‘EVALUATION OF THE FUNCTIONAL OUTCOME OF TOTAL KNEE REPLACEMENT IN RURAL POPULATION’

BY

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UNDER THE GUIDANCE OF

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APRIL- MAY- 2017

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Date: **Signature of the candidate**

Place: Kolar, Karnataka **DR. N RAJYALAKSHMI REDDY**

LIST OF ABBREVIATIONS USED

ACL	-	Anterior Cruciate Ligament
AP	-	Anteroposterior
BMI	-	Body mass index
BP	-	Blood pressure
CD	-	Cluster of differentiation
CRP	-	C Reactive protein
DMARDS	-	Disease Modifying Anti Rheumatic Drugs
DVT	-	Deep vein thrombosis
HSS	-	Hospital for Special Surgery
ICU	-	Intensive Care Unit
IL	-	Interleukin
KSS	-	Knee Society Score
LMWH	-	Low molecular weight heparin
LCL	-	Lateral collateral ligament
MCL	-	Medial collateral ligament
OA	-	Osteoarthritis
P value	-	Probability value

PCA	-	Posterior condylar axis
PCL	-	Posterior cruciate ligament
PLC	-	Posterolateral corner
PFL	-	Popliteo fibular ligament
ROM	-	Range of movement
RA	-	Rheumatoid arthritis
ROM	-	Range of motion
RTA	-	Road traffic accident
SF-36	-	Short form 36
SPSS	-	Statistical Program for Social Sciences
TEA	-	Trans epicondylar axis
TUG	-	Timed Up and Go test
TKR	-	Total knee replacement
WOMAC	-	Western Ontario and McMaster Universities Osteoarthritis index questionnaire score

ABSTRACT

BACKGROUND

Developments in science are increasing by the minute. Right from the increase in life span to the various treatment modalities for the complications associated with old age like joint replacements, man has come a long way. Total knee replacement is a surgical procedure with predictable outcomes. Urban and rural differences however still persist. Rural areas have less specialized doctors and facilities and the people may not understand the various protocols associated with surgeries.

OBJECTIVES

This observational study intends to review the outcome of total knee replacements performed in a rural population and evaluate the postoperative clinical, functional and radiological results in the replaced knees and the preoperative and postoperative lower limb alignment correction achieved and the incidence of early complications.

METHODS

We selected 26 people (30 knees) from the outdoor clinic who gave their informed consent for the study and satisfied our criteria. They were evaluated using the knee society score (KSS), preoperatively and postoperatively at the 3 months follow up for the clinical, functional and radiological outcomes. Data was analysed using the statistical program for social sciences (SPSS).

RESULTS

In our study we observed that the mean knee society score improved from 29 to 83.4 and the mean functional score improved from 35 to 83.5.

The number of patients suffering with osteoarthritis was more in our study.

INTERPRETATION

We found a significant increase in the KSS after total knee replacement compared to the preoperative scores. The knee flexion range increased from 56.20 to 1110. The complication rate in this study was only 6.6%.

CONCLUSION

We conclude that total knee replacement is a reliable and safe modality of treatment and can be performed in the rural population with results comparable to the other global studies.

KEY WORDS

Total knee replacement, rural population, osteoarthritis, rheumatoid arthritis, knee society score

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INTRODUCTION

With the advances in science, the life span of people is increasing, leading to a boost in the numbers of the geriatric population.[1] In our country there is an increase in the number of people suffering from osteoarthritis, the knee joint being more commonly affected.

In the Indian subcontinent a considerable increase in the body mass index (BMI) of the population has been observed, even in the rural population. 5% of the population is morbidly obese; the increased body weight playing a strong role in joint degeneration. Some practices seen more in our country such as sitting cross legged and squatting also leads to more wear and tear of the knee joint.

Most of our population hails from a rural background and are usually oblivious to the need of follow up, necessitating a surgical intervention with less complications. Improvement in functional scores after total knee replacement has substantiated the practicality of total knee replacement. Total knee replacement has emerged as a more reliable, longer lasting method of knee arthroplasty, with excellent pain relief and functioning. Most of the functional scores and references are based on western studies and the Indian studies are mostly on the urban population. So this study is intended to do a review of the results of total knee replacement done on patients hailing from rural backgrounds.

AIM AND OBJECTIVE OF THE STUDY

AIM

The aim of this prospective study is to present data based on the outcome of total knee replacements performed in our rurally based institution, Sri R. L. Jalappa Hospital and Research Centre, Tamaka, Kolar, Karnataka and analyse the outcome from October 2014 to October 2016.

OBJECTIVES

1. To assess the post-operative functional results in the replaced knee

2. To assess preoperative alignment of knees and the postoperative correction

REVIEW OF LITERATURE

SURGICAL ANATOMY OF KNEE JOINT

EMBRYOLOGY

The lower limb buds first appear at about 4 weeks after fertilization and the skeletal parts of the lower limb begin to chondrify in a proximo-distal sequence 5 weeks after fertilization. The bones around the knee joint, i.e. the femur, tibia and fibula have clear-cut cartilaginous forms by the 8th post ovulatory week, and the knee joint resembles that of the adult. The patella chondrifies during this time and tendons, cruciate ligaments, collateral ligaments and both menisci are clearly differentiated.[2]

Ossification in the lower epiphysis of the femur and upper epiphysis of the tibia occurs during the 13th week and ossification of the patella begins in the 14th week of gestation.[3]

OSSEOUS STRUCTURES

The knee joint is formed by three bones, the lower end of the femur, the upper end of the tibia, and the patella. The knee joint is capable of not only flexion and extension but also rotation in the horizontal plane and therefore is not a simple hinge joint as frequently considered. The distal end of the femur has two condyles, the medial condyle and the lateral condyle. Anteriorly they articulate with the patella, which is the largest sesamoid bone in the body which is grooved on its articular surface to fit in the intercondylar sulcus present between the two femoral condyles. The lateral facet of the patella articulates with the femur throughout most of the arc of motion whereas the medial facet articulates only in flexion. The long axis of the lateral condyle is

oriented along the sagittal plane, whereas the medial condyle is usually angled at an angle of about 22-degrees to the sagittal plane.

The proximal end of the tibia forms two surfaces called plateaus, which are separated in the midline by the intercondylar eminence with its medial and lateral tibial spines. The medial femoral condyle and the medial tibial plateau are congruent, whereas the lateral femoral condyle and the tibial plateau are convex, and the congruency is achieved by the soft tissues the lateral meniscus, and other ligaments which give the knee stability. The anterior prolongation of the medial femoral condyle and soft tissue configurations cause the screw home mechanism (internal rotation of the femur on the fixed tibia), during extension.[4]

MUSCLE ATTACHMENTS NEAR THE KNEE JOINT

Quadriceps femoris

This muscle has four components which attach as a trilaminar quadriceps tendon. The rectus femoris has a round tendon which flattens before its attachment at the upper border of the patella. The deepest layer of the quadriceps tendon is formed by the aponeurosis of the vastus intermedialis muscle and the intermediate layer by the central edges of the vastus lateralis and medialis. The lower most fibres of the vastus medialis serve to prevent lateral displacement of the patella, by inserting onto the side of the patella. These fibres atrophy in pathologies of the knee.

The patellar ligament gets inserted over the smooth rounded part of the tibial tubercle. The infrapatellar bursa lies over the rough, pitted anterior surface of the head of the tibia.

Popliteus

The popliteus muscle has a fan shaped origin from the lateral femoral condyle, fibula, and posterior horn of the lateral meniscus. It gets inserted into popliteal surface of the tibia.

Pes anserinus

It is the term for the conjoined insertion of the sartorius, gracilis, and semitendinosus muscles along the proximal medial aspect of the tibia.

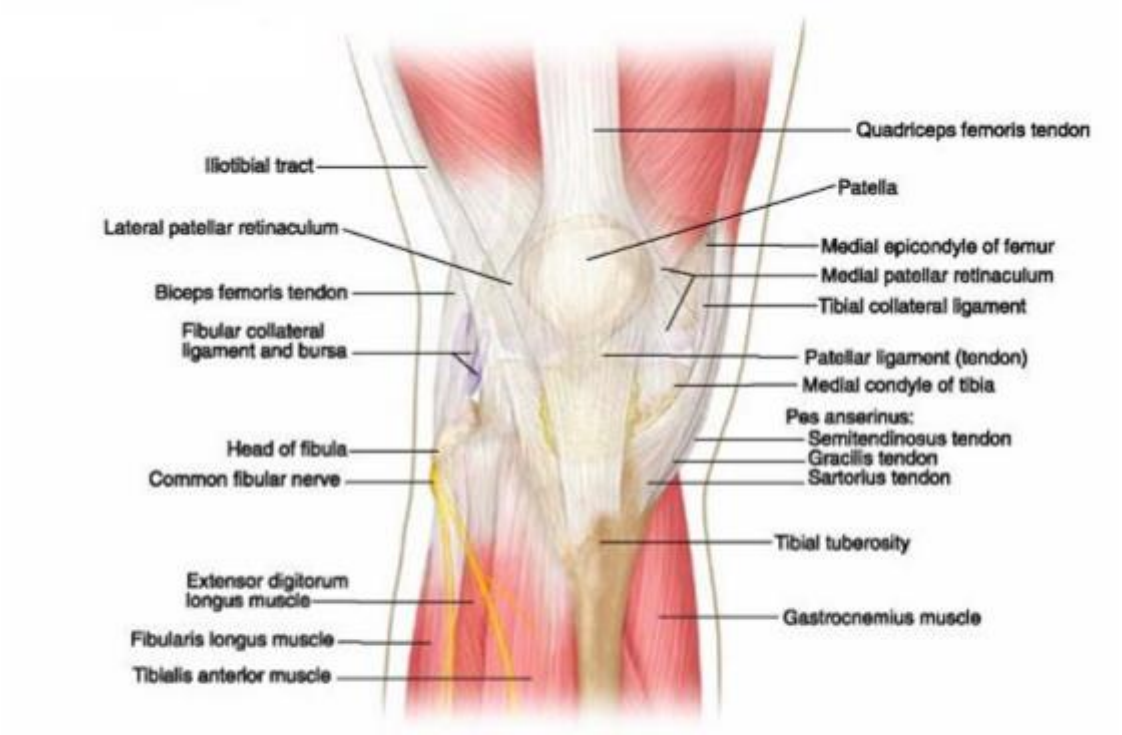
Soleus

The soleus originates from the soleal line and the middle third of the medial border of the tibia.

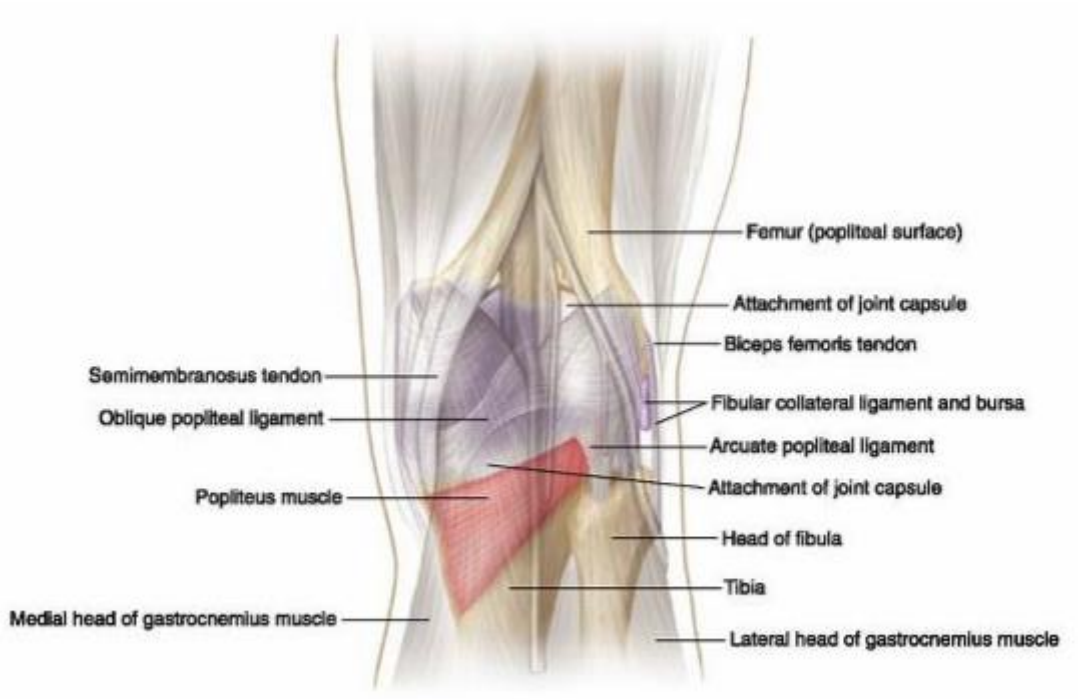
Ilio-tibial band

The fascia lata attaches around the tibial condyles. Another ribbon-like condensation which constitutes the ilio-tibial band is inserted into a smooth non-pitted facet on the anterior aspect of the lateral tibial condyle.[5]

