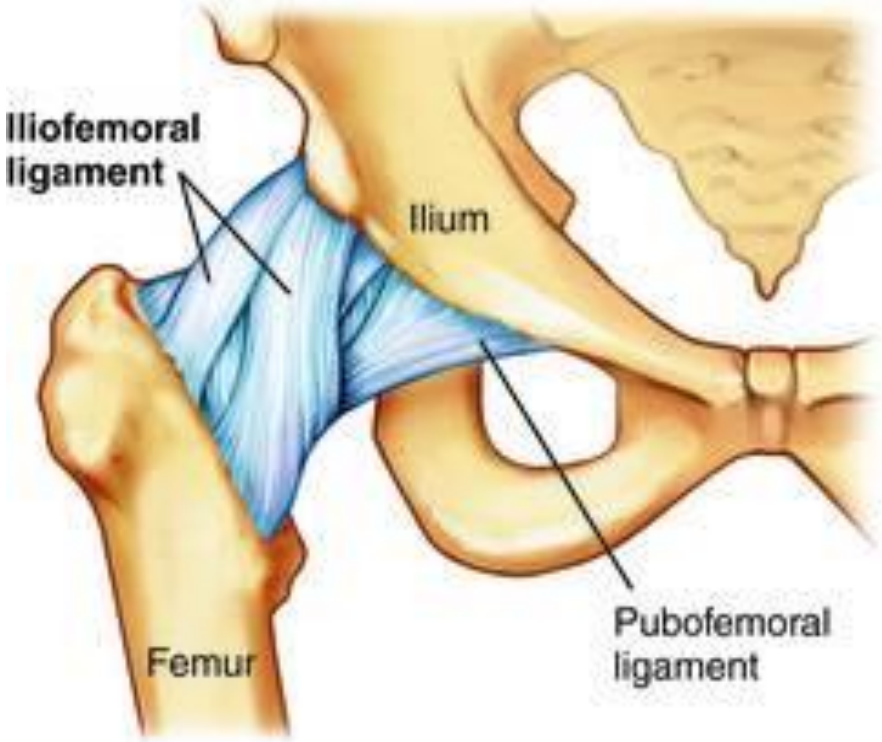
The hip joint is relatively stable due to:

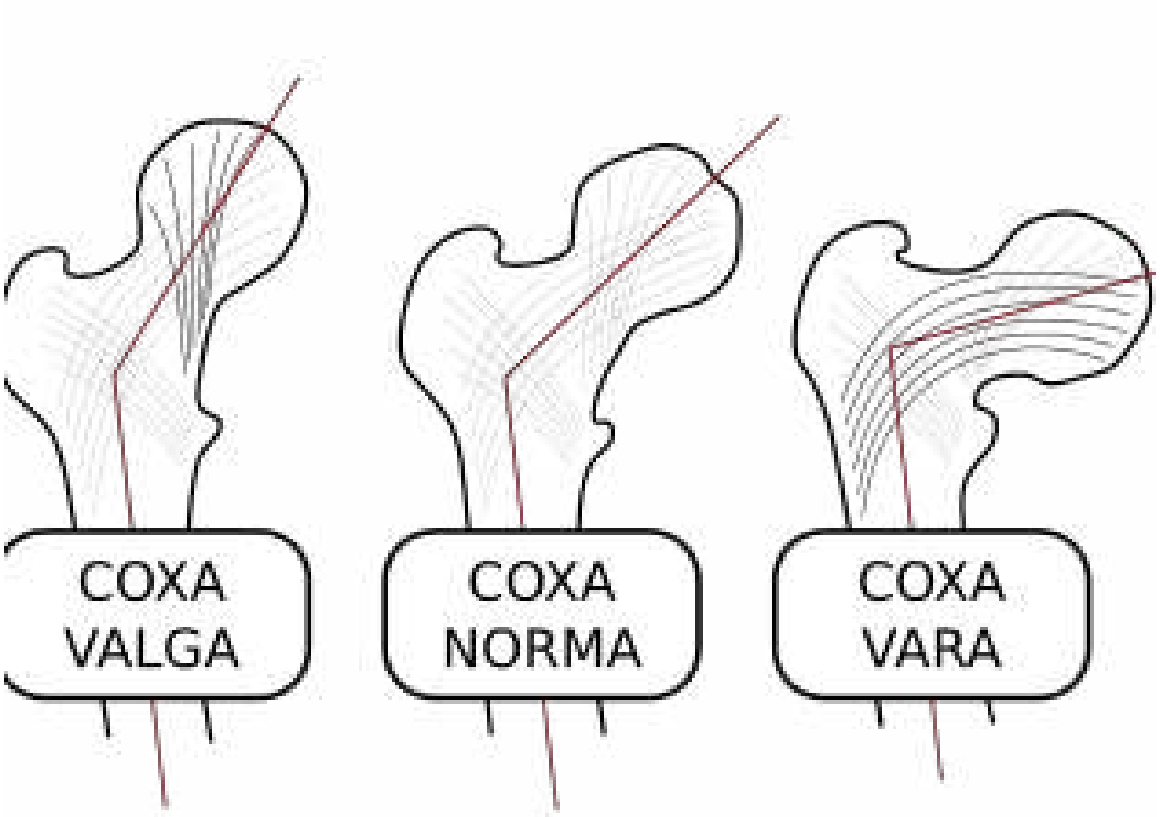
1) **Bony architecture**
2) **Strong ligaments**
3) **Large supportive muscles**

- The strong but loose fibrous capsule permits the hip joint to have the **second largest range** of **movement** and yet **support the weight** of the body, arms and head
- The hip joint is reinforced by four ligaments. Of these, the **Y-shaped** ligament of Bigelow or **ilio-femoral ligament** is the **strongest** ligament in the body

In the upright position the **ilio-femoral ligament** prevents the trunk from falling backwards without the need for muscular activity




