TOTAL KNEE ARTHROPLASTY
EVALUATION OF RESULTS OF DIFFERENT TYPES OF T.K.A. IN ARTHRITIS

This thesis is submitted for partial fulfilment of the M.D. Degree in Orthopaedic Surgery

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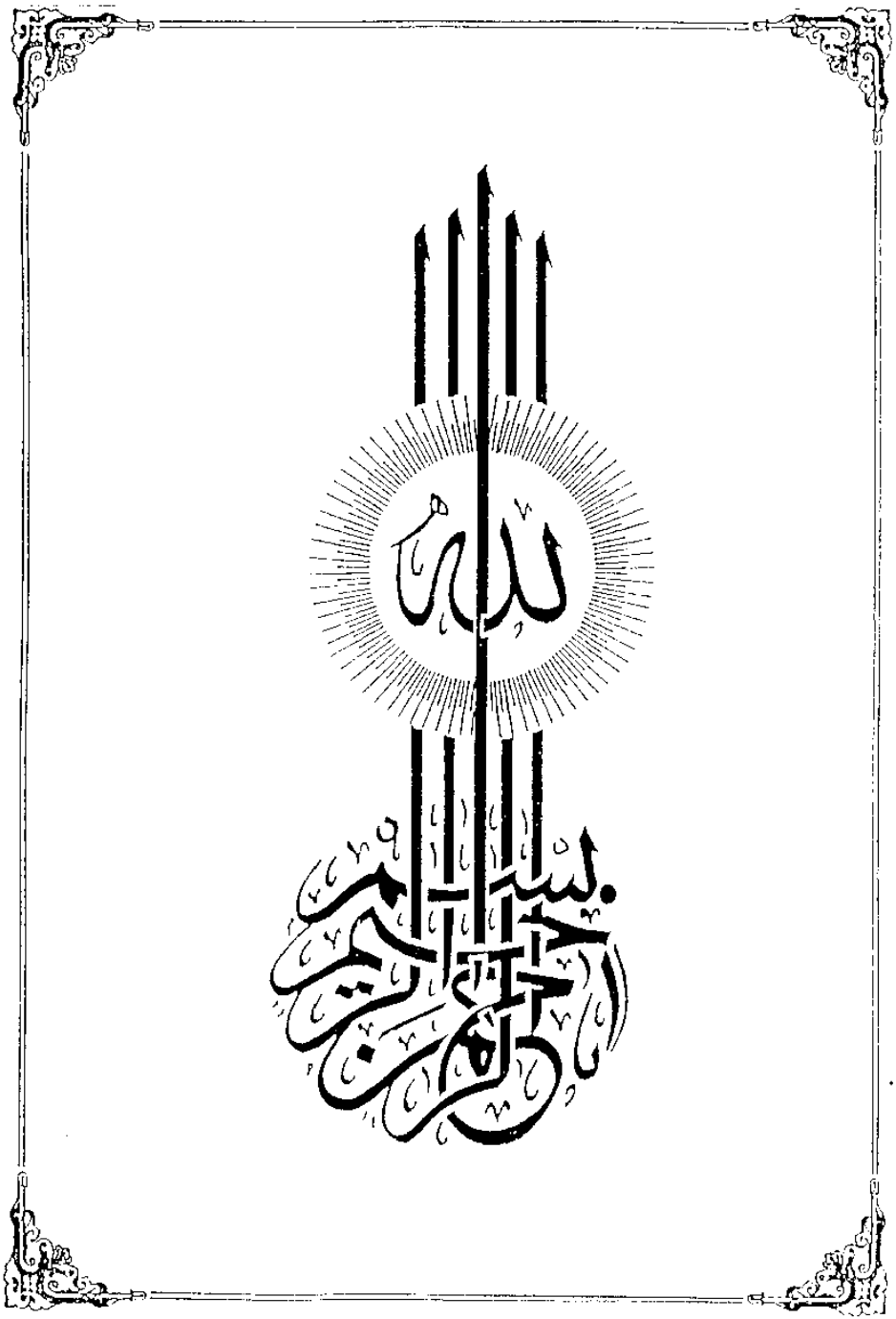

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C O N T E N T S

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INTRODUCTION AND AIM OF THE WORK

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Knee arthritis is a common problem in Orthopaedic practice, and no single traditional line of treatment, either conservative or surgical, has proved to be totally successful. This explains why total knee arthroplasty has become more popular than before.

On the other hand, Total Knee Arthroplasty (T.K.A.) is still a very expensive procedure to be done routinely in our country, but it may be the solution for some selected cases.