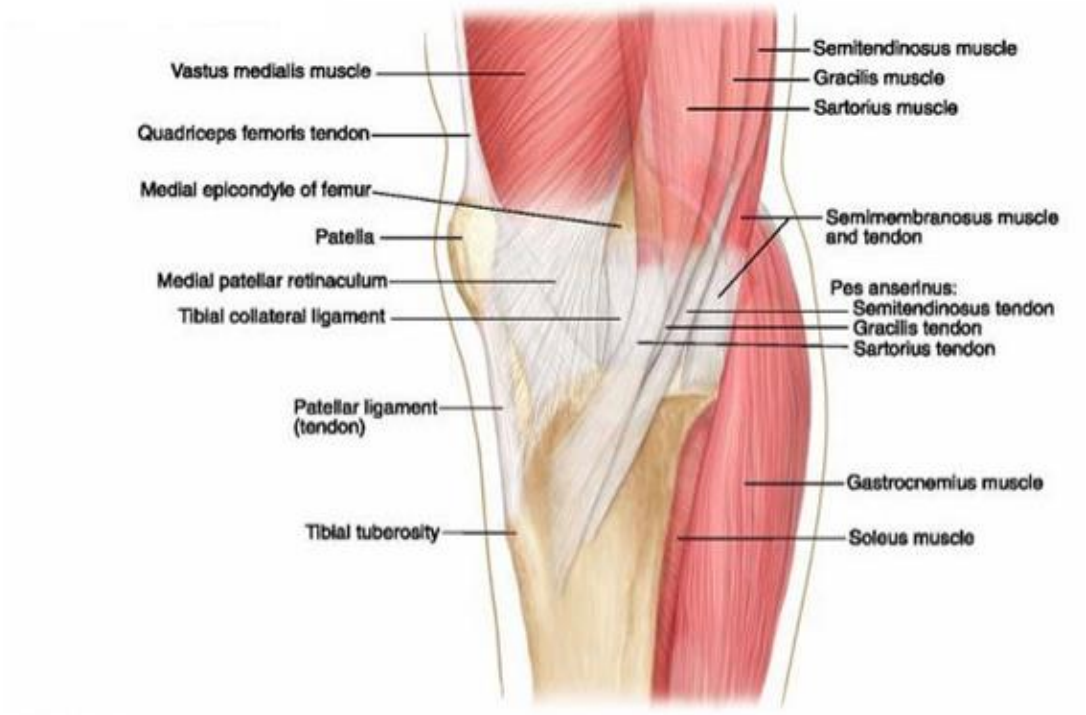
ANTERIOR VIEW OF RIGHT KNEE JOINT



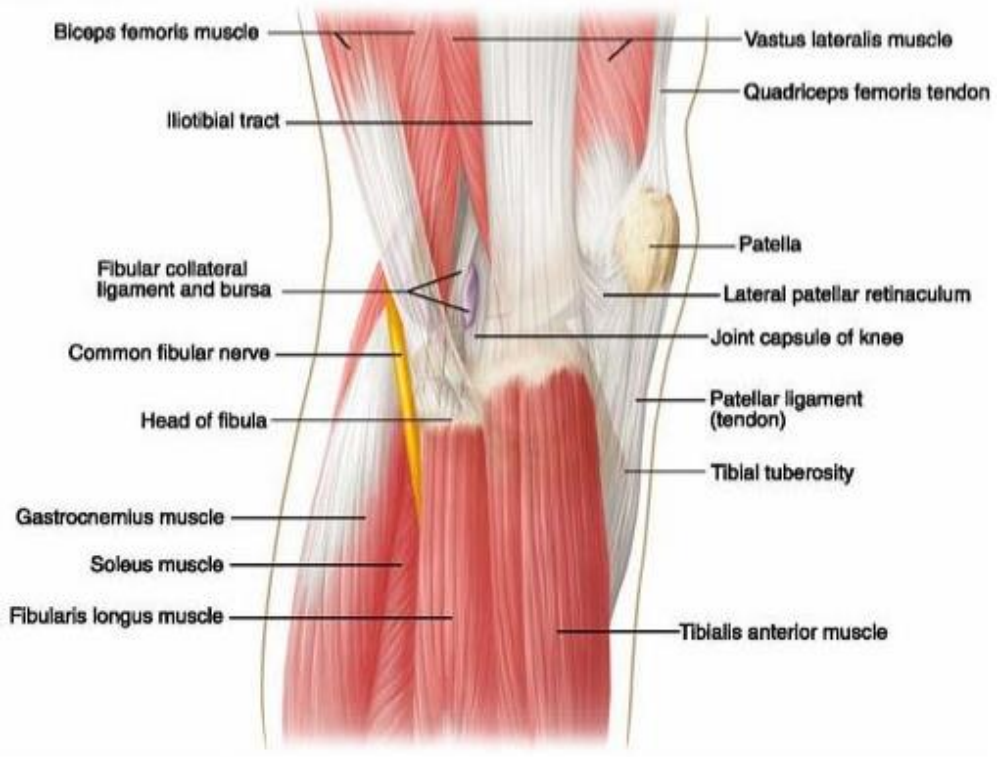
POSTERIOR VIEW OF RIGHT KNEE JOINT



MEDIAL VIEW OF THE RIGHT KNEE JOINT



LATERAL VIEW OF THE RIGHT KNEE JOINT



KNEE CAPSULE

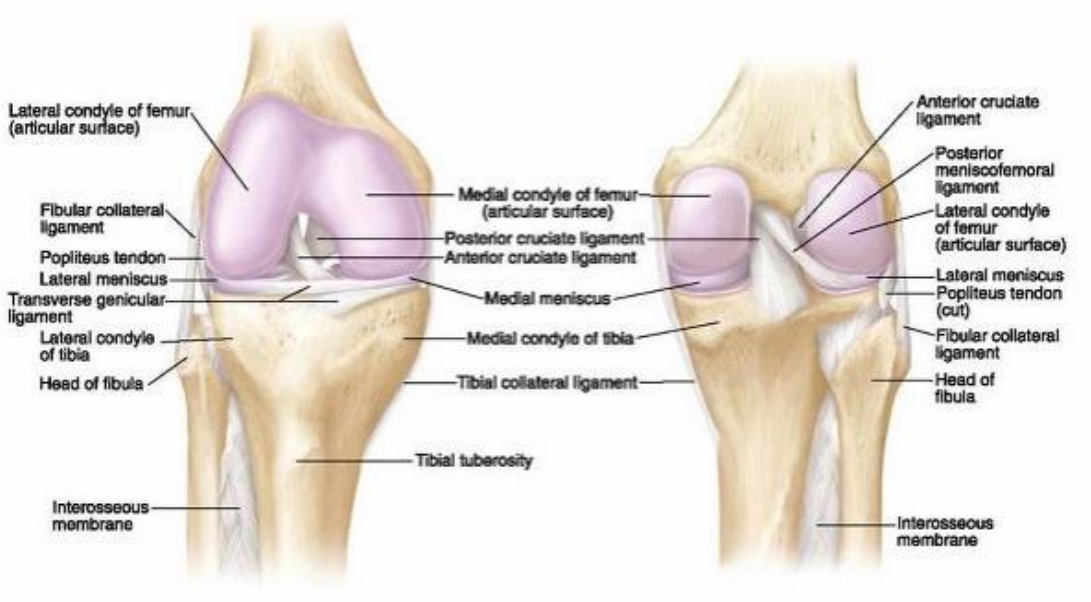
The capsule of the knee joint attaches at the proximal margins of the femoral condyles and the intercondylar notch, articular surface of the femur medially, above the groove of the popliteus tendon, and is deficient anteriorly. On the tibia it attaches to the margins of the tibial condyles posteriorly up to the distal edge of the groove for the posterior cruciate ligament and over the sides allowing the popliteus tendon to pass through and extends up to the tibial tuberosity anteriorly.

The capsular ligaments can be functionally divided into three parts, the anterior third comprising of ligaments forming the patella femoral articulation and the middle and posterior thirds comprising of ligaments forming the tibiofemoral articulation. The extensor mechanism can be divided in the coronal plane as three layers, a superficial or arciform layer, an intermediate or retinacular layer and a deep layer.[6]

STABILITY OF THE KNEE JOINT

The stability of the knee joint is offered by the interplay of many static and dynamic factors. The dynamic stabilisers include the muscles i.e. the quadriceps and the hamstrings. Static stability is offered by the tibiofemoral ligaments, the menisci, articular surfaces and the forces acting through the joint. The capsule strength is augmented by the ilio-tibial band and the gastrocnemius.

LIGAMENTS OF THE KNEE JOINT



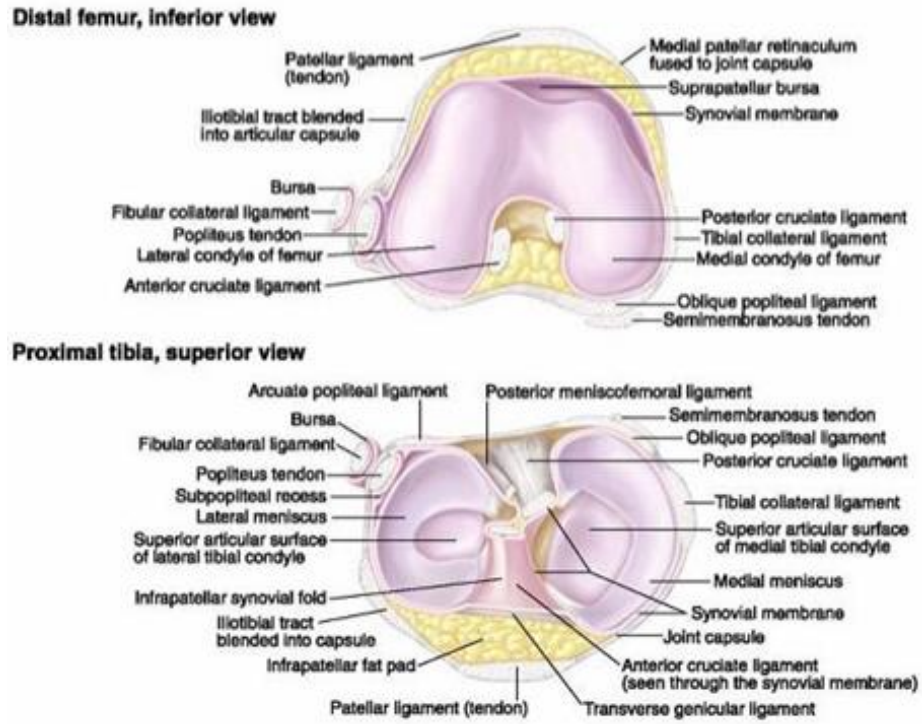
CRUCIATE LIGAMENTS WITH THE KNEE IN EXTENSION AND FLEXION

INTRA-ARTICULAR STRUCTURES

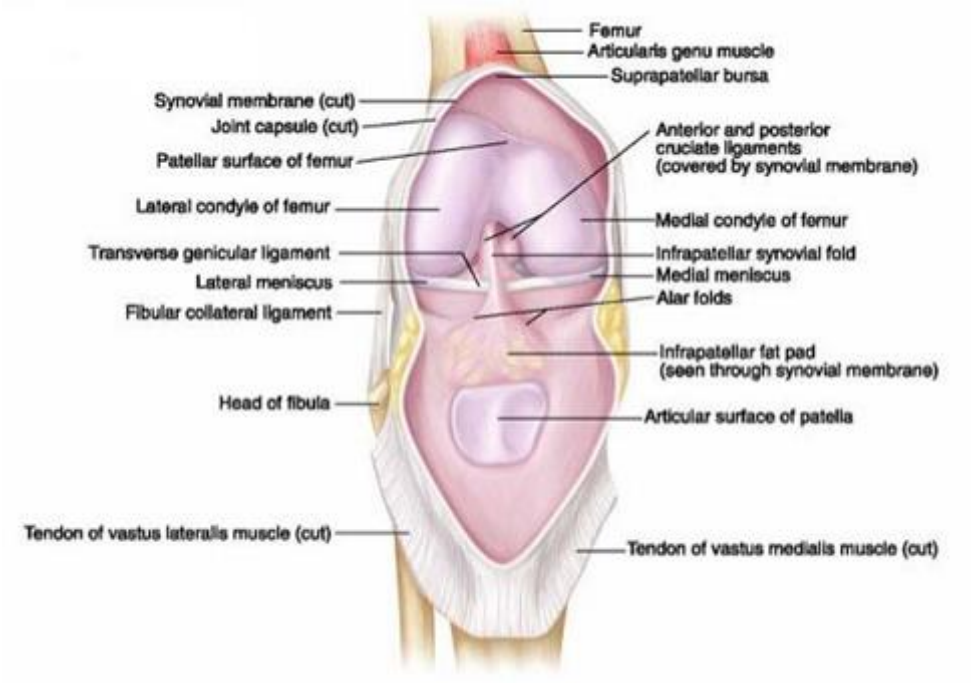
The anterior and posterior cruciate ligaments are a pair of strong ligaments named according to their tibial attachment, connecting the femur and tibia and are intra-capsular but not within the synovial membrane. The anterior cruciate ligament is taut in extension and the posterior cruciate ligament is taut in flexion. They cross each other and medial rotation of the flexed knee causes them to wind up tighter.

Menisci are a pair of almost avascular, fibrocartilaginous semilunar structures attached to the tibia at their horns. They function to distribute the joint fluid, provide nutrition, act as shock absorbers, deepen the joint, stabilise the joint, and have a load bearing function.

INTRA ARTICULAR STRUCTURES OF THE KNEE JOINT



ANTERIOR VIEW OF THE OPENED KNEE JOINT

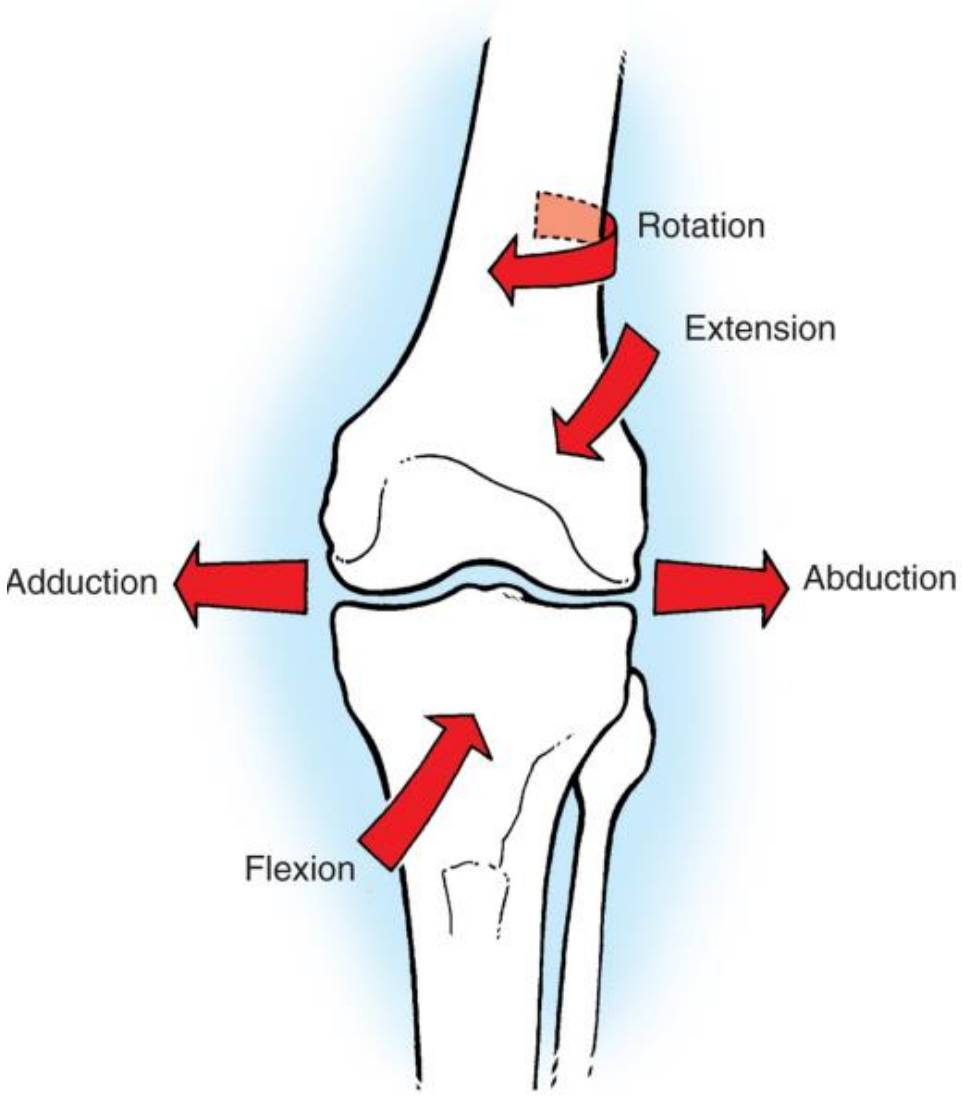


MOVEMENTS AT THE KNEE JOINT

Flexion and extension are the main movements at the knee joint. Flexion of the knee joint is an action of the hamstrings assisted by other muscles and is limited by the soft tissues behind the knee. Extension is performed primarily by the quadriceps and is limited by the medial and lateral ligaments and the anterior cruciate ligament. The passive medial rotation of the femur which occurs during terminal extension is responsible for the locking mechanism, which fixes the joint in $5\text{-}10^{0}$ of hyperextension. The unlocking is done by the popliteus muscle.

As the menisci are attached to the tibia, they act as one unit along with the tibia and move with it on the femur during flexion and extension. However during rotations, the menisci move along with the femur on the tibia.[5]

TRIAXIAL MOTION AT THE KNEE JOINT



BLOOD SUPPLY

An anastomosis formed by the superior, middle and inferior genicular branches of the popliteal artery, the descending genicular branches of the femoral artery, the descending branch of the lateral circumflex femoral artery, the circumflex fibular artery and the anterior and posterior tibial recurrent arteries lies around the patella and femoral and tibial condyles, which has a superficial and deep network. The superficial network lies between the skin and fascia around the patella and infrapatellar pad of fat. The deep network lies along the adjoining articular surfaces of the femur and tibia which supplies the capsule, synovial membrane, articular surfaces and cruciate ligaments.

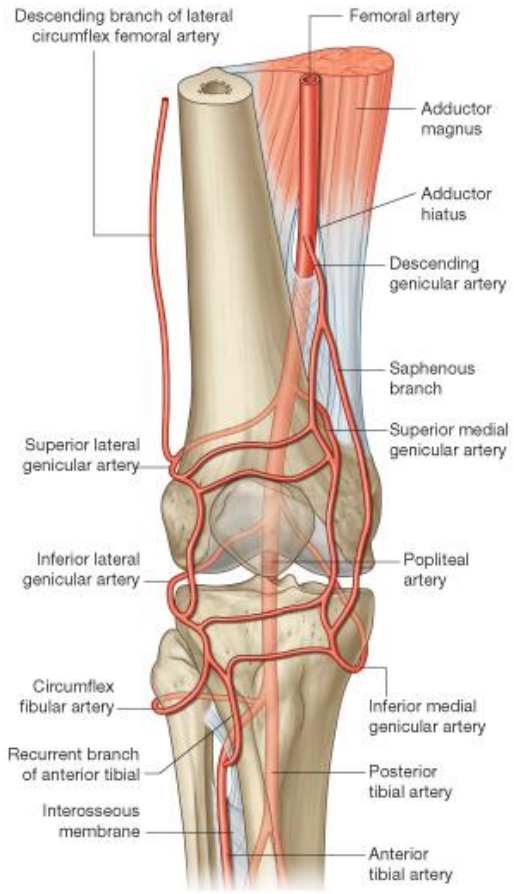
The veins draining the knee correspond in name to the arteries and run with them; the named smaller veins drain into the popliteal and femoral veins.

Lymphatic drainage is to the popliteal lymph nodes. Most of the lymph vessels accompany the genicular arteries; some vessels from the joint drain directly into a node between the popliteal artery and the posterior capsule.