Iliofemoral ligament
Ilium
Pubofemoral ligament
Femur

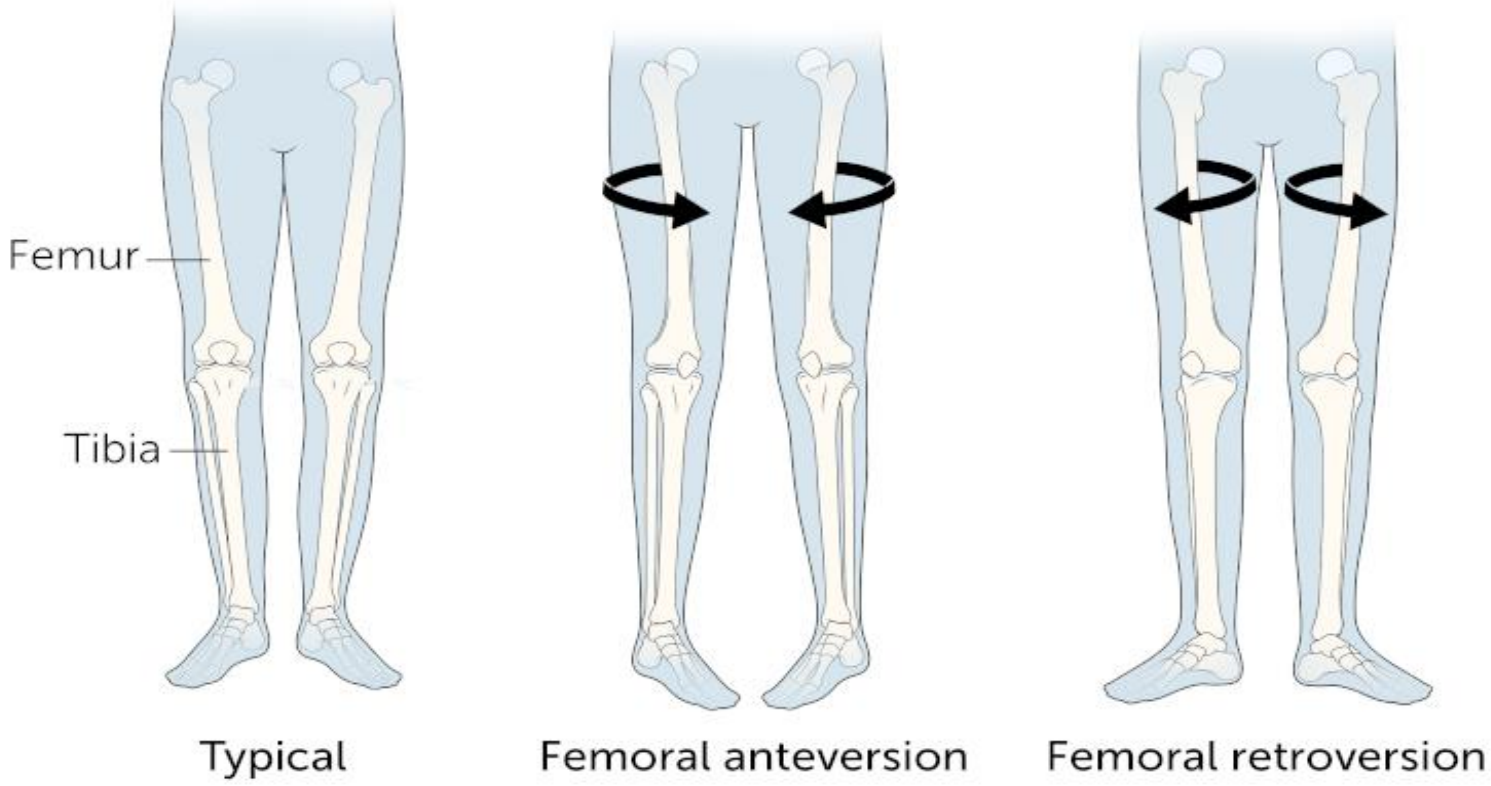


Femoral Neck Angle

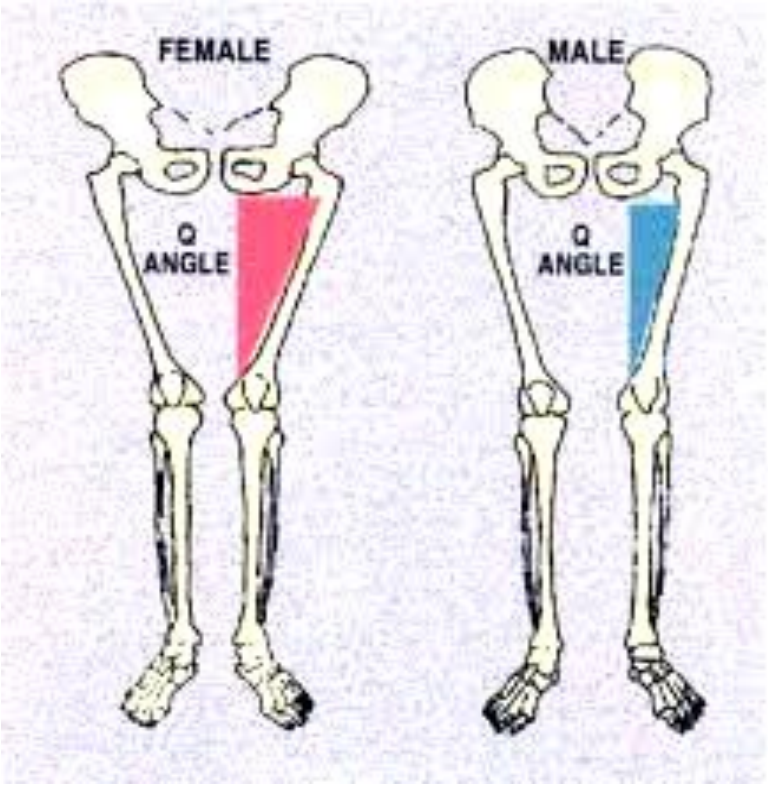
Coxa Valga : abnormally large angle. Associated with Genu Varum (bow-legs)

Coxa Vara: abnormally small angle. Associated with Genu Valgum (knock-knees)