So, the aim of this thesis is to evaluate and compare the results of the main types of total knee arthroplasties, available to us today, and to determine which type is superior to the others if possible.

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ANATOMY

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ANATOMY OF THE KNEE JOINT

The knee joint is the largest and most complicated joint in the body. It is a synovial joint of a modified hinge type that also permits some rotation. Its structure is complicated because it consists of three joints merged into one: an intermediate one between the patella and the femur, and lateral and medial ones between the femoral and tibial condyles (*Moore, 1980*).

The knee can flex and extend like a hinge. Extension if for propulsion, and flexion is used prior to this and also to absorb the shock (by quadriceps) in landing. In addition, the flexed knee can rotate, as in change of direction at speed. This active rotation is a matter of choice, and is not to be confused with the passive and the inevitable rotation that occurs in straightening the knee in the "screw home" mechanism. During all these movements the knee is adapted to weight bearing and stable in any position (*Last, 1985*).

Bony Contours

The bones involved in the knee joint are the femur, the tibia and the patella. The fibula is only indirectly associated. The articular surfaces are the large curved condyles of the femur, the flattened condyles on the tibia, and the patella (Fig. 1) (*Moore, 1980*).

The plateau of the tibia possesses two separate articular facets, each slightly concave. The larger medial facet lies wholly on the upper surface of the condyle, but the lateral facet curves back over the posterior margin of the tibial condyle. This beveled margin allows withdrawal of the lateral meniscus by the popliteus muscle. The median portion of the tibia between the

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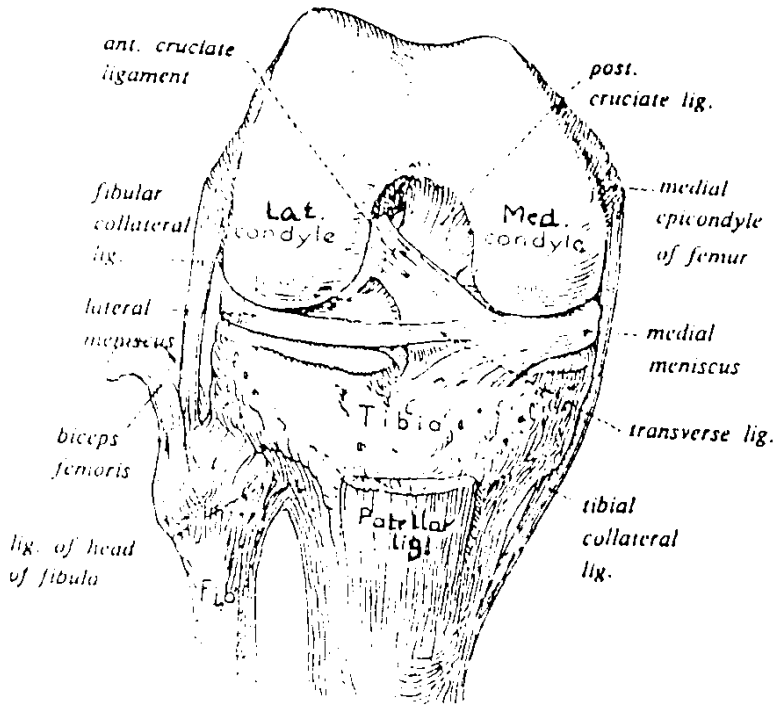
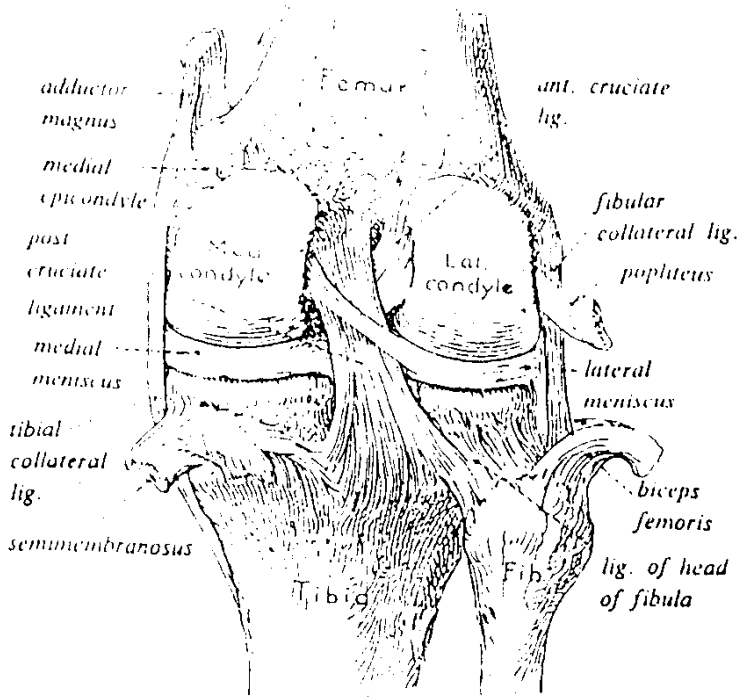