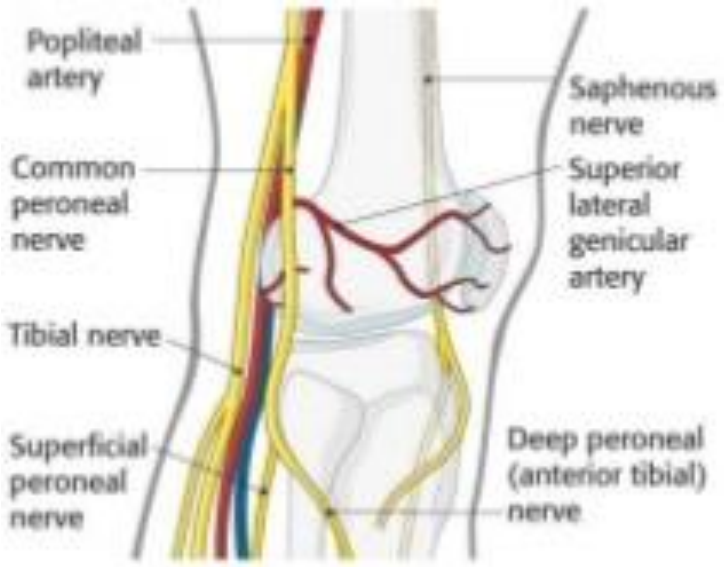
INNERVATION OF THE KNEE

The muscular branches of the femoral nerve, genicular branches from the tibial and common fibular nerves, and genicular branch of the obturator nerve are responsible for innervating the joint.[7]

BLOOD SUPPLY



INNERVATION OF THE KNEE JOINT



BIOMECHANICS OF THE KNEE JOINT

The knee consists of the following structures:

Ligaments- these are passive elastic structures which can be loaded in tension only

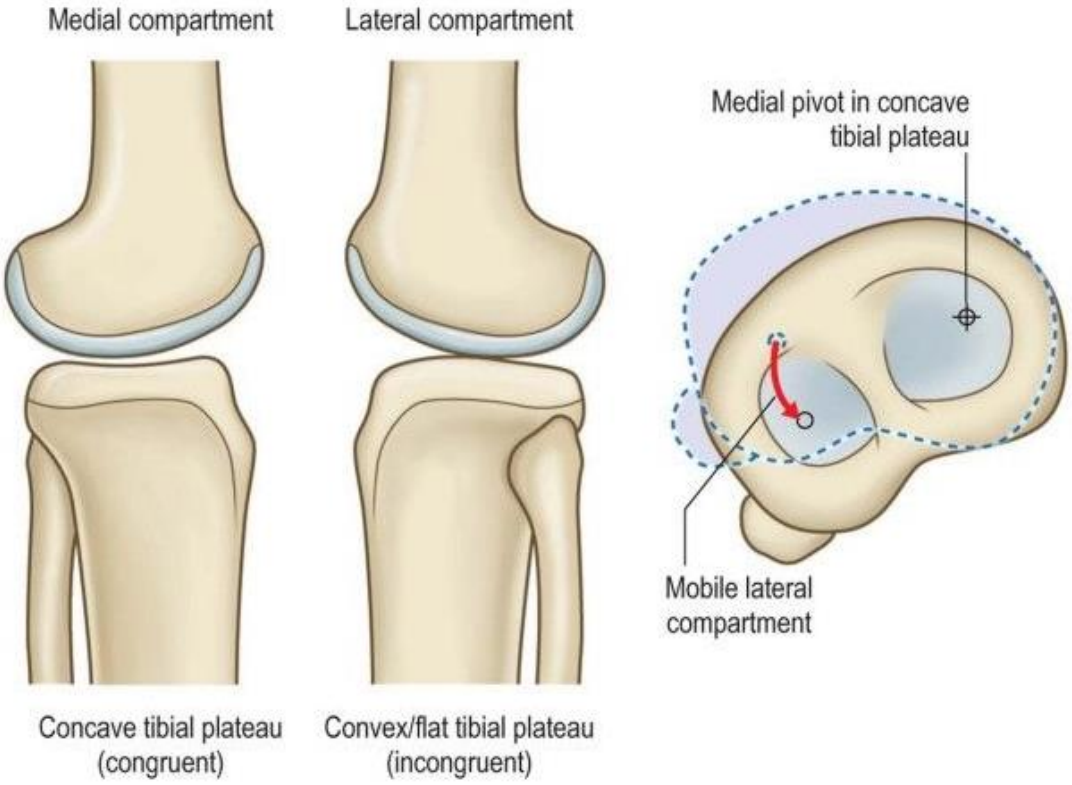
Musculotendinous units- these are active elastic structures which can act only under tension

Bone- it is essentially non elastic and serves to take the compressive loads in the joint[8]

Knee exhibits flexion and extension, abduction and adduction, and rotation around the long axis of the limb during gait. Knee also flexes around a varying transverse axis by virtue of its articular geometry and ligamentous restraints.

The internal rotation of the tibia during knee flexion and the external rotation of the tibia on the femur during extension, known as the screw-home mechanism, can be explained by the medially based pivoting of the knee. Many early knee prosthesis designs were unable to accomplish these complex knee motions which lead to their failure. Newer prosthesis designs aim to reproduce normal knee kinematics closely or at least try to approximate normal motion, keeping in mind polyethylene contact stresses and other concerns.[9]

SCREW HOME MECHANISM



ALIGNMENT

Mechanical axis of the lower limb- It is a straight line connecting the centre of the femoral head to the centre of the ankle.

Femoral mechanical axis- It is a straight line connecting the centre of the femoral head to the centre of the intercondylar region.

Tibia mechanical axis- It is a straight line connecting the centre of the tibial plateau to the centre of the ankle joint.

The mechanical axis of the lower limb is at an angle of 3^0 to the vertical line drawn from the symphysis pubis, and the joint line, which is at 90^0 to the vertical line, is in 3^0 of varus to the mechanical axis.

Anatomical axis of the femur and tibia- They are straight lines drawn along the medullary canals.

In the femur unlike the tibia, the mechanical and anatomical axes do not overlie each other. In the femur the anatomical axis makes an angle of 5- 7^0 to the mechanical axis and an angle of 8-10^0 to the vertical axis.[10]

Reference lines used to measure femoral rotation include the Whiteside line, the transepicondylar line and the posterior condylar line of femur.

Whiteside line- It is drawn from the deepest part of the trochlear grove anteriorly to the centre of the intercondylar notch posteriorly.

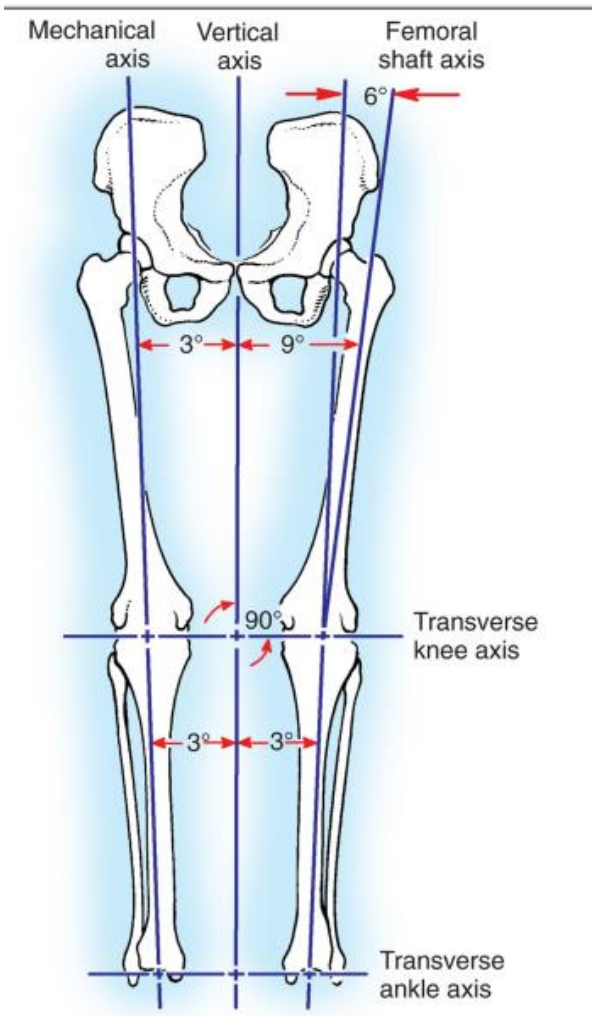
Transepicondylar axis- It is a line connecting the prominence of the lateral epicondyle to the medial epicondylar ridge (clinical TEA) or the medial epicondylar sulcus (surgical TEA)

Anteroposterior axis- It is a line that connects the centre of the trochlear sulcus anteriorly and the midpoint of the posterior aspect of the intercondylar notch. It is dependent on normal anatomy of the trochlear groove and intercondylar notch of the distal femur.

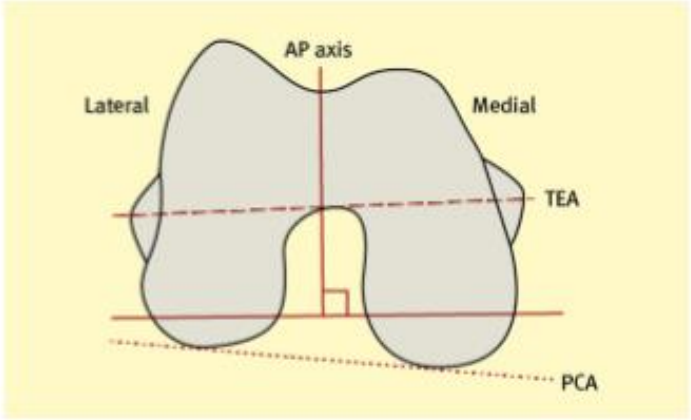
Posterior condylar axis- It is a line drawn along the posterior aspect of the femoral condyles.[11]

The reference for rotational alignment of the tibia is an anteroposterior line drawn perpendicular to the widest part of the tibial articular surface. Other anatomical references used for assessing rotational alignment of the tibia are posterior condylar line of the tibia and the transmalleolar axis.

AXES OF LOWER LIMB



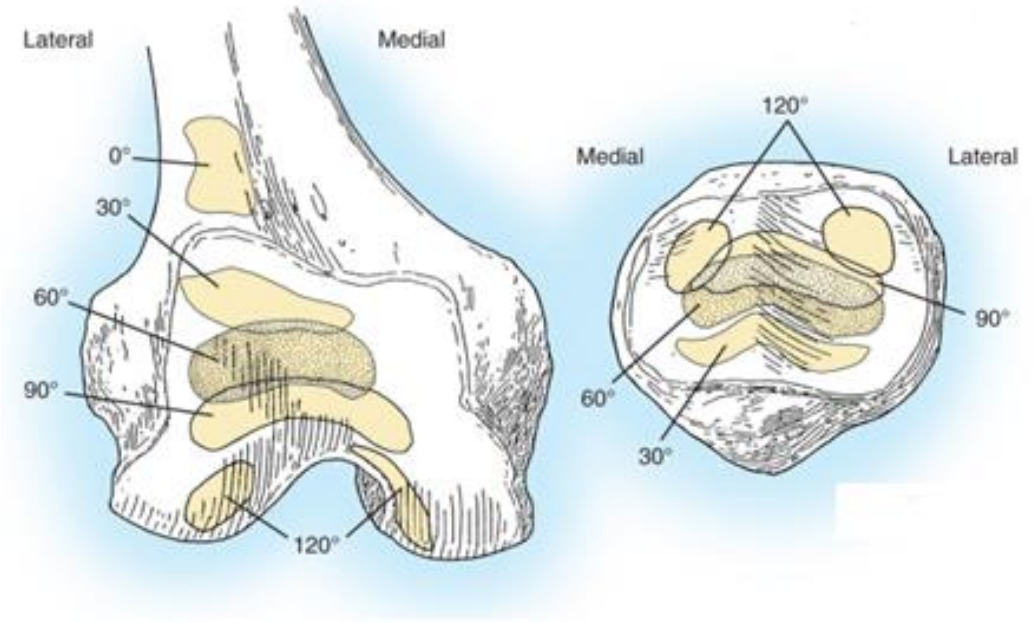
REFERENCE AXES FOR ROTATIONAL ALIGNMENT OF THE FEMUR



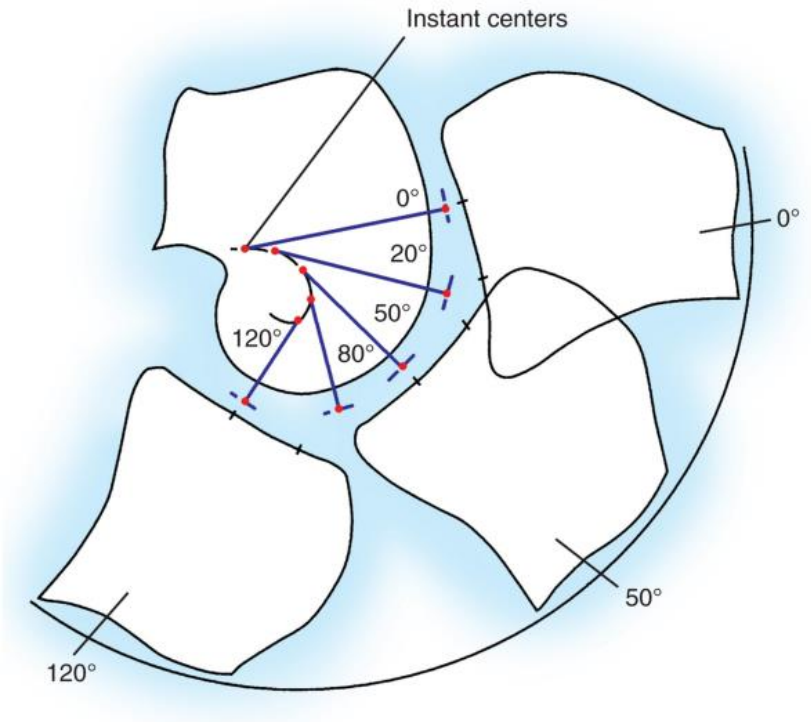
PATELLOFEMORAL JOINT MECHANICS

The patellofemoral joint protects the body's other joints by distributing shock loadings in the knee. The compressive forces from the femur are transmitted to the patella and then to the quadriceps femoris and patellar tendons where they are converted into tension forces and, due to their inherent viscoelastic nature provide shock absorption and help to hold the femur. Very high deceleration forces are imposed on the body while performing activities like sports. The patellofemoral force is nearly 1.5 times the quadriceps femoris force in 90^0 of flexion compared to zero force across the joint in extension which depicts how the compressive forces increase on the patellofemoral joint as the tibia follows its helicoid path over the femoral condyles, and the importance of controlling these forces.

PATELLO FEMORAL CONTACT ZONES



J SHAPED AXIS OF FLEXION



FEMOROTIBIAL JOINT MECHANICS

This joint is the main transmitter of compressive loads and tensile loads across the knee joint. The relative load carried on the tibia and the load carried by the quadriceps femoris muscles and patellofemoral joint is determined by the shapes of the surfaces of contact and the angle of the force applied to the tibia by the femur relative to the long axis of the tibia. The tibial surface over the region where most of the femorotibial contact occurs slopes about 9^0 posteriorly.[8]

In the stance phase of gait, the compressive force acting between the femur and tibia is much greater in the medial than in the lateral compartment, because the resultant ground-reaction force passes medial to the knee at all times. The medially directed ground-reaction force creates an external moment which adducts the knee in the frontal plane. The adduction moment determines the distribution of tibiofemoral load between the medial and lateral sides of the knee. The external knee adductor moment is resisted by a combination of muscle and ligament forces. The resistance is offered by the quadriceps in the first half of stance and by the gastrocnemius later. The quadriceps muscle also provides resistance to an adduction moment during knee extension. After heel strike and during midstance ligaments provide resistance to the external knee adductor moment. The adductor moment is resisted by the passive lateral supporting structures of the knee for nearly 60% of the stance phase of gait. The contribution of ligaments to resist adduction moment during walking is inversely proportional to the muscle force resisting it.

The posterior lateral corner (PLC) ligaments, the lateral collateral ligament (LCL) and the popliteofibular ligament (PFL), provide the primary passive restraint to lateral joint opening.