Femoral Retroversion and Anteversion



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FEMALE
Q
ANGLE
MALE
Q
ANGLE

Movements of the hip joint

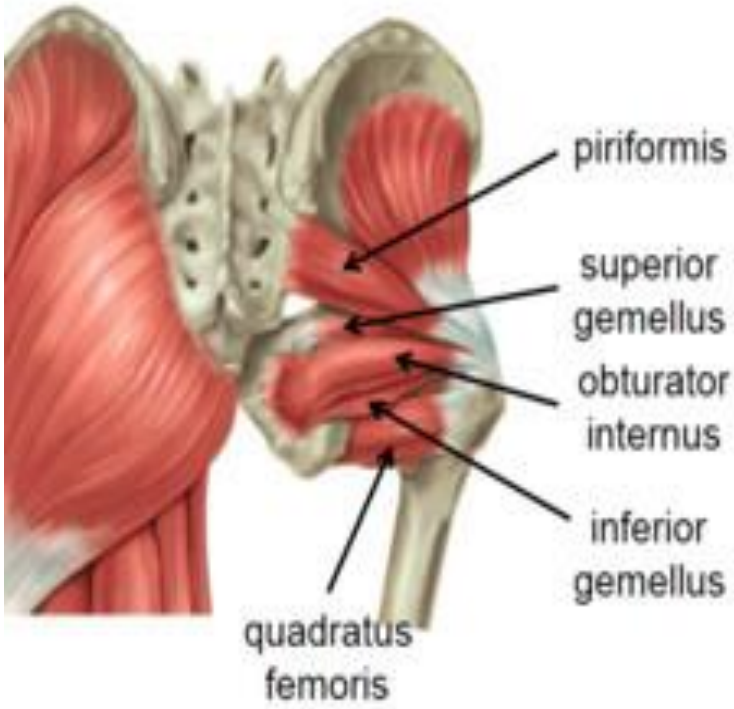
Lateral or External Rotation

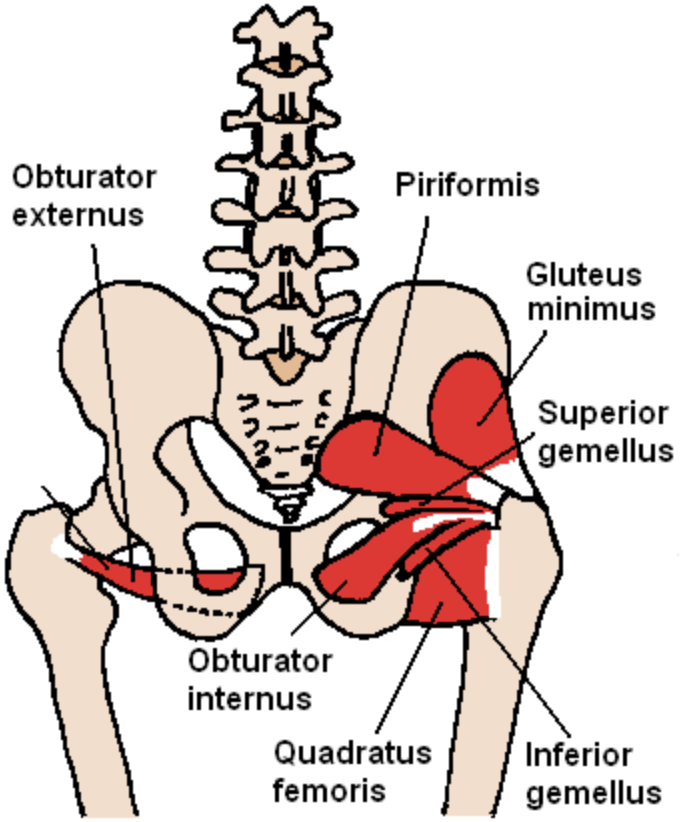
Gluteus Maximus, 6 Deep Rotators:

piriformis, quadratus femoris, obturator internus and externus, gemellus inferior and superior

The iliofemoral ligament **inhibits** lateral rotation

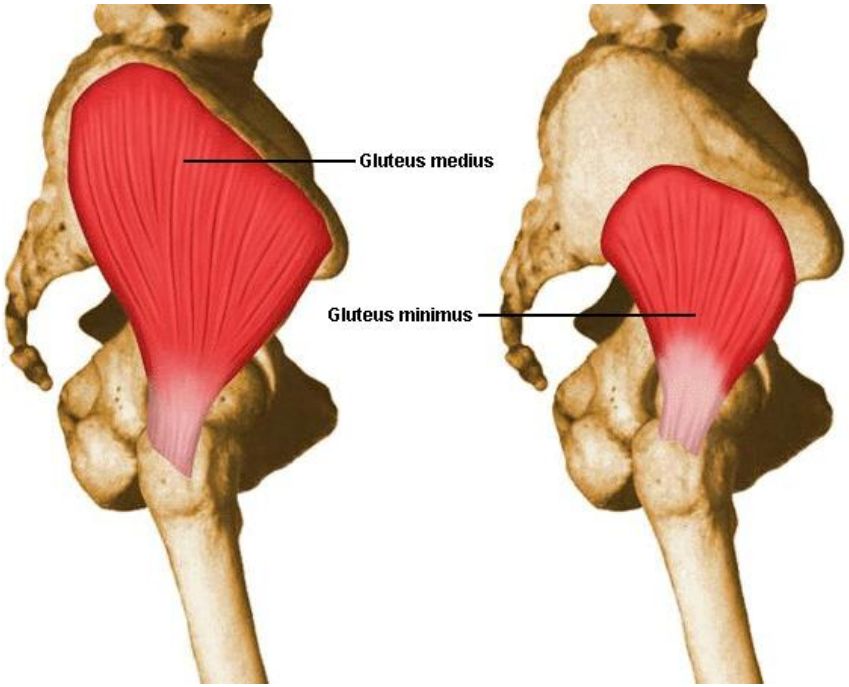
Deep lateral rotators

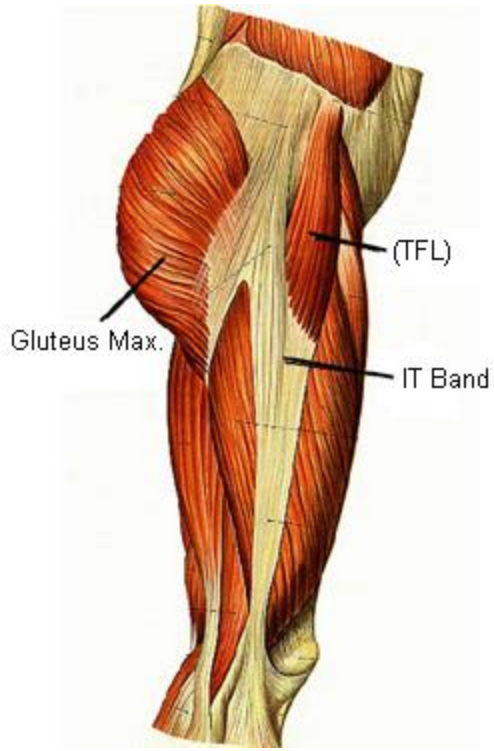




Medial or Internal Rotation

Gluteus Medius and Minimus, Tensor Fascia Latae

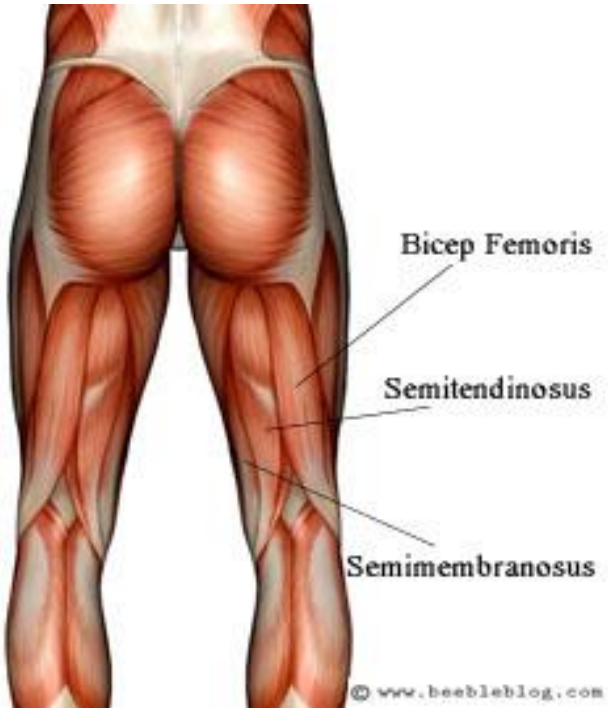




Extension (5 to 20 degrees)