Ant. Aspect of the knee joint



Post. aspect of the knee joint *(El Rakhawy, 1980).*

Fig. (1)

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plateau is occupied by an elevation - the spine of the tibia. Anteriorly there is a depression, the anterior intercondylar fossa, to which from anterior to posterior are attached the anterior horn of medial meniscus, the anterior cruciate ligament, and the anterior horn of the lateral meniscus. The two bony tubercles forming the spine, together with the menisci, enhance the impression of cupping seen in intact specimens. By projecting toward the inner sides of the femoral condyles they act as side-to-side stabilizers. Behind the tubercles, the posterior intercondylar fossa gives attachment to the medial then the lateral meniscus and behind them on the margin of the tibia between the condyles, the posterior cruciate ligament.

The femur has two asymmetric condyles, separated posteriorly by a deep notch, but fusing anteriorly into a trochlear groove for articulation with the patella. The femoral groove is separated from the medial and lateral femoral condyles by an indistinct ridge, more prominent laterally. The distal surface of the medial condyle is narrower, longer and more curved than the lateral condyle. This is for the "screw home" movement.

The patella is described as possessing seven facets. Both medial and lateral facets are divided horizontally into approximately equal thirds, while the seventh or odd facet lies along the extreme medial border of the patella. Overall, the medial facet is smaller and slightly convex, while the lateral, which consists of roughly two thirds of the bone, has a sagittal convexity and coronal concavity.

The patella fits the patellar surface of the femur imperfectly. The contact patch has been investigated by dye (*Goodfellow, 1976*) and casting tech-

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niques (*Aglietti, 1975*). Both methods give very similar results and indicate that the area of contact never exceeds about one third the total patellar surface available, the most extensive contact being made at 45° in which position it shows an eclipse occupying the central medial and lateral facets. In full extension, the lower medial and lateral patellar facets rest against the upper position of the femoral groove. At 90° the contact area has shifted to the upper medial and lateral patellar facets and with further flexion the contact patch separates into distinct medial and lateral areas. Because the odd facet only makes contact with the femur in extreme flexion (as in the act of squatting), this facet is habitually a non-contact zone in Western man, a fact that is thought to have some pathological significance.

The knee joint possesses very little inherent stability by virtue of its shape. It is also one of the most flexible joints in the body. For both these reasons, proper function is unusually dependent on ligament integrity.

Capsular Attachments

The articular capsule that invests the joint, is usually thin and, in some areas deficient, while the patella and ligamentum patellae serve as a capsule in front (*gardener et al., 1975*).

On the femur, the capsule adheres below the ephiphyseal line down to the articular margin except in two places. At the back it is attached to the intercondylar ridge at the lower limit of the popliteal surface, and on the lateral condyle it encloses the pit for the popliteus tendon. On the tibia the capsule is attached around the margins of the plateau except in two places. Posteriorly it is attached to the ridge between the condyles at the lower end

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of the groove for the posterior cruciate ligament and laterally the capsule is not attached to the tibia but is prolonged down over the popliteus tendon to the styloid process on the head of the fibula. The edges of this prolongation are the arcuate ligament posteriorly and the short external lateral ligament anteriorly. The arcuate ligament is the edge of the capsule that arches down from the lateral meniscus to the styloid process of the fibula. The superficial fires of the popliteus muscle are attached to it. The thickness of the adult capsule varies very much. From the lower margin of the patella to the anterior margin of the plateau of the tibia it is excessively thin. It is invaginated together with the synovial membrane by a pad of fat whose herniation into the joint raises up a medial fold called the infrapatellar fold. The capsule has two main gaps in it, one allowing popliteus tendon to enter, the other communicating with the suprapatellar bursa (*Last, 1985*).