The ACL is loaded when there is resultant anterior shear force. In early stance, maximum force is transmitted to the ACL at this time as the shear force from the patellar tendon dominates the resultant shear force applied to the leg. Patellar tendon shear force is large in early stance because of the large quadriceps force and also because the line of action of the patellar tendon is inclined anteriorly relative to the long axis of the tibia. In late stance the force is smaller because the posterior component of the ground-reaction force is nearly equal to the sum of the anterior shear forces of the patellar tendon, gastrocnemius, and the tibiofemoral contact force. Gastrocnemius applies an anterior shear force to the shank just before contralateral heel strike because the knee is nearly fully extended, and at small flexion angles the muscle wraps around the back of the tibia. Tibiofemoral contact force applies an anterior shear force to the leg due to the posterior slope of the tibial plateau. The ground-reaction force applies a posterior shear force to the leg because the line of action of the resultant ground force passes behind the knee which increases before contralateral heel strike as the angle between the shank and the ground increases. The posterior cruciate ligament (PCL) is unloaded during stance because the resultant shear force at the knee is pointed anteriorly.[12]

ETIOLOGY

OSTEOARTHRITIS

Osteoarthritis (OA) is the most frequent joint disease with prevalence of 22% to 39% in India.[13]

Osteoarthrosis is the progressive loss of articular cartilage leading to exposure of the subchondral bone. The body's protective mechanism attempts to repair the cartilage and remodel the subchondral bone and forms osteophytes, but after the degenerative process sets in, it is usually progressive and leads to a downhill slope of the patient's condition.

Numerous treatment modalities have been devised including lifestyle modification, exercises and medications which may temporarily improve the patients symptoms and mobility, but do not change the course of the disease. Various surgeries such as arthroscopic debridement, arthrodesis to relieve the pain, osteotomies around the joint to alter the force transmission, interposition of various substances between the articulating surfaces leading to the development of joint replacement and cartilage repair therapies have been devised.[14]

As conservative methods of treatment and surgeries like osteotomies do not alter the disease process the results have been found to deteriorate. Moreover the surgeries to convert previously operated knees into a total joint replacement may be difficult.[15]

It has been found that patients suffering with osteoarthritis have a good range of movement during static evaluation. But when investigated it was found that even though the mean static ROM in patients with OA was 98°, during level walking a mean functional ROM of only 48° was demonstrated when a maximum joint angle of

about 65° is required, which implies that joint movement is affected by the load bearing and pain. So patients with osteoarthritis may feel comfortable if the knee is braced and held stiff. The effects of load-bearing are even more marked in stair-climbing and getting up from sitting position with the patients using side rails and supporting more of the body weight on their upper limbs to reduce the demands on their knees. Electrogoniometry accurately measures the functional ROM during load-bearing in various activities and is a better determinant of functional ability than knee scoring systems where static measurements are used.[16]

CLASSIFICATION OF OSTEOARTHRITIS

Ahlbäck classification criteria

Stage 0: No radiographic signs of arthritis

Stage I: Narrowing of the joint space (with or without subchondral sclerosis)

Stage II: Obliteration of the joint space

Stage III: Bone defect/loss <5 mm

Stage IV: Bone defect/loss between 5 and 10 mm

Stage V: Bone defect/loss >10 mm, often with subluxation and arthritis of the other compartment

Joint space narrowing is defined by a space inferior to 3 mm, or inferior to half of the space in the other compartment (or in the homologous compartment of the other knee).[17]

Osteoarthritis was initially thought to be a disease of the articular cartilage. Now it is believed to affect the articular and periarticular structures causing subchondral bone attrition and remodelling, meniscal degeneration, ligamentous laxity, fat pad extrusion, and impairments of neuromuscular control. The diagnosis is mostly clinical as there is poor correlation between the patient's symptoms and radiological findings.[18]

The mechanism of pain production in osteoarthritis is not clear, the articular cartilage is aneural. The possible causes of pain are elevated intraosseous pressure, bone marrow oedema, structural changes, periosteal stretching, capsular mechanoreceptors stimulated by intra-articular hypertension and nociceptors activated by ischemia caused by mild synovitis.

RISK FACTORS

Patient Related

Age - older than 50 years

Gender- female predilection (more symptoms and more number of joints involved)

Genetics- genetic factors appear to influence risk of developing primary OA

Strong family history

Obesity- with increasing body weight, the contact stresses passing through the joint increase, leading to increased degeneration of the joint

Specific occupations, or sports stress (e.g., with high impact loading with farming or soccer), repetitive knee bending or heavy weight lifting

Joint related

Joint location: OA is more common in knee joint may be due to alteration in chondrocyte responsiveness to different cytokines

Joint hypermobility or instability

Lower extremity malalignment

Trauma to the joint

Crystals in joint fluid / cartilage

History of immobilisation

Quadriceps weakness (20%–70% of patients with knee OA)

Peripheral neuropathy

CLASSIFICATION OF OSTEOARTHRITIS

Primary/ Idiopathic- Localized, Generalised and Erosive

Secondary

PATHOGENESIS

Cytokines, mechanical trauma and altered genetics are implicated in the pathogenesis. Articular cartilage is made of hyaline cartilage which has chondrocytes embedded in an extracellular matrix which consists of water, type II collagen and proteoglycan which degenerates and regenerates in equilibrium. A state of compensated OA occurs where the degeneration and regeneration are still balanced, although with further insult the regenerative or repair process comes to an end, leading on to primary osteoarthritis

CLINICAL FINDINGS

Difficulty in walking (decreased walking speed as well as reduced stride length), squatting, deformity, instability, crepitus, tenderness and reduced range of movement of the knee joint may be present. In the cases of synovitis, inflammation may be present.

LABORATORY FINDINGS

These are usually required to rule out secondary causes or differential diagnosis.

Blood- The erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), full blood count, rheumatoid factor, antinuclear antibodies

Synovial fluid analysis- usually reveals a low white cell count of <2000ul.

RADIOLOGICAL FINDINGS

The plain radiograph is the investigation of choice. The radiological features in knee OA include joint space narrowing (due to loss of articular cartilage), osteophytes (formed by enchondral ossification), subchondral bone sclerosis (at areas of increased weight transmission), cyst formation (where cartilage is thin or absent), osteochondral bodies (fragmented debris) and bone deformity.[19]

MANAGEMENT OF OSTEOARTHRITIS

Conservative methods like physiotherapy, analgesics, weight reduction, and surgical methods like osteotomy are all advised before opting for a definitive surgery like joint replacement.

RHEUMATOID ARTHRITIS

Rheumatoid arthritis is another debilitating disease of connective tissue etiology which if sets in at an early age can lead to joint destruction. Some characteristic differences seen in rheumatoid affected knees are valgus deformity, juxtaarticular osteoporosis, systemic musculature involvement, upper extremity involvement and reduced immunity which can lead to difficulties in wound healing, rehabilitation and surgical complications.[20]

The prevalence of RA ranges from 0.28% to 0.7% with mortality rates almost twice as high when compared to the general population.[21]

ETIOLOGY

T cells, B cells and pro-inflammatory cytokines are responsible in the pathophysiology of rheumatoid arthritis. Production of IL-7 from differentiated T cells results in synovitis. The B cells present antigens and autoantibodies and produce cytokines which aggravates the effect. The characteristic finding is the formation of pannus which destroys bone through its high osteoclast number. Antigen-activated CD4+ T cells activate mononuclear cells, synovial fibroblasts, chondrocytes and osteoclasts which augment the response. Systemic effects are also produced by the pro inflammatory cytokines such as production of acute-phase proteins (such as CRP), anaemia of chronic disease, cardiovascular disease and osteoporosis and affection of the hypothalamic pituitary adrenal axis.[22]

While evaluating the functional outcome the indication for surgery must be borne in mind. In a comparative study it was found that rheumatoid knees had a lower pre and post-operative knee score and functional score as compared to osteoarthritic knees.[23]

MANAGEMENT OF RHEUMATOID ARTHRITIS

Conservative methods like analgesics, DMARDS (Disease Modifying Anti Rheumatic Drugs), physiotherapy are indicated before opting for joint replacement.

RURAL AREAS

In rural areas the patients live further away from hospitals than their urban counterparts and may be less consistent with follow up and coherent with instructions. Nowadays as awareness is spreading the number of patients presenting for total knee replacements has been steadily increasing and was noted to be more than 27%.[24]

In patients who have more than one compartment involved with an underlying disorder, and especially hailing from a rural background it may be prudent to go for a long lasting definitive line of management in the first step itself.

Joint replacement is an excellent treatment modality for arthritis. Total knee arthroplasty has elaborate evidence that it relieves pain, corrects deformity and improves the patient's ability to perform their daily activities.

HOSPITAL STAY

As the geriatric population increases in light of the longer life span; and the younger population take more to sports there is a steady increase in the number of individuals affected by arthritis requiring joint arthroplasty, increasing the burden on medical resources. With the increasing developments and facilities the length of hospital stay can be reduced with proper preoperative evaluation.

The length of hospital stay increases by 10%- 13% for every advancing decade in life.

The general condition of elderly patients must be improved before the surgery, as a majority of them have a less than optimal general condition, have other comorbidities and are more prone to sepsis.

A higher BMI influenced the length of hospital stay, with a significant increase of 4-7% in the length of hospital stay. It may also be associated with difficult surgery and rehabilitation.

Preoperative haemoglobin values also play a role in increasing the number of days in hospital because of the requirement of blood transfusion to optimize the haemoglobin value.

A poorly motivated patient using a walking aid and having difficulty with stairs may have an increased hospital stay in view of the need for more rehabilitative efforts.[25]

GENDER IMPLICATIONS

Although males and females have different bone quality and body habitus, it was found that there was no advantage of gender specific implants in the aspect of implant fit or patient satisfaction.[26]

OBESITY

Obesity correlates with the development of degenerative disease of the knee and it was shown that in patients who are morbidly obese, TKR is associated with lower functional rating scores and more complications. The subjects should therefore be counselled to lose weight and maintain the reduction, because even though the pain reduction and mobility is achieved there is a decrease in functional abilities and even difficulty to walk without support.[27]

Increase of the BMI by just one unit increases the risk of incurring an adverse event by 8%. There is also an increased rate of prosthetic infection and clinically significant DVT in obese patients. 5-15% of weight loss produces improvement in the cardiovascular and metabolic health.[28]

DIFFICULTIES IN PRIMARY TKR

Even primary TKR can be challenging, especially in cases where there are previous incisions on the knee, severe coronal deformities, genu recurvatum, post osteotomy, stiff knee, extra articular deformities and neglected patellar deformities.

Patients presenting for total knee replacement might have previously been operated for bony or soft tissue injuries or conditions. The surrounding skin must be checked for infection, draining fistulae, adherence to the bone and elasticity to make sure there will be no wound tension after surgery. Wound healing is also affected by smoking, obesity, renal and liver insufficiency, corticosteroid use and diabetes.

In these cases the surgeon can either use the old incision, or go for a new incision or a prophylactic flap.

A coronal deformity of fixed varus or valgus deviation of ≥ 20° from the neutral mechanical axis on weight-bearing films is a hard task and needs proper restoration. The cause of the deformity must be evaluated as either intraarticular or extraarticular. Usually there is bone defect on one side and stretched soft tissues on the other side of the joint. These knees usually are associated with other deformities. Bony defects can be treated with cement, metal augments or bone graft. The limb alignment is usually 5° and 7°, but varies especially in patients with coronal plane deformity.

Genu recurvatum (hyperextension > 5°) may be due to a congenital, traumatic, infective, degenerative or iatrogenic causes which has to be evaluated in order to avoid postoperative complications. Factors like coronal alignment, patellar tracking, torsional deformity and grading muscle strength against gravity must be assessed. Hinged prosthesis may become necessary if the muscles cannot overcome gravity.

Stiffness of the knee can limit flexion or extension or both. It can be due to traumatic, infective or degenerative causes. Stiffness of traumatic aetiology affects both flexion and extension whereas infective aetiology affects flexion more than extension .Soft-tissue contraction can be due to involvement of the posterior capsule, collateral ligaments and the extensor mechanism. Fixed contractures affect the patient's ability

to walk there by increasing the contractures. Use of a wheelchair for long durations can also cause flexion contractures. .

Extra-articular deformities can be multidirectional and need proper operative alignment to avoid complications. They may involve the femur proximal to the epicondyles or the tibia distal to the tip of the fibula. These deformities may be genetic, developmental, metabolic, iatrogenic, or traumatic in aetiology.

Preoperative evaluation in a severely deformed knee should include quantifying and locating the deformity, establishing whether correction of the deformity should be intraarticular or extra articular, deciding the need for soft tissue or bony procedures, fixation, need for computer navigated surgery and patient specific implants.

Distal femoral and high tibial osteotomies although performed to delay the need for TKR eventually complicate the surgery as extra articular deformities of varying degrees close to the knee joint are formed which if not managed by soft tissue and bony procedures might require simultaneous or staged osteotomies to restore the mechanical alignment at the time of TKR.

TKR is a reliable option in patients with osteoarthritis and chronic dislocation of the patella to provide a biomechanically efficient extensor mechanism.[29]

USE OF A TOURNIQUET

Total knee arthroplasty can be performed with or without a tourniquet. A pneumatic tourniquet is preferred as the pressure can be regulated as opposed to the elastic tourniquet where the pressure exerted is unknown.

There are 3 methods of tourniquet application.

1. Inflate it before the incision and deflate it after cement has hardened

2. Inflate it before applying cement and deflate it following hardening

3. Inflate it before incision and deflate it after skin closure[30]

The debate of whether to use a tourniquet or not depends on the increased blood loss during surgery versus complications like limb ischaemia, deep vein thrombosis, pulmonary embolism etc. It has been found that there is no increased incidence of wound complications or deep vein thrombosis. The long term range of flexion for patients operated with and without tourniquet control was found to be equal and none of the patients complained of extra pain.[31]

CEMENTED VS NON CEMENTED

There is evidence to show that cemented components have longer survival when compared to uncemented implants. The advantages are that it is less technically challenging as bone cuts do not require a perfect fit with the prosthesis, and cement can fill any defects and achieve a primary stable fixation. The operating and tourniquet times are also significantly less. Cement may also act as a barrier to polyethylene debris generated from the articular surface and prevents osteolysis and implant loosening. Cement also can be used as a medium for antibiotic administration by the use of antibiotic impregnated cement, which helps reduce the chance of surgical infections.[32]

APPROACH

The trend of minimally-invasive techniques is growing poplar in view of smaller scar, less blood loss, less pain and early recovery. Many approaches are described namely subvastus, midvastus, and limited medial or lateral parapatellar, truly quadriceps-sparing etc. The distinguishing features are the shorter incision, avoiding eversion of the patella and handling the extensor mechanism differently. The pitfalls however are that a smaller incision leads to a smaller field of vision, which may on the contrary increase operating times and cause more soft tissue damage even though smaller instruments are used. The application of minimal invasive surgeries must be done on selected patients to avoid complications.[33]

UNILATERAL VS BILATERAL KNEE REPLACEMENT

The peri-operative mortality rate of patients undergoing simultaneous bilateral sequential TKR is similar to that of patients undergoing unilateral TKR and peri-operative morbidity and clinical results are similar in both groups.[34]

A single surgery for bilateral knees sounds appealing to the time conscious person, but considering the increased stress response it can create in the body especially keeping in mind the population groups to which arthroplasty is targeted, a single surgery might not be safe. By staging the procedure the insult on the body is halved and it was found that staging the surgeries by a week allowed the patients to recover from the first surgery and leave the hospital with both knees operated with fewer complications.[35]

INFECTION

One of the dreaded complications of total knee arthroplasty is infection. It was found that the chance of haematogenous spread was also possible, especially in people with rheumatoid arthritis with skin lesions hence necessitating suitable healing of the lesions before surgery and improving the general condition of the patient and making sure there is no preoperative source of infection like a urinary tract or respiratory tract infection. To prevent these possibilities prophylactic antibiotics are administered despite the complications.[36]

It was noted that the chance of postoperative infections is increased by 22.2% in those patients who had received a prior intraarticular steroid injection, thereby discouraging the use in patients who are potentially candidates for TKR.[37]

CLASSIFICATION AND THE CHARACTERISTICS OF INFECTION

ACCORDING TO THE ROUTE OF INFECTION

Perioperative - inoculation of microorganisms into the surgical wound during surgery or immediately thereafter

Haematogenous - through blood or lymph spread from a distant focus of infection

Contiguous - contiguous spread from an adjacent focus of infection (e.g. penetrating trauma, pre-existing osteomyelitis, skin and soft tissue lesions)

ACCORDING TO THE ONSET OF SYMPTOMS AFTER IMPLANTATION

Early infection (<3 months) - predominantly acquired during implant surgery or the following 2 to 4 days and caused by highly virulent organisms (e.g. Staphylococcus aureus or gram-negative bacilli)

Delayed or low-grade infection (3–24 months) - predominantly acquired during implant surgery and caused by less virulent organisms (eg, coagulase-negative staphylococci or Propionibacterium acnes)

Late infection (>24 months) - predominantly caused by haematogenous seeding from remote infections[38]

RISK FACTORS FOR INFECTION IN TOTAL KNEE ARTHROPLASTY

Medical conditions- diabetes, obesity, hypokalemia, rheumatoid arthritis, urinary tract infection, operative technique, prolonged operative time (i.e. > 2.5 h)

Other factors- immunosuppressive therapy (i.e. cortisone use), malnourishment, smoking, skin ulceration, previous surgery

INTRA-OPERATIVE COMPLICATIONS

1. Hemorrhage

2. Irregular bone cuts hampering alignment of prosthesis

3. Fractures of the femur, tibia or patella

4. Avulsion of patellar ligament, medial or lateral collateral ligament

5. Neurovascular injury

6. Fat embolism syndrome

POST-OPERATIVE COMPLICATIONS:

EARLY

1. Delayed wound healing like marginal skin necrosis, complete sloughing, and sinus formation, small or large hematoma.

2. Wound drainage with negative cultures (sterile after 48 hours of incubation)

3. Hematoma or seroma

4. Superficial wound infection

5. Deep vein thrombosis and embolism

6. Secondary haemorrhage

7. Tourniquet palsy

8. Neurovascular injury

LATE

1. Wear and deformation

2. Infection

3. Loosening

4. Instability

5. Anterior knee pain

6. Fracture or dislocation of patella or tibio femoral joint

7. Component breakage, loosening, osteolysis

8. Patellar femoral complications

9. Stiffness of knee

10. Periprosthetic fractures

11. Need for reoperation[39]

PAIN MANAGEMENT AFTER TKR

There is conflicting evidence to whether Bupivacaine and morphine when injected into the knee, after skin closure are useful or not to provide postoperative analgesia.[40]

However postoperative corticosteroid periarticular injections appear to offer pain relief in the early postoperative period with a faster functional improvement, with no noted complications.[41]

CONTROL OF BLOOD LOSS

The presence of optimal haemoglobin is a prerequisite for an early rehabilitation and recovery. In TKR where blood loss is expected, either the prevention of blood loss or restoration of lost blood must be done.