Gluteus Maximus and Hamstrings

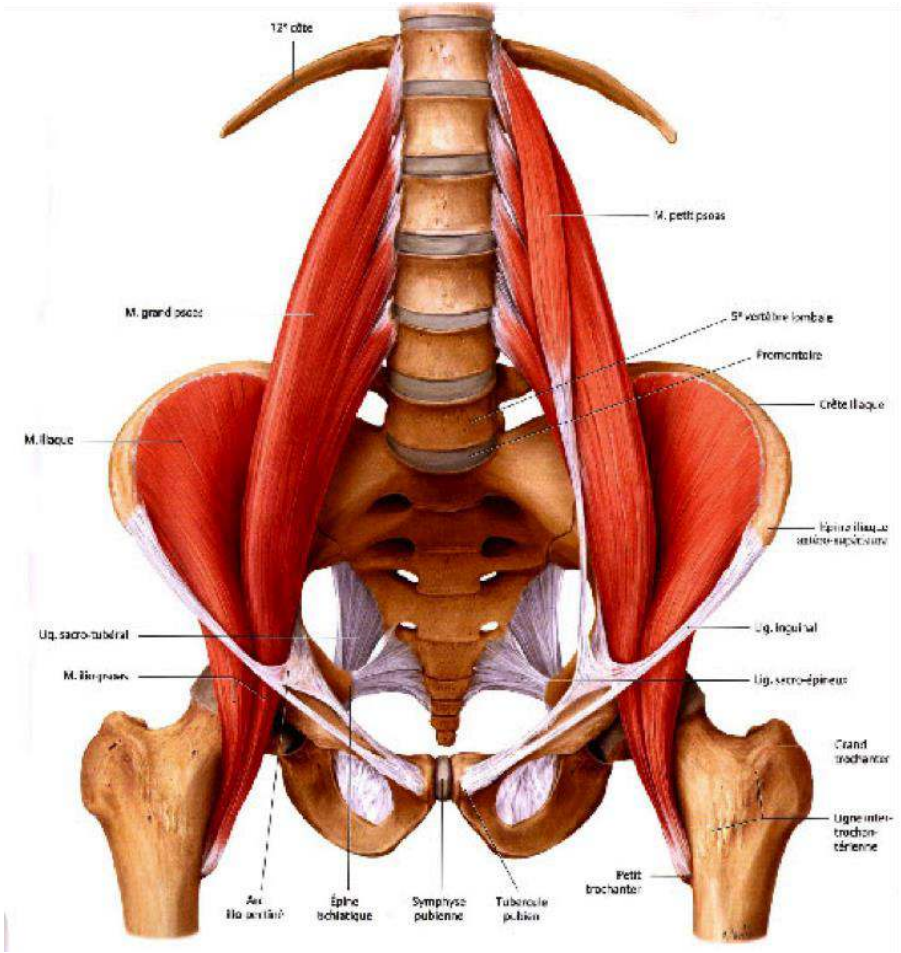
(Biceps femoris, Semitendinosis, Semimembranosis,)

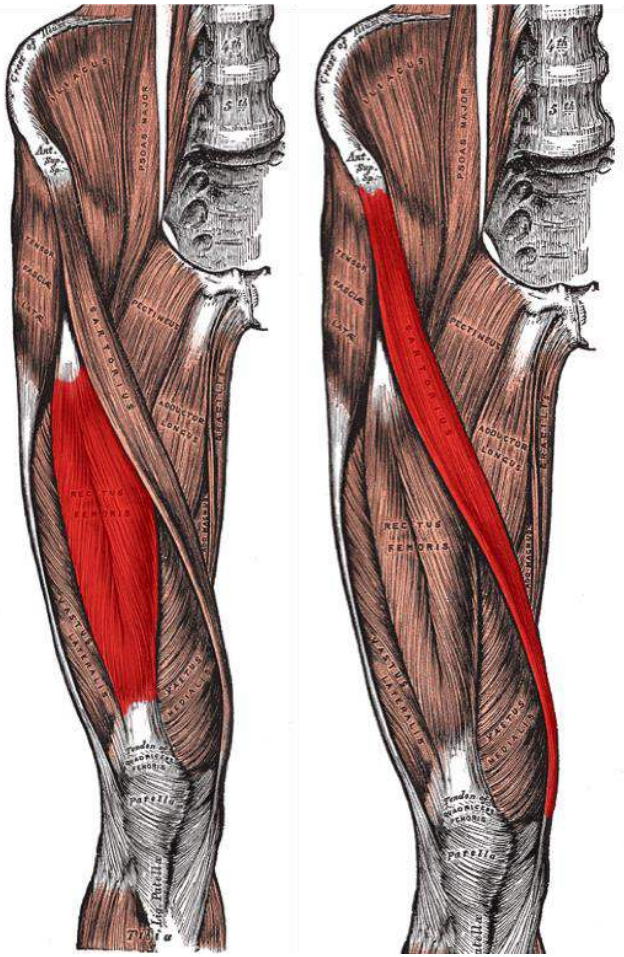




Flexion:

Iliopsoas, Rectus Femoris, Sartorius

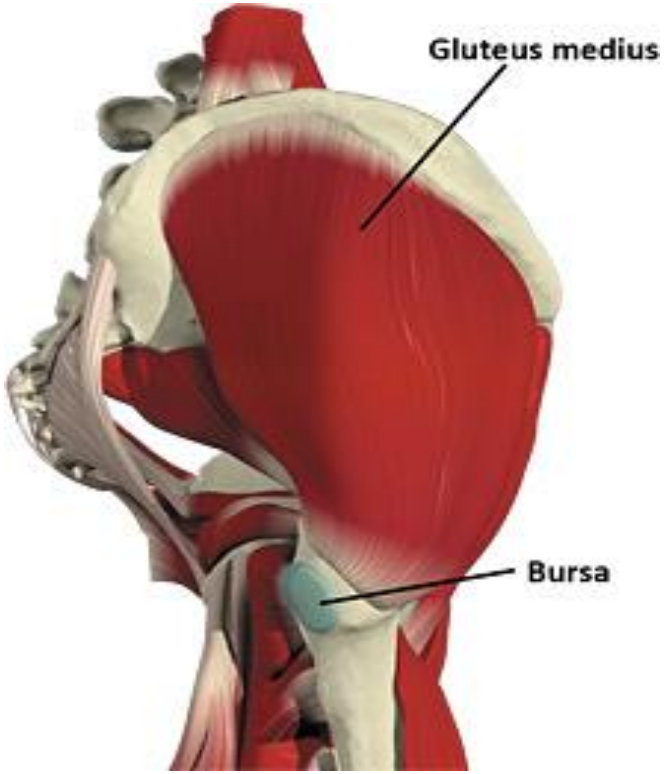




Abduction:

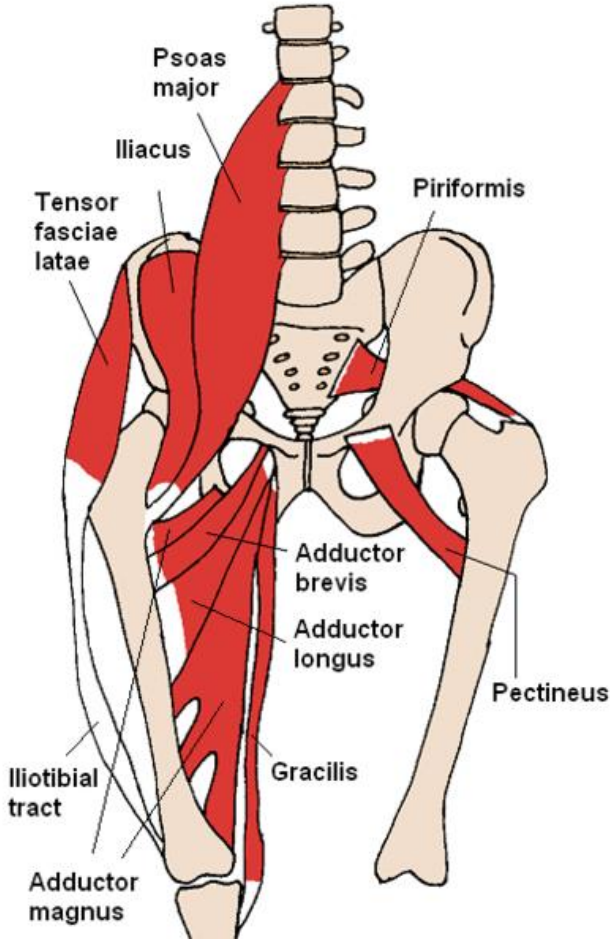
Gluteus Medius, Tensor Fascia Latae





Adduction

Adductor Magnus, Longus, Brevis and Gracilis



Common Causes of Hip Pain

- **Osteoarthritis.** This is an age-related wear-and-tear type of arthritis. It usually occurs in people 50 years of age and older and often in individuals with a family history of arthritis. The cartilage cushioning the bones of the hip wears away. The bones then rub against each other, causing hip pain and stiffness. Osteoarthritis may also be caused or accelerated by subtle irregularities in how the hip developed in childhood.
- **Rheumatoid arthritis**. This is an autoimmune disease in which the synovial membrane becomes inflamed and thickened. This chronic inflammation can damage the cartilage, leading to pain and stiffness. Rheumatoid arthritis is the most common type of a group of disorders termed inflammatory arthritis.
- **Posttraumatic arthritis**. This can follow a serious hip injury or fracture. The cartilage may become damaged and lead to hip pain and stiffness over time.
- **Osteonecrosis**. An injury to the hip, such as a dislocation or fracture, may limit the blood supply to the femoral head. This is called osteonecrosis (also sometimes referred to as avascular necrosis). The lack of blood may cause the surface of the bone to collapse, and arthritis will result. Some diseases can also cause osteonecrosis.
- **Childhood hip disease**. Some infants and children have hip problems. Even though the problems are successfully treated during childhood, they may still cause arthritis later in life. This happens because the hip may not grow normally, and the joint surfaces are affected. Learn more: Developmental Dysplasia of the Hip (DDH), Adolescent Hip Dysplasia
-

Osteo-Arthritis

Also known as "**wear and tear**" arthritis

It is a **degenerative disease** in which the surface cartilage of the joint wears away, eventually leaving just bone beneath it exposed

Healthy cartilage acts as padding in the joint

Symptoms include:

Discomfort and stiffness in groin, buttocks and thigh upon waking

Pain flares up with activity, calms down with rest

Loss of hip range

May feel a **grating** sensation on movement

Swelling, stiffness and warmth in hip area

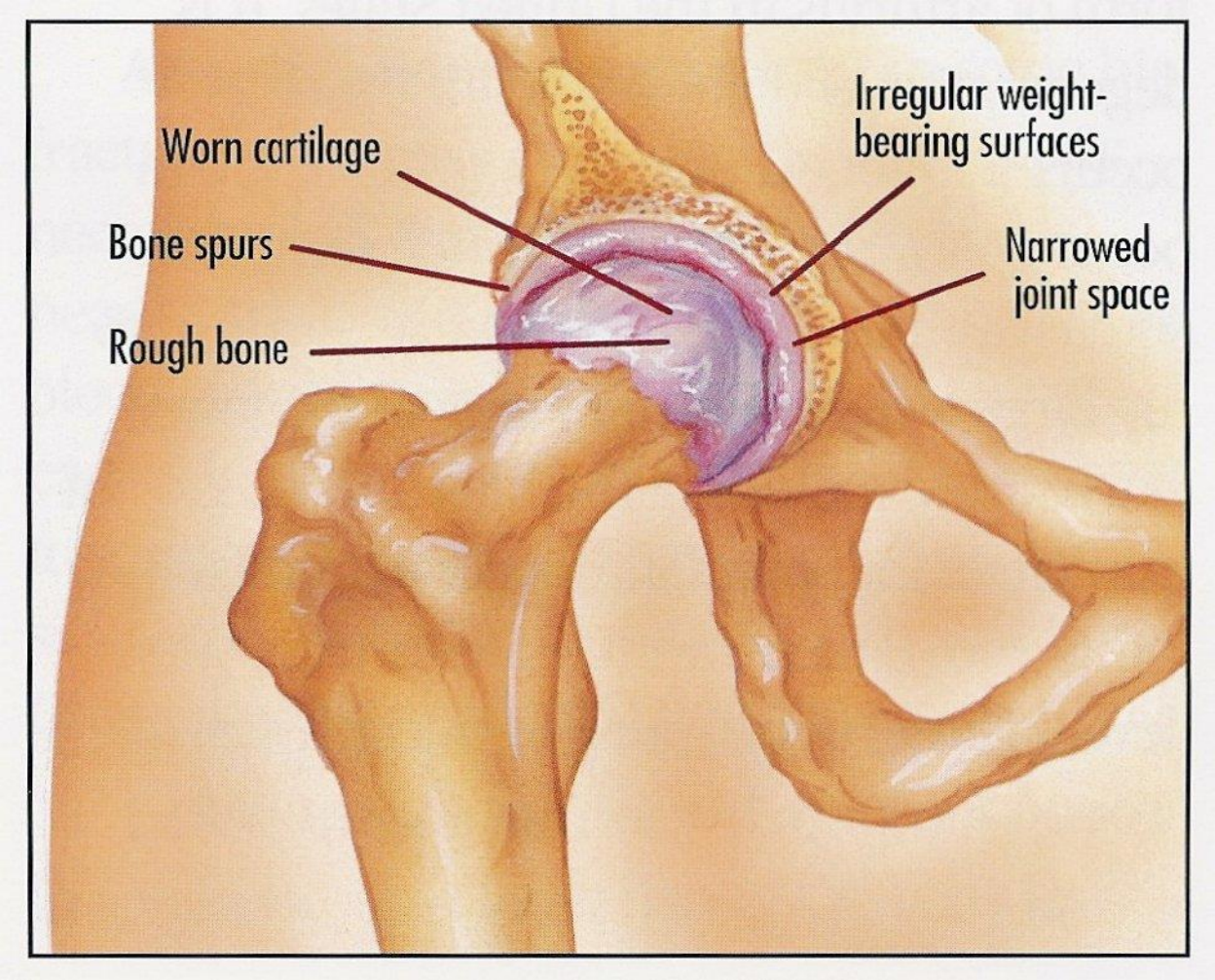

Worn cartilage
Bone spurs
Rough bone
Irregular weight-bearing surfaces
Narrowed joint space



Figure 1



Figure 2


Elderly female with left hip osteoarthritis
L
severely narrowed
joint space (arthritis)
acetabulum
femoral
head
greater
trochanter
lesser trochanter
femoral
canal

Treatment:

Rest and **avoid overuse**

Regular, **gentle exercise** to keep hip functioning and maintain strength and range of motion

General strengthening exercises to improve **posture**

Non-weight bearing exercise is preferable

Weight control

Surgical hip replacement in extreme cases

When is surgery recommended

- There are several reasons why your orthopaedic surgeon may recommend total hip replacement surgery. People who benefit from hip replacement surgery often have:
- Hip pain that limits everyday activities, such as walking or bending
- Hip pain that continues while resting, either during the day or at night
- Stiffness in a hip that limits the ability to move or lift the leg
- Inadequate pain relief from anti-inflammatory drugs, physical therapy, or walking supports

Recommendations for surgery are based on a patient's pain and disability, not age. Most patients who undergo total hip replacement are 50 to 80 years old, but orthopaedic surgeons evaluate patients individually. Total hip replacements have been performed successfully at all ages, from the young teenager with juvenile arthritis to the elderly patient with degenerative arthritis.

Orthopedic Evaluation

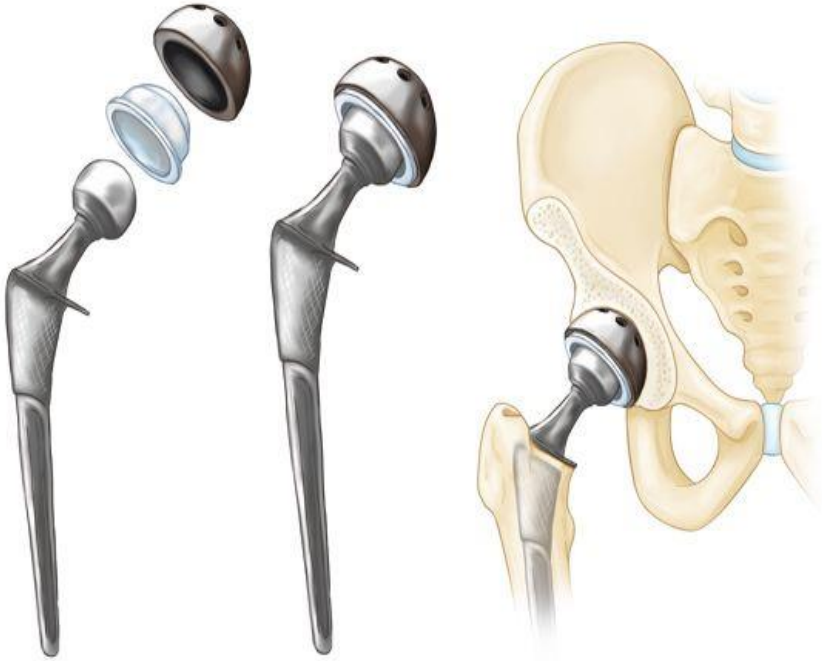
- Medical history. The orthopaedic surgeon will gather information about one's general health and ask questions about the extent of the hip pain and how it affects one's ability to perform everyday activities.
- Physical examination. This will assess hip mobility, strength, and alignment.
- X-rays. These images help to determine the extent of damage or deformity in the hip.
- Other tests. Occasionally other tests, such as a magnetic resonance imaging (MRI) scan, may be needed to determine the condition of the bone and soft tissues of the hip.