Capsular Thickening

Medially and laterally the capsule is greatly thickened, forming two ligaments. In old terminology they were named the short lateral ligaments (internal and external). The short internal ligament lies deep to the tibial collateral (medial) ligament of the knee joint. It is a thickening of capsule which extends from the medial epicondyle of the femur to the medial meniscus; it holds the medial convexity of the meniscus firmly to the femur. It blends with the medial ligament at the femoral attachment, but below this the two are separated by a bursa. Elsewhere around the convexity of the meniscus the capsule, attached above to femur and below to tibia, is thin and lax; it is known as the coronary ligament. The short external lateral ligament is a cord-like thickening of the capsule on the lateral side of the joint, just anterior to the arcuate ligament. Its femoral attachment is on the epicondyle, where it

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blends with the tendon of popliteus. Its lower attachment is on the medial border and styloid process of the upper end of the fibula. It is not infrequently absent or poorly developed. Elsewhere on the lateral aspect of the joint the capsule, attached to the lateral meniscus, is thin and lax both above and below. This lax capsule is known as the coronary ligament, and it allows great mobility of the lateral meniscus (*Last, 1985*).

Ligaments

The capsule is reinforced by four main ligaments namely the patellar retinacular, the tibial and fibular collateral ligaments and the oblique popliteal ligament (*Last, 1985*).

The capsule is strengthened on both sides by the aponeurotic expansions of the vasti and the overlying fascia. The combined fascial-aponeurotic sheets are known as the medial and the lateral retinaculum of the patella, respectively (*Gardner et al., 1975*).

These accessory patellar ligaments are strong, resistant, fibrous supports connecting the margins of the patella near its apex with the margins of the tibial plateau and the anterolateral surfaces of the tibial condyles as far back as the collateral ligaments. Their purpose is to fix the apex of the patella to prevent dislocation (*McVay, 1984*).

The tibial collateral ligament is a broad, flat band that extends from the medial epicondyle of the femur to the medial surface of the tibia. The ligament lies immediately external to the capsule; its deep portion is attached to the capsule (medial and posterior), to the outer aspect of the

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medial meniscus, and to the tibia above the groove for the semimembranosus tendon. One or more bursae may be present deep to the ligament. The tibial collateral ligament and the widespread expansions of the semimembranosus tendon are important supports for the medial side of the joint.

The fibular collateral ligament, more rounded and cord-like, extends from the lateral epicondyle of the femur to the head of the fibula. Its deep aspect is related to the short external lateral ligament, and it is separated from the lateral meniscus by the tendon of the popliteus muscle. It is one of the most important stabilizing factors on the lateral side of the joint together with the biceps tendon, popliteus tendon and ilio-tibial tract (*Gardner et al., 1975*).

Both the tibial and fibular collateral ligaments are attached just behind the axis of flexion of the femoral condyle. So, they drawn taut by (and limits extension) the terminal "screw home" movement of the knee (*Last, 1985*).

The oblique popliteal ligament is a thick rounded band of great strength, perforated by the middle genicular vessels. It is an expansion from the insertion of semimembranosus which slopes up to the popliteal surfaces of the femur. It blends with the capsule above the lateral condyle of the femur, and in the intercondylar notch rather above its margin, so that a prolongation upwards of synovial membrane extends a little on the popliteal surface of the femur. The obliquity of this ligament limits rotation-extension in the "screw home" or locked position (*Last, 1985*).

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The Intra-articular Structures

Include the cruciate ligaments, the menisci, and the femoral tendon of the popliteus, of these only the menisci are intrasynovial.

The Cruciate Ligaments

Consist of a pair of very strong ligaments connecting tibia to femur, and cross each other as the limbs of the letter X.

The anterior cruciate ligament is attached to the anterior part of the tibial plateau in front of the tibial spine and extends upwards and backwards to a smooth impression on the lateral condyle of the femur well back in the intercondylar notch. The average length of ligament is 38mm and the average width 11mm.

The posterior cruciate ligament is attached to the posterior part of the head of the tibia between the condyles and passes forwards medial to the anterior cruciate ligament. It is attached to a smooth notch. The average length of the ligament is 38mm and the average width 13mm and is narrowest in its middle portion, fanning out to a greater extent superiorly than it does inferiorly. They are essential to the antero-posterior stability of the knee joint especially in the flexed position. The role of each cruciate ligament must be studies studied separately.

The main bulk of the posterior cruciate ligament is tight on knee flexion. It prevents the femur from sliding forwards off the tibial plateau. In the weight bearing flexed knee, it is the only stabilizing factor of the femur and its attached quadriceps. Thus with a ruptured posterior cruciate

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