Tranexamic acid is a fibrinolysis inhibitor which can be administered intramuscular, intravenous, intraarticular or orally. It reaches the peak plasma concentration faster when administered intravenously. It is found to be effective when administered once preoperatively and once after deflation of the tourniquet, while performing a cemented TKR without increasing thromboembolic phenomena.[42]

The presence of a drain put postoperatively did not have any beneficial effects, and may interfere with mobilization. A reinfusion drain may prove beneficial especially in the cases of uncemented TKR.[43]

However a subcutaneous indwelling closed suction drainage method is a reasonable option for reduction of postoperative bleeding and transfusion rate after TKR.[44]

PREVENTING DEEP VEIN THROMBOSIS

Subcutaneous administration of LMW heparin once a day is found to be better than foot intermittent compression system.[45]

Early mobilization of patients after TKR has several benefits including decreasing the incidence of DVT to 1%. Walking within the first 24 hours decreased the incidence of DVT by 3 times. It is possible by preoperative patient motivation, and a postoperative rehabilitation team consisting of the surgeon, physiotherapist, anaesthetist and nursing staff.[46]

RATING OF TKR

Recovery of the patient may be evaluated by either

-short term goals (<3 weeks) which includes ability to mobilize and look after themselves at home

-long term goals (>3 weeks to years) which includes return to the work place etc.

Patients look to joint arthroplasty as a path to get back to their active sport regimens. The UCLA (University of California and Los Angeles) score was found to be a reliable medium to assess activity levels in patients.

Strong correlation was found between the knee society score (KSS) and UCLA score.[47]

There are numerous scoring systems to assess the functional outcome of patients. Studies comparing the long term function have compared SF-36 (Short form 36), WOMAC (Western Ontario and McMaster Universities Osteoarthritis index

questionnaire score), HSS (Hospital for Special Surgery) scores or similar functional scores. The early functional recovery can be evaluated by a simple unique 'Timed Up and Go' test (TUG).

Knee society scoring system is an excellent tool to assess the functional and clinical outcomes after total knee replacement.[48]

The Knee society scoring system has come up with a new dual knee rating system which eliminates the inequality of scores associated with patient infirmity. It consists of

1) A knee score rating the knee joint itself and

2) A functional score rating the patients' ability to walk and climb stairs.

In a retrospective study, 76 total knee replacements using the Genesis II prosthesis(Smith and Nephew, Memphis) in 60 patients(16 bilateral cases), performed between February 2005 and February 2008, study at final follow up revealed the mean knee society score to be 87.9 with 77.3% (58 knees)-excellent, 21.3% (16 knees)-good, 1.3% (1 knee)-fair, none poor.[49]

TECHNIQUES OF TKR

The surgical aim of total knee arthroplasty is to achieve symmetric balanced flexion and extension gaps. Precise soft tissue balancing combined with accurate bone resections determine rotation of the femoral component which if not done meticulously, result in failure of the procedure.

There are 2 surgical techniques to achieve this prerequisite.

Gap balancing surgical technique

Measured resection technique

GAP BALANCING SURGICAL TECHNIQUE

Gap balancing techniques require ligament releases prior to bone cuts. The ligament releases are done to correct fixed deformities and bring the limb into correct alignment before making the bone cuts.

Gap balancing can be done in two ways

1. Balancing the flexion gap first.

2. Balancing the extension gap first

Balancing flexion gap first

After exposing the knee joint, a perpendicular proximal tibial resection is made relative to the longitudinal axis of the tibia. This step is vital as it is the base for further bone cuts. A varus tibial resection results in internal rotation of the femoral component and vice versa. All osteophytes must be removed. The tibial cut should be parallel to the transepicondylar axis and perpendicular to the anteroposterior axis in

flexion. For adjustment, soft tissue release can be done. After the femoral cuts are made, gap symmetry is confirmed with spacer blocks. The extension gap is now evaluated and soft tissue releases are performed and limb alignment is checked. If the gap is symmetric, distal femoral cut is given and gaps are checked again.

Balancing extension gap first

The distal femur and the proximal tibial cuts are given followed by osteophyte resection and then by soft tissue release. Osteophyte resection if not done completely can cause stress on the ligaments which can lead to malrotation of the femur. After extension gap is made, and osteophytes are removed, gap symmetry, soft tissue balance and lower extremity alignment versus the mechanical axis are assessed by spacer blocks. If necessary, further soft tissue release can be done and flexion gap adjusted before the tibial cut. An asymmetric gap could be due to any of the following:

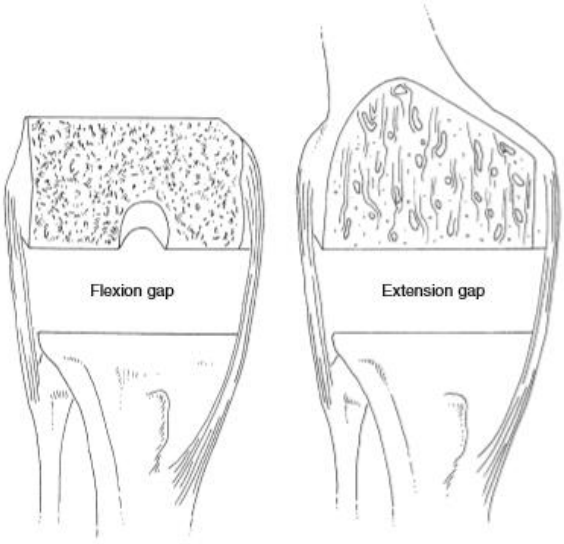
1. An error in the proximal tibial resection

2. An error in precise determination of the TEA

3. The flexion gap stabilizing structures being tensioned are incompetent.

The femur cut is given again parallel to the tibia, and gap symmetry is confirmed.

FLEXION GAP MUST EQUAL THE EXTENSION GAP



MEASURED RESECTION SURGICAL TECHNIQUE

In this technique, bony landmarks such as the Transepicondylar Axis (TEA), the anteroposterior (AP) axis and the posterior condylar axis are used to set femoral component rotation. Here bone cuts are made independent of soft tissue tension.

Approximating the flexion-extension axis of the knee, the TEA corresponds to the femoral collateral ligamentous origin. Enhanced central patellofemoral tracking, improved femorotibial kinematics and a rectangular flexion gap can be obtained by placing the femoral component parallel to the TEA. The TEA can also be referenced in revision TKA and in Primary TKA where there is posterior condylar hypoplasia or erosion. The posterior condylar axis most frequently corresponds to the rotation alignment of the implanted femoral component, falling within ± 1° in 62% of the patients. Both techniques can be used to establish femoral component rotation and a rectangular flexion gap. Because the gap balancing technique is less dependent bony anatomy it can be used to provide more reproducible flexion gap stability.[11]

HISTORY OF TKR AND IMPLANT EVOLUTION

EARLY DAYS

Prior to the concept of arthroplasty, arthrodesis was considered the only salvage for problematic joints.

INTERPOSITION ARTHROPLASTY

In1826, Barton attempted a simple resection of an ankylosed joint with some success.

In 1861, Ferguson reported the first case of soft tissue interposition knee arthroplasty, after which the patient had a useful limb. It was then understood that interposition of soft tissue and foreign material between the joint surfaces could prevent ankylosis.

In 1910, John B. Murphy used medial and lateral autogenous tissue flaps sutured between the joint surfaces to prevent ankylosis.

Other materials like tanned pig bladder, patellar bursae, tensor fascia lata and fat were also used. However complications such as shortening, infection, an inflammatory response and reankylosis were noted.

In 1938, Venables and Stuck first used Vitallium (cobalt-chrome) which had excellent wear properties and did not corrode.

Then the era of biological implants progressed into the era of metallic prostheses and the age of interpositional arthroplasty faded out.

TIBIAL HEMI-ARTHROPLASTY

In 1894, Themistocles Gluck used an ivory cup with an intra medullary peg inserted into the tibia producing a hemi-arthroplasty of the knee.

FEMORAL HEMI-ARTHROPLASTY

In 1940, Willis Campbell used a metallic hip implant, which served as a base for using foreign materials as implants.

In 1952, Rocher used an acrylic cap for the distal femur.

In 1954, Kraft and Levinthal made a large prosthesis to reconstruction the entire distal end of the femur after resecting a large giant cell tumour.

In the mid-1950s, Platt produced his Condylar Cup which was a stainless-steel surface replacement for the femur. Over 50% of patients achieved 50^0 of flexion and another 20% around 90^0 or more. 44% of patients were pain free, 23% had occasional twinge's of pain, 10% of the patients knees re-ankylosed and 20% got infected, of whom two patients required amputation. These femoral prostheses were similar to tibial hemi-arthroplasty in the aspects of minimal loss of bone stock with correction of valgus/ varus deformities and intrinsic soft tissue balance and the high rates of infection and instability.[50]

THE HINGED TOTAL KNEE

In 1891,Themistocles Gluck developed the first hinged total knee prosthesis of ivory and used cement made from colophony, pumice and gypsum.

In 1951, Borje Walldius inserted an acrylic resin prototype in severe rheumatoid patients. Some cases were successful and two wheelchair bound patients were able to walk after the surgery.

In1958, the Walldius knee underwent modification to incorporate a patellar flange and longer stems for the femur and tibia, to increase stability, though the stems were

relatively short (10cm). At follow-up, 20 of the 58 patients had occasional pain. Nearly 60% of patients achieved 60-90^0 of flexion and 25% managed over 90^0. Complications noted were fixed flexion deformity, infection, bony union, painless fibrous ankylosis and breakage of the implant. There was one prosthesis with a broken stem for which revision to a newer model with a thicker stem was performed.

In the 1950's, Shiers produced a hinged prosthesis with a 15cm tibial stem and a posteriorly placed roller bearing joint, which could allow flexion with no soft tissue impingement.

A French hinge implant designed by Groupe pour I'Utilasation et I'Etitude des Prostheses Articulaires called GUEPAR hinge implant had a posteriorly placed axis of rotation, but had complications of high rates of loosening and infection.

SEMICONSTRAINED TOTAL KNEE REPLACEMENT

Sheehan designed prototypes where the femoral condyle had two radii of curvature which could allow a constant change in the centre of rotation of flexion. The two femoral condyles were angled to allow the tibial button freedom to rotate in flexion but locking it in extension.[51]

SURFACE TOTAL KNEE REPLACEMENT

Articular surface replacement

In 1968, Gunston, put forth his pioneer work of total knee replacement which provided better physiological stability than the mechanical stability of the massive hinges. It was based on Macintosh's blocks principles i.e. to replace the lost bone and to rely on the tension of the surrounding ligaments for stability. It consisted of two semi-circular metal femoral components and two high-density polyethylene tibial

concave runners. The femoral components were slotted into the condyles. The patella and the femoral groove were preserved.

Condylar replacement

In 1970, Freeman and Swanson inserted the first prototype which worked on the concept of a cylinder in a shallow groove to provide medial/lateral stability due to its width.

In1980, Freeman and Samuelson, modified it by decreasing the posterior tibial lip size and displacing the articular surface of the tibia posteriorly. It permitted a greater range of flexion and the presence of a trochlea on the femoral component helped avoid the problems of lateral patellar subluxation.[52]

CONCEPTS LEADING TO THE EVOLUTION OF IMPLANTS

Anatomical Approach

This approach involved the implant that preserved most or all of the soft tissues of the knee joint, especially one or both cruciate ligaments.

Functional Approach

The functional approach to knee arthroplasty believed in, removing both cruciate ligaments, in order to streamline the knee biomechanics.[53]

MATERIALS AND METHODS

SOURCE OF DATA

This observational study was conducted at R. L. Jalappa Hospital and Research Centre, Tamaka, Kolar attached to Sri Devaraj URS Medical College, between November 2014 and October 2016 which included a 3 month follow up period.

INCLUSION AND EXCLUSION CRITERIA

INCLUSION CRITERIA:

-All patients above the age of 45 years requiring TKR as a treatment modality for osteoarthritis, rheumatoid arthritis, post traumatic arthritis, connective tissue disorders, or tumours for unilateral or bilateral knee joints

EXCLUSION CRITERIA:

-Acute infective conditions, local or systemic.

-Patients with comorbid conditions unfit for surgery.

-Patients with joint or other abnormalities deterring mobilization.

-Neuropathic arthritis

METHOD OF COLLECTING DATA

Patients who fulfilled the above said criteria were evaluated clinically, radiologically and through laboratory tests to ascertain need for the surgery and fitness to undergo the procedure.

All patients were treated with the same category of medication, similar anaesthetic and intraoperative techniques.

Subjects were evaluated preoperatively and postoperatively on follow up at 3 months, on their recovery and progress using Knee society score.

SCORING SYSTEM

Clinical assessment is done by the Knee Society Score (KSS) (Insall, 1989), which is divided into three sections:

Clinical Knee score (100 points):

Pain, range of motion and stability in anteroposterior and mediolateral directions is assessed. It has deductions for flexion contractures, extension lag and malalignment. All values are summed up with necessary deductions made, to obtain a Knee Score which has a maximum of 100 points.

Knee Functional Score (100 points):

Functional score is assessed by the ability to walk and ascend and descend stairs. Ability to walk is measured by city blocks. Deductions are made if patient needs ambulatory aids to walk. All values are summed with deductions made if necessary, to obtain a Functional Score which has a maximum of 100 points.

Patient Category:

The classification system assigns patients to three categories depending on their associated medical conditions. This categorization explains how other physical conditions can affect the score.

The knee score and functional score are considered separately.

Scores between 100 & 80 are excellent; between 79& 70 are good; between 69 & 60 are fair and less than 60 are poor.

RADIOLOGICAL ASSESSMENT

The following findings were looked for

1. Alignment

2. Femoral notching in lateral view

3. Implant sizing

4. A Roentgenographic Knee Evaluation system endorsed by The Knee Society for each of the components is determined by measuring the width of the radiolucent lines for each of the zones in millimetres for each of the components. The total width is added for each zone for each of the prosthesis. This total produces a numerical score for each component. There may be 5 to 7 zones assigned for the femur and tibia. This score can be rated as follows for a 7 zone tibial component: 4 or less and non-progressive is probably not significant; 5-9 should be closely followed for progression and 10 or greater signifies possible or impending failure regardless of symptoms.