Description of Total Hip Arthroplasty

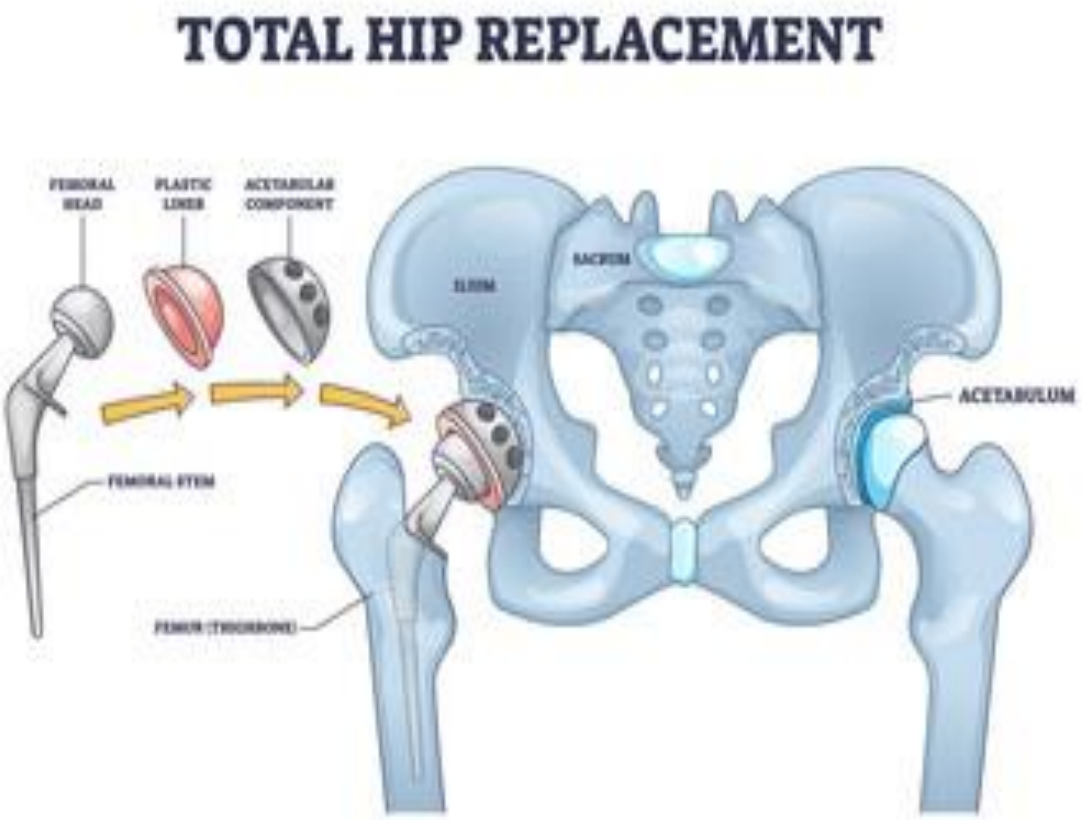
- In a total hip replacement (also called total hip arthroplasty), the damaged bone and cartilage is removed and replaced with prosthetic components.
- The damaged femoral head is removed and replaced with a **metal stem that is placed into the hollow center of the femur**. The femoral stem may be either cemented or "press fit" into the bone.
- **A metal or ceramic ball is placed on the upper part of the stem. This ball replaces the damaged femoral head that was removed.**
- The damaged cartilage surface of the socket (acetabulum) is removed and **replaced with a metal socket**. Screws or cement are sometimes used to hold the socket in place.
- A plastic, ceramic, or metal spacer (also called a liner) is inserted between the new ball and the socket to allow for a smooth gliding surface.

Hip Replacement





TOTAL HIP REPLACEMENT



Femoral Component

- A standard non-cemented femoral component. (Center) A close-up of this component showing the porous surface for bone ingrowth. (Right) The femoral component and the acetabular component working together.



Acetabular Component

The acetabular component shows the plastic (polyethylene) liner inside the metal shell. The porous surface of this acetabular component allows for bone ingrowth. The holes around the cup are used if screws are needed to hold the cup in place.

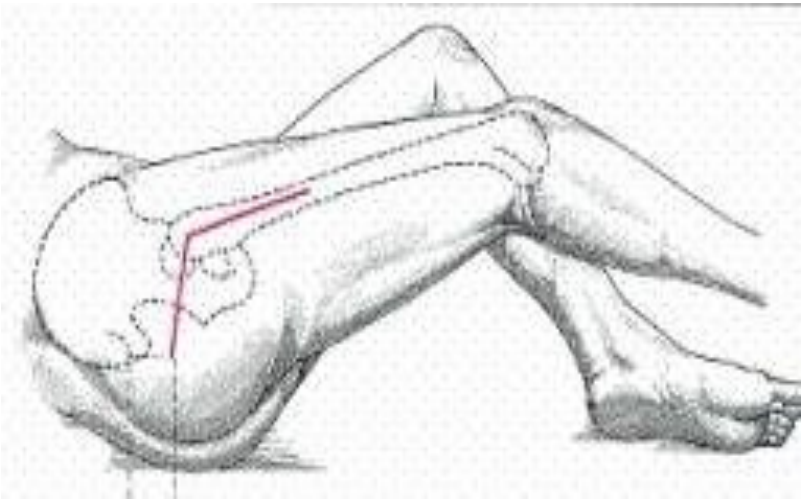


Posterior Surgical Approach

A most common surgical approach for THR.

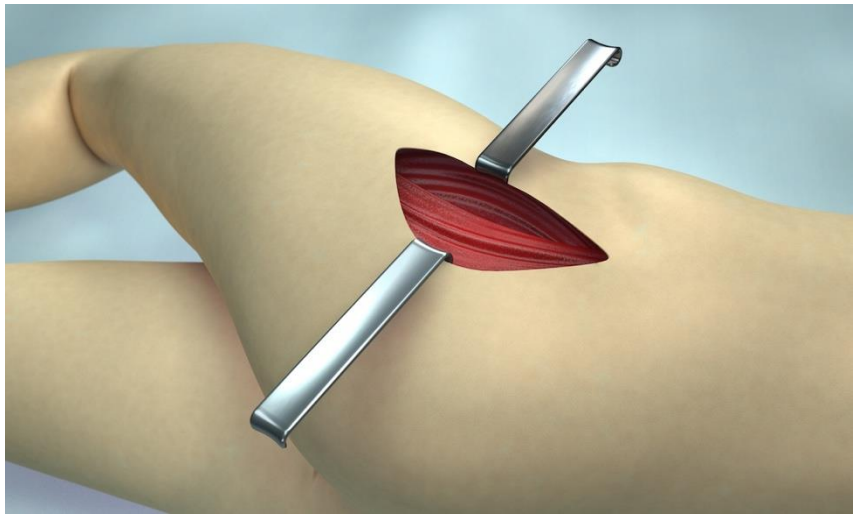
With the posterior approach, the surgeon has a better view of the hip joint, but they have to cut through muscles and soft tissues to access the joint. The recovery will take longer

The location of a traditional posterior hip replacement scar is usually on the side/back of the hip.



Lateral Approach

A direct lateral or anterolateral approach uses an incision directly down the outside of the hip while the patient lays on their side, like the posterior approach. Surgeons may use this method to correct deformities or when using a specialized implant. The disadvantage to this way is the **hip abductor muscles that need to be cut to access the** joint. Additional cutting increases both the surgical and recovery times.



Anterior Surgical Approach

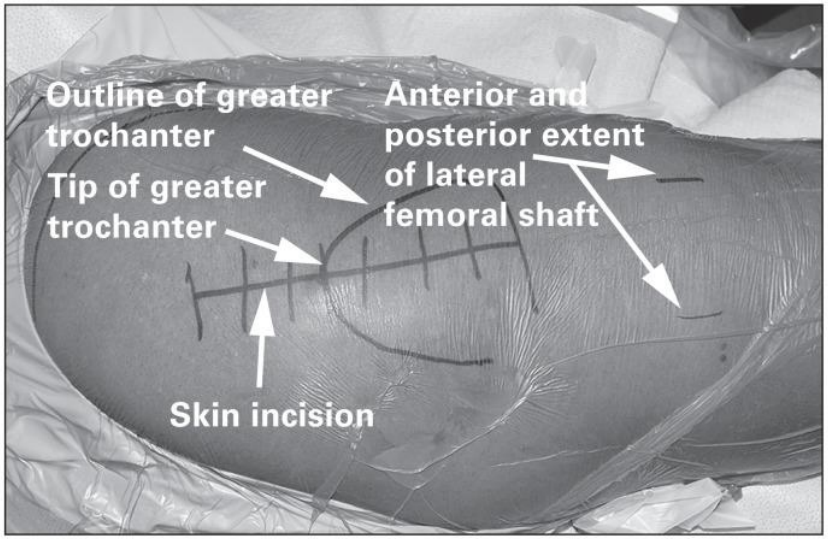
The standard anterior hip replacement scar is usually a vertical scar which actually **crosses the groin crease**. This is located in the front of the upper thigh.



Anterior Approach

Frontal entry makes it possible to reach the hip joint by separating muscles, rather than splitting them. In the appropriately selected patient, the anterior hip replacement is likely associated with less postoperative pain, especially in the first two to four weeks. Afterwards, there are no recovery differences between the anterior and posterior approaches.

Leg length and implant position are also able to be measured with the anterior approach.



Anterior Surgical Approach (Bikini)



- **A bikini incision** hip replacement is a minimally invasive hip replacement procedure in which the damaged hip joint is replaced with implants through a small diagonal incision made in the **the front of hip.** The surgical scar formed as a result of this surgical technique is small enough to be concealed by a bikini.

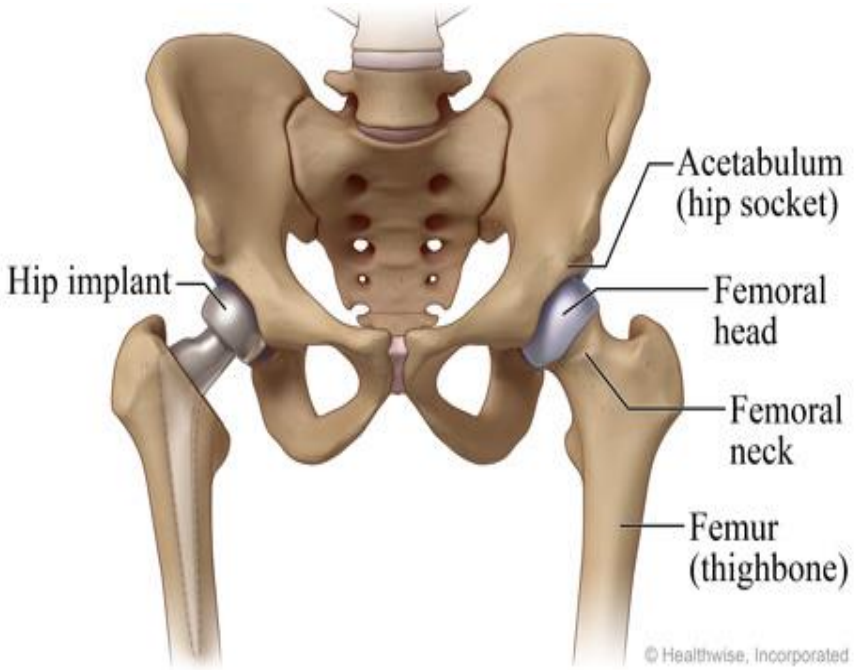
Possible Complications (post surgery)

- Dislocation. This occurs when the ball comes out of the socket. The risk for dislocation is greatest in the first few months after surgery while the tissues are healing. However, dislocation is uncommon.
- If the ball does come out of the socket, a closed reduction usually can put it back into place without the need for more surgery. In situations in which the hip continues to dislocate, further surgery may be necessary.
- Loosening and implant wear. Over a period of years, the hip prosthesis may wear out or loosen. This is most often due to everyday activity. It can also result from a biologic thinning of the bone called osteolysis. If loosening is painful, a second surgery called a revision may be necessary.

- Leg-length inequality. Sometimes after a hip replacement, one leg may feel longer or shorter than the other. Your orthopedic surgeon will make every effort to make your leg lengths even but may lengthen or shorten your leg slightly to maximize the stability and biomechanics of the hip. Some patients may feel more comfortable with a shoe lift after surgery.

PARTIAL HIP REPLACEMENT

- A partial hip replacement removes and replaces the ball (femoral head) of the hip joint. It does not replace the socket. This surgery is most often done to repair certain types of hip fractures.
- The ceramic or metal ball is attached to a metal stem. This is called a hip implant. The stem is set down into the core of the thighbone (femur).



Post-Operative Rehab

No specific general hip replacement protocol is currently in use, as small elements of the rehabilitation process are surgeon-specific. For example, in some enhanced recovery after surgery protocols, patients are mobilized out of bed within the first 6 hours post-surgery.

Other settings may only start mobilizing patients out of bed on day 1 or 2 post-surgery.

Accelerated rehabilitation programs and early mobilization have been shown to give patients more confidence in their post-operative mobilization and activities of daily living, as well as being more comfortable with earlier discharge.

Post-Operative Aims

Aim of post-operative rehabilitation: address the functional needs of the patient (e.g. start mobilizing) and to improve mobility, strength, flexibility and reduce pain. This starts as an assisted process, but the aim is to get the patient as functional as possible before discharge.

As a result of the underlying pre-operative pathology, patients may present with muscle atrophy and loss of strength, particularly in the **gluteus medius and quadriceps muscles.** The result of the loss of strength is that the elderly are less independent.

Surgery will correct the joint problems but **associated muscle weakness that was present** before the surgery will remain and require post-operative rehabilitation (research has shown **hip abductor weakness** after surgery is a major risk associated with joint instability and prosthetic loosening). Patients can achieve significant improvements through a targeted strengthening program following total hip replacement.

Rehab Progression

6 Weeks Post Surgery:

Patients are normally followed up by an orthopedic surgeon.

The surgeon determines if the patient is allowed the following:

- Full range of motion at the hip
- Full weight bearing without mobility assistive device
- Driving

After 6 Weeks:

- Gain of initial ROM, stabilization, and proprioception
- Endurance
- Flexibility
- Balance
- Speed, precision, neurological coordination
- Functional exercises

Realistic expectations

With normal use and activity, the material between the head and the socket of every total hip replacement implant begins to wear. **Excessive activity or being overweight** may speed up this normal wear and cause the total hip replacement to loosen and become painful. Therefore, most surgeons advise against high-impact activities such as running, jogging, jumping, or other high-impact sports.

Realistic activities following total hip replacement include unlimited walking, swimming, golf, driving, hiking, biking, dancing, and other low-impact sports.

With appropriate activity modification, hip replacements can last for many years.

How Can Pilates Help?

Movement system versus isolated exercises

Work the **whole body**

Attention as always to perfect **alignment** and **correct movement patterns**

Include **one sided** exercises using ideal apparatus

Work in the **pain-free range** if need be

Address **weakness** and i**nflexibility**

Make necessary changes to **life-style**