As the follow up for our study was only 3 months, radiolucent lines indicating implant loosening/ failure did not hold much value and were not looked for in our study.

STATISTICAL ANALYSIS

Subjects were evaluated using Knee society score and the data so obtained was entered into Microsoft excel data sheet and was analysed using SPSS 22 version software (Statistical Program for Social Sciences).

Categorical data was represented in the form of frequencies and proportions.

Chi-square was used as test of significance.

Continuous data was represented as mean and standard deviation.

Independent t test was used as test of significance to identify the mean difference between two groups.

Paired t test is the test of significance for paired data such as before and after surgery.

A probability value p value <0.05 was considered as statistically significant.

INSTRUMENTS AND IMPLANTS

In our study cemented TKR was performed using posterior cruciate ligament substituting prosthesis under pneumatic tourniquet control. Patelloplasty was done for the patella. The following instruments were used:-

FEMORAL

1. Femoral intramedullary guide

2. Femoral locating device

3. Distal femoral cutting jig

4. Femoral A/P cutting jig

5. Femoral notch and chamfer cutting jig

TIBIAL

1. Extramedullary proximal tibial alignment jig and ankle clamp assembly

2. Proximal tibia cutting jig

3. Tibial plateau preparation - punch guide, drill bushing, drill and modular keel punch system

PATELLOPLASTY CONSISTS OF

1. Osteophyte removal to allow better positioning of the patella in the trochlear groove of the femoral component

2. Patellar rim cautery to denervate the patella

3. Division of patello- femoral ligament if tight

4. Soft tissue release from the lateral aspect of the patella to avoid maltracking

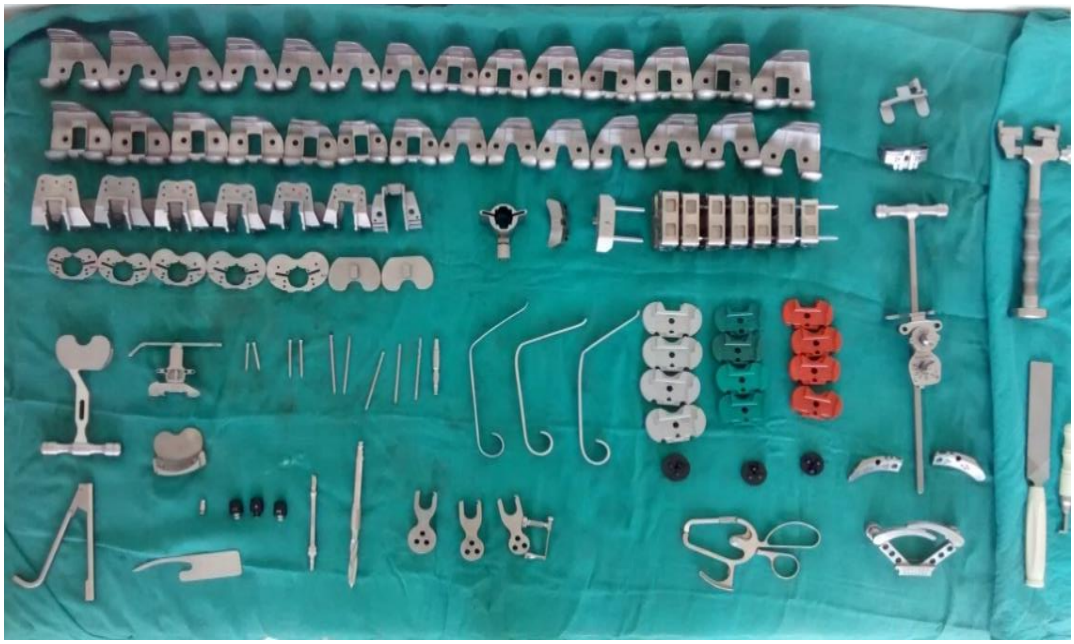
SURGICAL TECHNIQUE:

A midline skin incision is given followed by a median parapatellar approach which facilitates eversion of the patella. ACL, PCL and both the menisci are removed. Ligament balancing is performed prior to bone resection by release of the contracted soft tissues on the concave side of any fixed angular deformity.

It is possible to correct relatively minor flexion contractures by removal of more bone, but when a contracture is severe (45 degrees or more) it is advisable to divide the posterior capsule transversely.

The bone cuts are performed using provided standard jigs and cutting blocks. The tibial cut is given at 90^0 to the long axis and less than 5^0 of posterior sloping and sizing is done. Distal femoral cut is given at 5^0 of valgus to the anatomical axis and perpendicularly in saggital plane. This is followed by anterior-posterior and chamfer cuts, femoral notch cut and peg holes and tibial notch cut. After this trial implants are placed and stability is checked. Then the appropriate size original implants are fixed with cement. Patelloplasty is done.

INSTRUMENTS AND TRIAL IMPLANTS



POSTOPERATIVE MANAGEMENT

The knee was immobilized in a Jones compression bandage and knee immobilizer. Postoperative check radiographs were taken. Patient was advised to perform static quadriceps exercises which were taught preoperatively.

1st postoperative day- The patient was made to stand with support holding a walker and walk full weight bearing within the limits of pain with the knee immobilizer on. Straight leg raising exercises were started. A pillow or rolled towel was placed under the heel.

2nd postoperative day- Drain (if present) was removed and wound inspection and dressing was done. Epidural catheter was removed. Patient was made to perform dynamic quadriceps exercises along with other exercises and continue ambulation. Active and passive knee flexion was encouraged.

3rd postoperative day- DVT prophylaxis was given in the form of low molecular weight heparin for three days

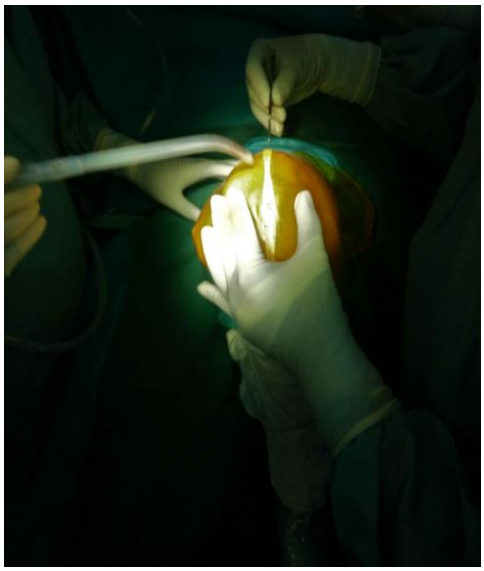
5th postoperative day- intravenous antibiotics were stopped and oral antibiotics were started (for 5 more days).

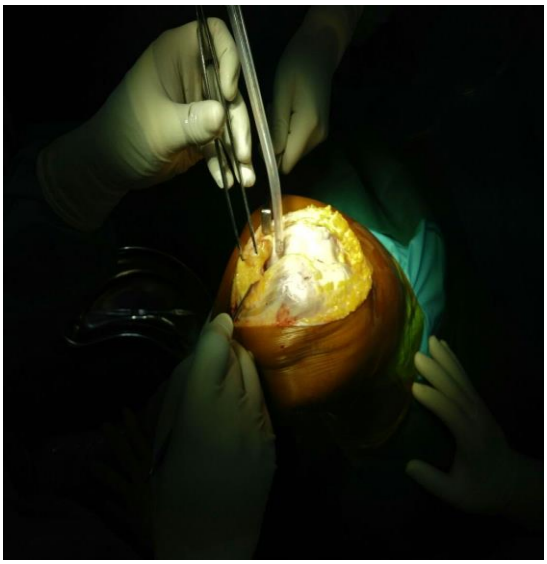
12th postoperative day- sutures/ staples were removed and patient was discharged from the hospital to be reviewed every month till 3 months if there were no complications. If any complications were noted, the patient was asked to review at frequent intervals.

OPERATIVE PHOTOGRAPHS

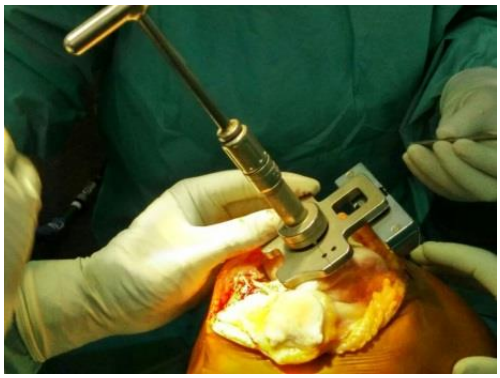
PAINTING AND DRAPING

SKIN INCISION AND EXPOSING THE KNEE JOINT

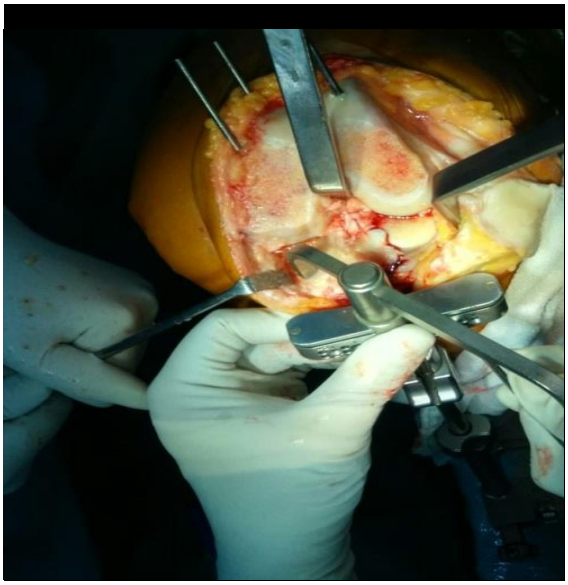




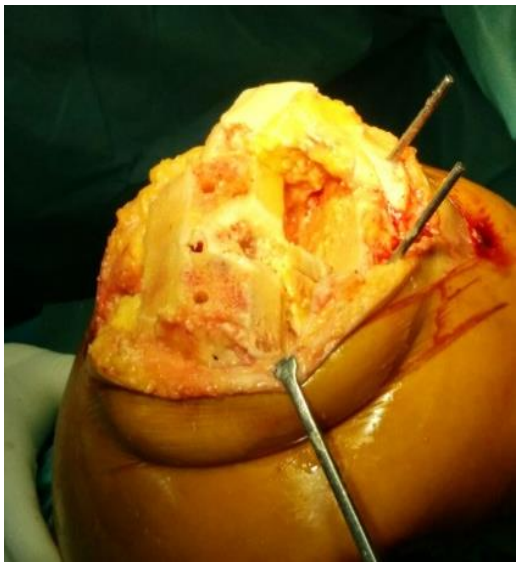
FEMORAL CUTS



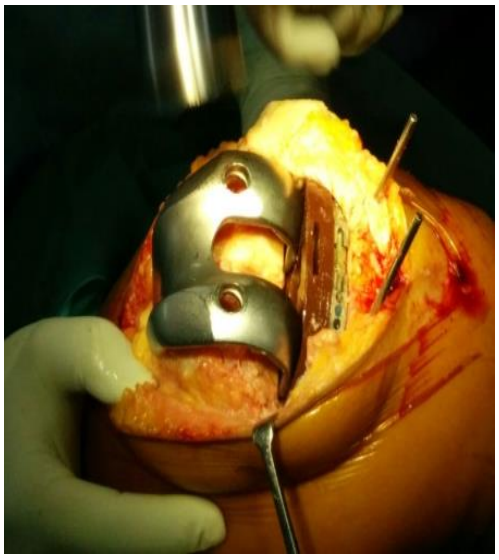
TIBIAL CUTS



CHECKING EXTENSION AND FLEXION GAPS

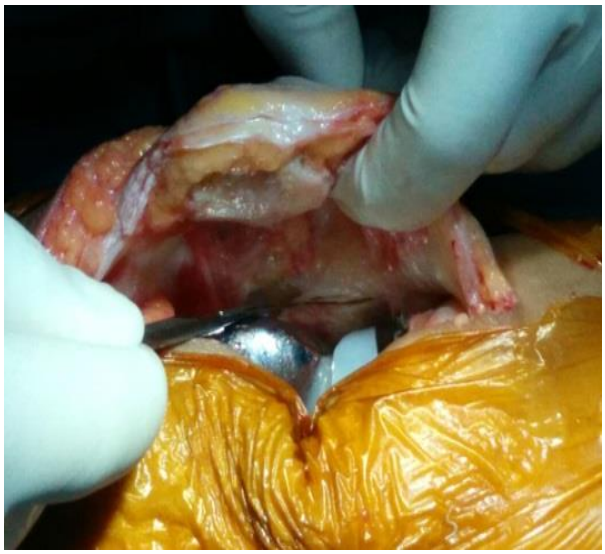


FITTING OF TRIAL IMPLANTS



IMPLANTATION

SOFT TISSUE RELEASE



CLOSURE

RESULTS

AGE DISTRIBUTION

Table 1: Age distribution of subjects

Age	Number of knees	Percentage
<50 years	7	23.3%
51 to 60 years	7	23.3%
61 to 70 years	11	36.7%
> 70 years	5	16.7%

Majority of subjects were in the age group 61 to 70 years (36.7%). Mean age of subjects in the study was 61.87 ± 11.67 years.

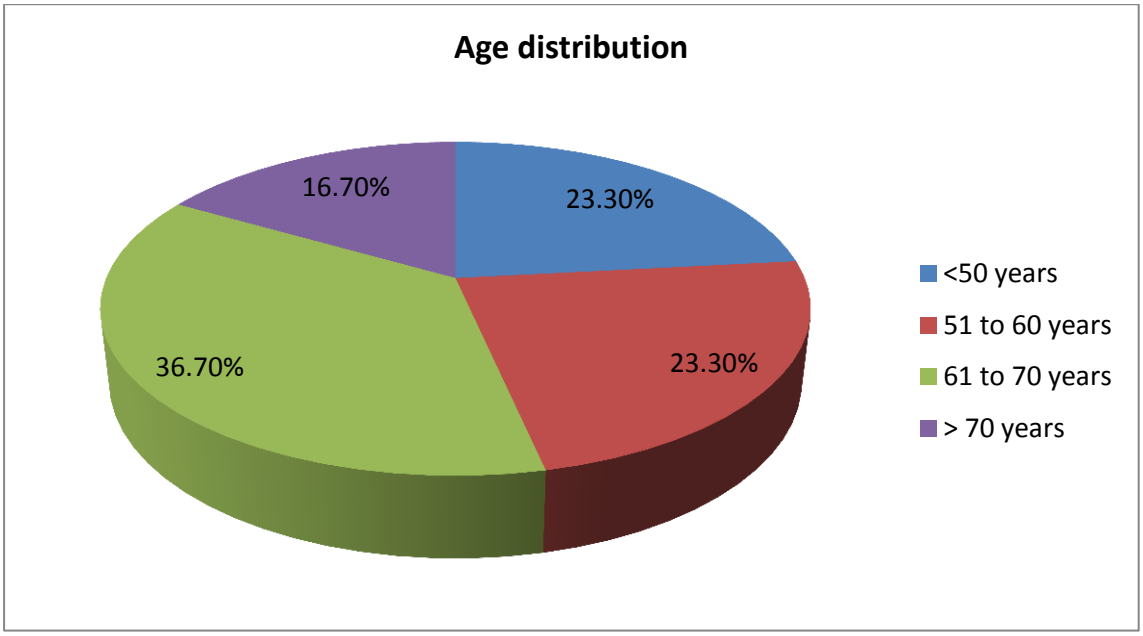


Figure 1: Pie diagram showing age distribution of subjects

GENDER DISTRIBUTION

Table 2: Gender distribution of subjects

Gender	Number of knees	Percentage
Female	17	56.7%
Male	13	43.3%

Majority of subjects were females (56.7%) and 43.3% were males.

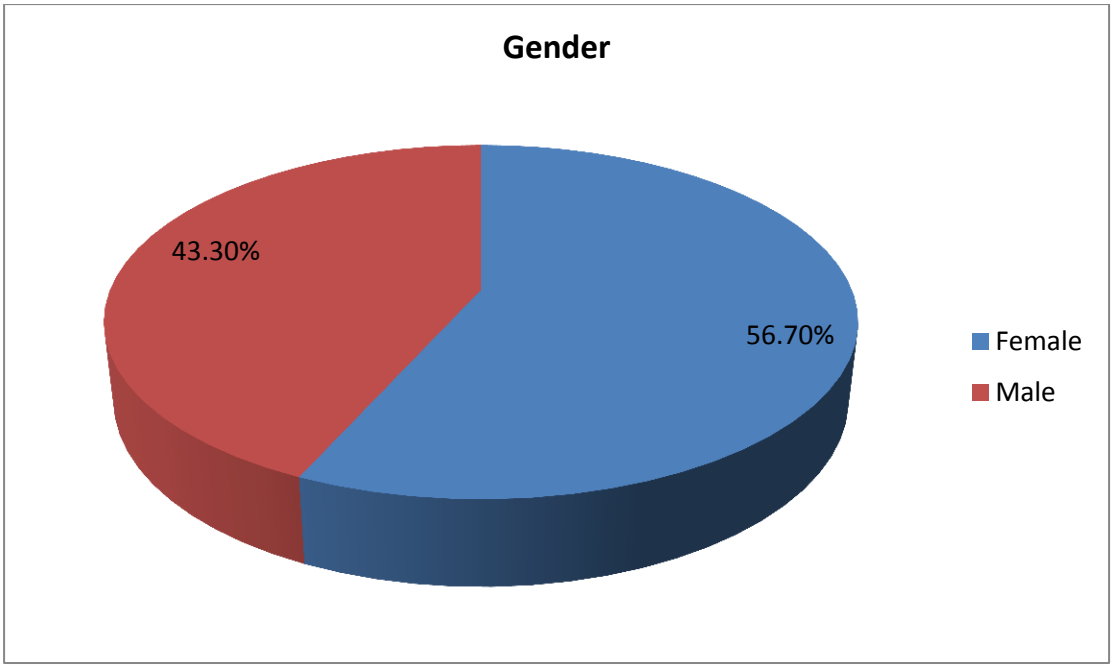


Figure 2: Pie diagram showing Gender distribution of subjects

BMI CLASSIFICATION OF PATIENTS IN THE STUDY

Table 3: BMI classification of subjects

Body Mass Index	Number of knees	Percentage
Normal	15	50.0%
Overweight	12	40.0%
Obese	3	10.0%

Mean weight of subjects in the study was 63.1 ± 11.8 kgs, mean height was 156.5 ± 10.1 cms and mean BMI was 25.6 ± 3.5.

50% of subjects in the study had normal BMI, 40% were overweight and 10% were obese.

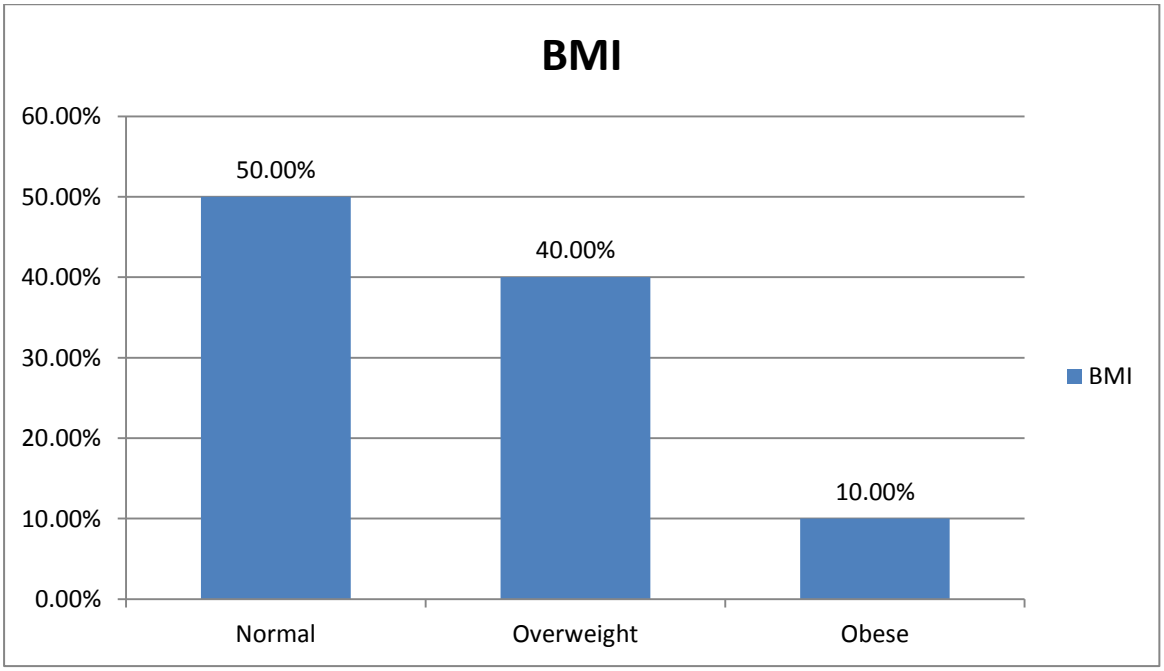


Figure 3: Bar diagram showing BMI classification of subjects

DIAGNOSIS OF SUBJECTS

Table 4: Diagnosis of subjects

Diagnosis	Number of knees	Percentage
Osteoarthritis	19	63.3%
Rheumatoid arthritis	11	36.7%

All the patients in this study suffered from arthritis. The majority of them had osteoarthritis i.e. 63.3%. The remaining 36.7% had rheumatoid arthritis.

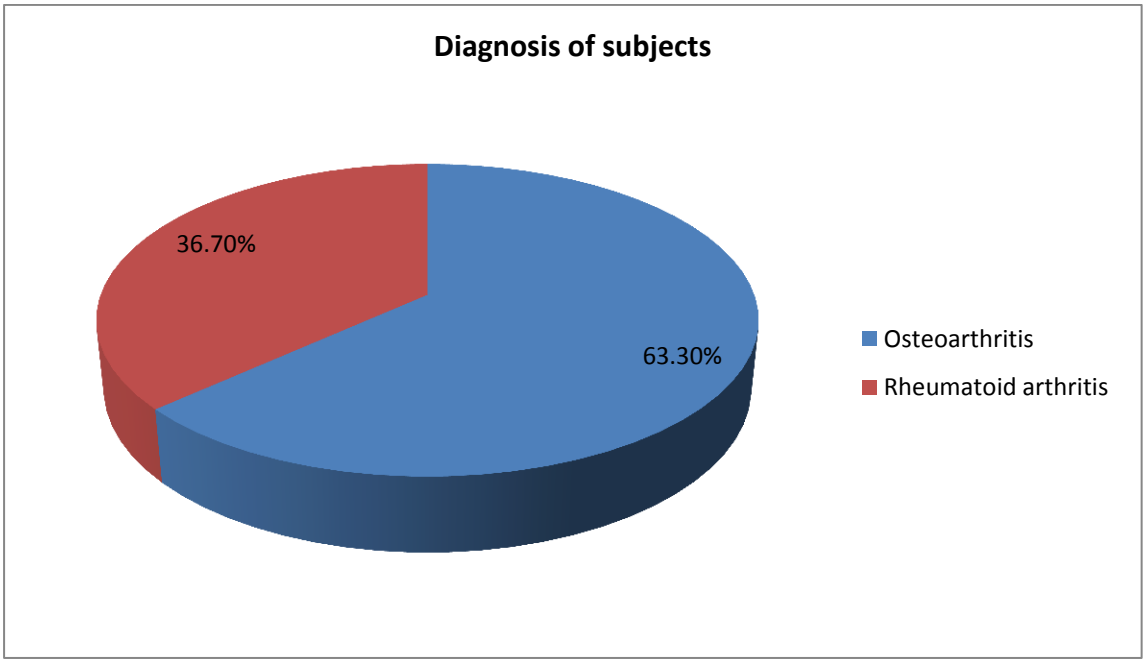


Figure 4: Pie diagram showing diagnosis of subjects

PREOPERATIVE AND POSTOPERATIVE COMPARISON OF KNEE SOCIETY SCORES

Table 5: Preoperative and postoperative comparison of Knee Society Scores

Knee Society Score	Diagnosis		P value
	Mean	SD	
Preoperative Clinical Score	29.0	21.6	<0.001*
Postoperative Clinical Score	83.4	8.0	
Preoperative Functional Score	35.0	16.3	<0.001*
Postoperative Functional Score	83.5	8.9	

Mean clinical score preoperatively was 29 ± 21.6 and postoperatively it was 83.4 ± 8. There was significant improvement in clinical outcome after surgery.

Similarly mean functional score preoperatively was 35 ± 16.3 and postoperatively it was 83.5 ± 8.9. There was significant improvement in functional outcome after surgery.

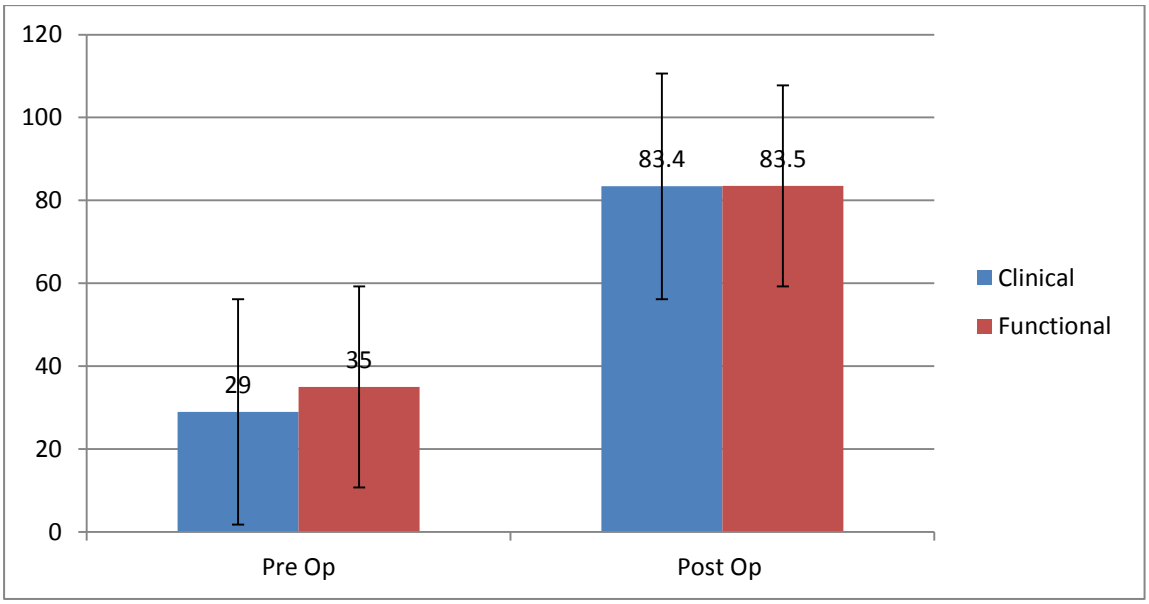


Figure 5: Bar diagram showing Knee Society Score Clinical and Functional outcome at preoperative and postoperative evaluation

PATIENT CLASSIFICATION IN THE STUDY

Table 6: Patient classification in the study

Patient Classification	Number of knees	Percentage
Unilateral or bilateral (opposite knee successfully replaced)	4	13.3%
Unilateral, other knee symptomatic	20	66.7%
Multiple arthritis or medical infirmity	6	20.0%

13.3% of subjects were operated previously on opposite side, 66.7% of them were operated for the first time and 20% in the study had co morbidities.

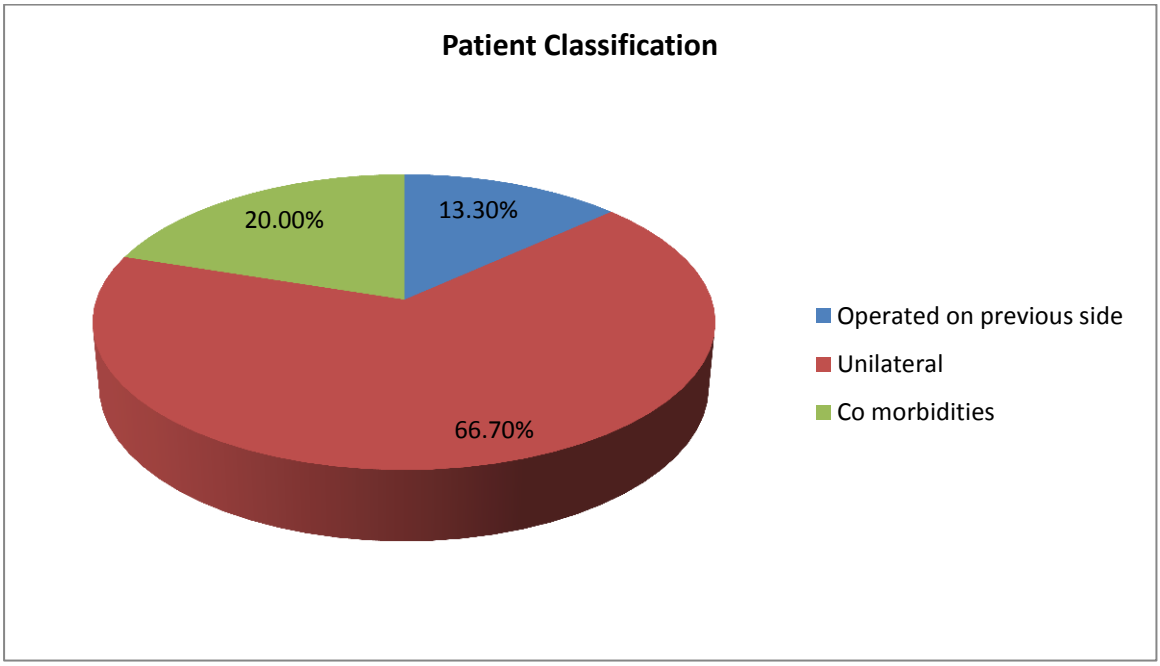


Figure 6: Pie diagram showing Patient classification in the study

RANGE OF MOVEMENTS

Table 7: Range of movement's comparison at preoperative and postoperative period

	Diagnosis	
	Mean	SD
Pre op ROM in degrees	56.2	22.7
Post op ROM in degrrees	111.0	9.9
P value	<0.001*	

Average range of movement preoperatively was $56.2^0 \pm 22.7$ and postoperatively it improved to $111^0 \pm 9.9$. Hence there was significant increase in average range of movements before and after surgery.

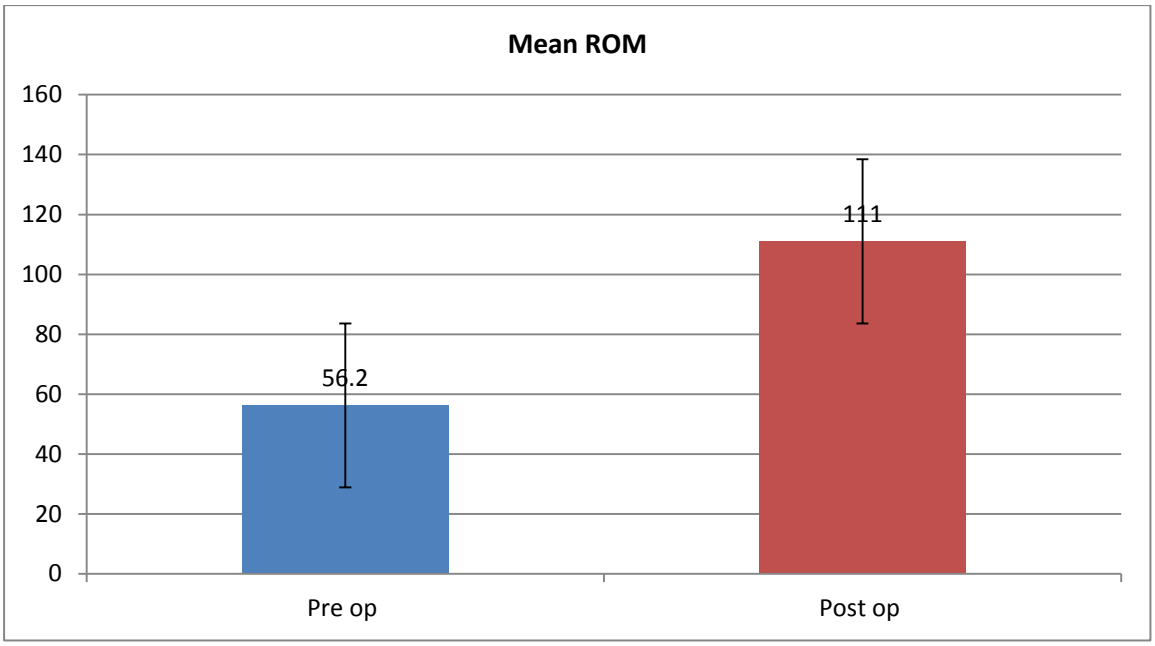
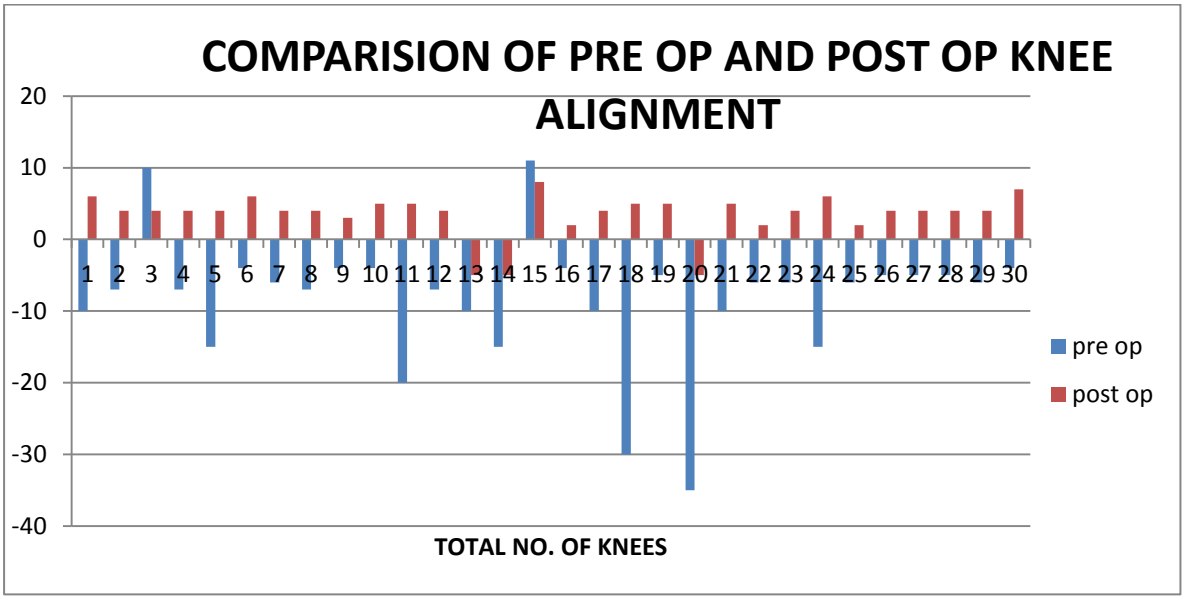


Figure 7: Bar diagram showing Range of movement's comparison at preoperative and postoperative evaluation

PREOPERATIVE AND POSTOPERATIVE COMPARISION OF KNEE ALIGNMENT

Table 8: Comparison of the preoperative and postoperative alignment of the knee joint



Preoperatively 28 knees had varus alignment (maximum 35^0) and 2 knees had valgus alignment (maximum 11^0).

Postoperatively all the knees were aligned in valgus except for 3 knees which had a varus alignment of 5^0.

PRE-OPERATIVE MEAN KNEE SOCIETY SCORE

Mean Clinical Knee score - 29

Mean Functional Knee score - 35

GRADE	CLINICAL KNEE SCORE		FUNCTIONAL KNEE SCORE	
	NUMBER OF KNEES	PERCENTAGE	NUMBER OF KNEES	PERCENTAGE
Excellent	01	3.3	00	00
Good	00	00	02	6.7
Fair	01	3.3	00	00
Poor	28	93.3	28	93.3

POSTOPERATIVE MEAN KNEE SOCIETY SCORE

Mean Clinical Knee score – 83.4

Mean Functional knee score – 83.5

GRADE	CLINICAL KNEE SCORE		FUNCTIONAL KNEE SCORE	
	NUMBER OF KNEES	PERCENTAGE	NUMBER OF KNEES	PERCENTAGE
Excellent	21	70	24	80
Good	08	26.7	05	16.7
Fair	01	3.3	01	3.3
Poor	00	00	00	00

COMPLICATIONS

Postoperatively 1 patient of rheumatoid aetiology had anterior knee pain after surgery which was relieved by physiotherapy.

The lateral view postoperative radiograph of one patient showed notching of the femur and anterior sloping of the tibia. However this patient did not have any problem related to this in the 3 months she was followed up.

RADIOLOGICAL AND CLINICAL PHOTOGRAPHS

CASE 1


R.L. JALAPPA HOSPITAL & RE

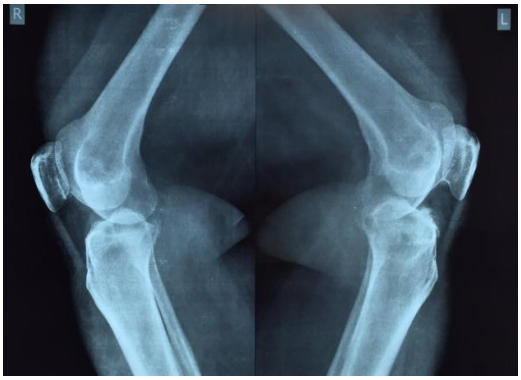
CASE 2








R
L


R
L


R


R

CASE 3

CASE 4






DISCUSSION

Right from historical times, doctors and scientists have tried many non-surgical and surgical modalities for knee arthritis. Now we can say unanimously that the only long term treatment for any progressive pathological condition of the knee joint is total knee arthroplasty.

There is drastic pain relief, a good functional outcome and it can safely be advised for patients especially in the middle age or elderly age groups. In the younger age groups it must be advised and performed with caution as the chances of loosening with increased activity and the need for revision arthroplasty is more.

In India, as patients have a habit of squatting and sitting cross legged, they must be counselled and motivated that after surgery they must not sit that way and a gross lifestyle modification is required. The use of dining table and chair instead of sitting on the floor to eat and use of western style toilet must be explained, and patients who are ready to make the necessary changes can be taken up for the surgery.

Along with the costs of the prosthesis and surgery the patient may also incur charges for the lifestyle modifications which need to be done at their home.

Various prosthesis have been designed with increasing instrumentation to restore the knee anatomy as far as possible to normal, and attempts are being made to make them pocket friendly i.e. within the common man's reach. As more patients are opting for total knee arthroplasty, the burden on the health care system is escalating, as with the increasing life span, the geriatric population is on the rise. Hence more surgeons are required to perform these surgeries and the prosthesis should also have easy instrumentation and be user friendly.

Preoperative evaluation is very important in these patients and factors like habits, body weight, activity level and socio-economic status must be considered before operating, to select the type of implant as well as to determine postoperative recovery, wound healing, chance of complications etc.

In this study, knees affected with osteoarthritis or rheumatoid arthritis with the patient being clinically symptomatic, not responding to the usual conservative methods of treatment and with or without radiological evidence of tri-compartmental involvement were taken up for surgery. The aim was to provide a pain free, mobile and functional joint with as little complications as possible.

The ideal candidate for a total knee arthroplasty is one who is clinically symptomatic, not too obese, has reasonable expectations, and who will not put great demands on their knee like sports etc.

Our inclusion criteria intended to involve and treat all the cases which justified a TKR, and the age mentioned was not necessarily the youngest age limit for all the aetiologies. The subjects suffering from rheumatoid arthritis had an earlier onset of symptoms compared to those suffering from osteoarthritis. This can be accounted to the inflammatory pathology. In our study, the age of the youngest operated rheumatoid patient was 46 years whereas the youngest operated osteoarthritis patient was 53 years old. No other aetiology was observed in our study.

An absolute contraindication to performing this surgery is the presence of recent or active infection either local or systemic.

In addition to careful patient selection, proper prosthetic design selection, a flawless surgical technique and an equally dedicated post-operative rehabilitation is inevitably required for the success of total knee replacement.

A total of 26 patients with 30 knees were selected from the outdoor clinic. A preoperative examination and assessment proforma was made and used in all cases.

1. AGE:

YEAR	AUTHOR	MEAN AGE OF PATIENTS
2001	BACK ET AL [54]	61.0
2007	HOOPER ET AL [55]	66.9
2016	PRESENT SERIES	61.87

In our series the mean age of patients was 61.87 years, which was comparable to the mean age of patients in the study conducted by Back et al where it was 61. In the study conducted by Hooper et al, the mean age of patients was 66.9 years.

2. GENDER:

YEAR	AUTHOR	GENDER			
		MALE		FEMALE	
		NUMBER OF KNEES	PERCENTAGE	NUMBER OF KNEES	PERCENTAGE
2007	HOOPER ET AL[55]	105	56.45	81	43.54
2016	PRESENT STUDY	13	43.33	17	56.67

In 2007 Hooper et al conducted a study where it was found that there were predominantly males (56.45%). In our study there were more female patients (56.67%).

3. **WEIGHT AND BMI**

The mean weight of the patients in our series was 63.1 kg and the mean BMI was 25.6 kg/ m^2 which was comparable to other studies. With increasing body weight, the forces transmitted through the prosthesis will be more, leading to polyethylene wear and implant failure.

50% of subjects in the study had normal BMI, 40% were overweight and 10% were obese.

4. **COMPARATIVE OVERALL RESULTS**

A.

YEAR	AUTHOR	CLINICAL KNEE SCORE (IN %)				FUNCTIONAL KNEE SCORE (IN %)			
		E	G	F	P	E	G	F	P
2009	A.SUHAIL ET AL[49]	77.3	21.3	1.3	0	64	29.3	6.7	0
2011	SENAN ET AL[48]	60	13.3	00	13.3	34.6	46.1	00	46.1
2016	PRESENT SERIES	70	26.7	3.3	00	80	16.7	3.3	00

In a study conducted by Suhail et al in 2009, according to the clinical knee score 77.3% knees rated excellent, 21.3% good and 1.3% fair. The outcome according to the functional knee score was 64% knees were excellent, 29.3% good and 6.7% fair.

In an another study conducted by Williams et al in 2010 the clinical knee score rated 92% knees as excellent, 1.6% good and 6.5% fair .[56]

Senan et al in their study in 2011 also showed similar outcomes, the clinical knee score rated 60% knees excellent, 13.3% good, and 13.3% poor and the functional knee score outcome showed 34.6% knees as excellent, 46.1% good and 46.1% poor.[48]

In a series of cases studied by Reddy et al in 2013 the outcome according to the functional knee score was found to be excellent in 79.4% knees, good in 5.8%, and poor in 5.8%.[20]

In our series it was noted that the results of the knee society clinical score was excellent in 70% knees, good in 26.7%, fair in 3.3% and the functional knee score showed excellent results in 80% knees, good in 16.7% and fair results in 3.3%, which were comparable to the results of other studies performed in India and abroad.

B.

YEAR	AUTHOR	MEAN CLINICAL KNEE SCORE		MEAN FUNCTIONAL KNEE SCORE	
		PREOP	POSTOP	PREOP	POSTOP
2008	SMITH ET AL [57]	39.0	93.0	51.7	70.0
2008	KIM T. H. ET AL [58]	30.9	94.2	44.9	84.7
2010	KIM Y. H. ET AL [26]	35.3	94	44.2	83
2016	PRESENT SERIES	29	83.4	35	83.5

A study conducted by Smith et al in 2008 showed the mean clinical knee score was 39.0 preoperatively and 93.0 postoperatively and mean functional score was 51.07 preoperatively and 70.0 postoperatively.

In an another study performed by Kim T. H. et al in 2008, the mean clinical knee score increased from 30.9 preoperatively to 94.2 postoperatively and the mean functional score improved from 44.9 preoperatively to 84.7 postoperatively.

In a series of cases studied by Kim Y. H. et al in 2010, it was seen that the mean clinical knee score was 35.3 preoperatively and 94 postoperatively and mean functional score was 44.2 preoperatively and 83 postoperatively.

In our series it was noted that the mean knee society scores were comparable to the means of other studies performed elsewhere; the mean clinical knee score was 29 preoperatively and 83.4 postoperatively and the mean functional score was 35 preoperatively and 83.5 postoperatively.

C.

YEAR	AUTHOR	MEAN PREOPERATIVE ROM IN DEGREES	MEAN POSTOPERATIVE ROM IN DEGREES
1999	LI ET AL [59]	88	100
2007	NUTTON ET AL [60]	126	136
2008	KIM T. H. ET AL [58]	117.3	134.7
2010	WILLIAMS ET AL [56]	99	115.5
2016	PRESENT SERIES	56.2	111

A Study conducted by Li et al in 1999 showed that mean preoperative ROM was 88^0 and mean postoperative ROM was 100^0.

In another study by Nutton et al in 2007 showed that the mean ROM had increased from 126^0 preoperatively to a mean postoperative ROM of 136^0.

In a series of cases studied by Kim et al in 2008 showed that mean preoperative ROM was 117.3^0 and mean postoperative ROM was 134.7^0.

Williams et al in 2010 showed that mean preoperative ROM was 99^0 and mean postoperative ROM was 115.5^0.

It was noted that the range of movement achieved after total knee arthroplasty in our study was comparable to the results of other studies performed elsewhere. In our study the mean preoperative ROM was 56.2^0 and mean postoperative ROM was 111^0. The slight decrease may be attributable to the ill compliance of patients regarding postoperative rehabilitation

5. ETIOLOGY

The number of patients with osteoarthritis (19 knees, 63.3%) was more than rheumatoid arthritis of the knee joint. This correlates with the findings of Back et al. (2001) in whose series 354 (83%) had osteoarthritis and 59 (14 %) had rheumatoid arthritis, and the remaining other aetiologies (2%).

YEAR	AUTHOR	OSTEOARTHRITIS	RHEUMATOID ARTHRITIS
2001	BACK ET AL [54]	353(83%)	59(14%)
2016	PRESENT SERIES	19(63.3%)	11(36.7%)

In a series of cases of rheumatoid knee studied by Reddy et al in 2013 the outcome according to the functional knee score was found to be excellent in 79.4% knees, good in 5.8%, and poor in 5.8%.

In our study out of the 11 rheumatoid knees, 90.9% were found to have excellent result and 9.09% good results according to the functional knee score.

In a series conducted by Suhail et al (2009), in osteoarthritic knees, the outcome according to the clinical knee score was 77.3% knees excellent, 21.3% good and 1.3% fair. The outcome according to the functional knee score was 64% knees were excellent, 29.3% good and 6.7% fair.

In our study out of the 19 osteoarthritic knees the clinical scoring was excellent in 78.9%, good in 15.7%, fair in 9.09%, and the mean functional scoring was 84.2% excellent and 15.7% good.

In a study conducted by Krishna Kiran et al (2005), they reported that rheumatoid knees have a lower pre and postoperative scores when compared to osteoarthritic knees.[23] Hooper et al (2009) however did not find any relation to the pathology of the arthritis.[55] In our study we did not see any difference. In our study the outcome of knees affected with osteoarthritis and rheumatoid arthritis were comparable.

All our patients were mobilized from the first postoperative day and low molecular weight heparin was initiated on day 2 or 3 (12 hours after the epidural catheter was removed), and we had no cases of deep vein thrombosis or cardiovascular complications.

In our series, pain not amenable to conservative treatment was the strongest factor for surgery, all the 30 patients walked less than 5 blocks preoperatively and were further restricted from walking by pain, flexion deformity up to 30^0, and instability up to 5^0 with restricted or painful range of motion.

Postoperatively, all the patients could walk more than 10 blocks, there was no evidence of flexion deformity and three knees had mild varus alignment of the lower limb.

CONCLUSION

- The increase of awareness of joint replacement and its acceptance has been noted in the rural population.
- Patients have an early recovery and can perform their activities of daily living with much more ease due to pain relief. Relief of pain is often total, with an increased walking ability and stability of the joint.
- Our results are on par with the other global studies; more than 96% of the patients had a good to excellent score.
- TKR has an excellent outcome in degenerative and inflammatory arthritis.
- Correction of deformities in majority of our patients to the physiological range of valgus and reproducibility of the technique is excellent.
- 6.6% incidence of complications is less compared to other studies. Absence of deep infection in our study may be due to the thorough preoperative work up, aseptic operating conditions and suitable antibiotics. Scrupulous attention was paid to preoperative screening, medical fitness, intraoperative technique, and postoperative rehabilitation programme.
- KSS scoring system is found to be relevant, simple but more exacting and more objective. Increasing age and poor medical condition will not affect the clinical score of the knee.
- In our study there were no cases of deep vein thrombosis which we attribute to the early mobilisation and use of low molecular weight heparin.

We conclude that total knee replacement is a reliable and safe modality of treatment and can be performed in the rural population with results comparable to the other global studies.

SUMMARY

The present study was conducted at R. L. Jalappa Hospital and Research Centre, Tamaka, Kolar attached to Sri Devaraj Urs Medical College, between October 2014 and October 2016; which included a 3 month follow up period.

30 knees, affected with either osteoarthritis or rheumatoid arthritis were treated surgically with total knee arthroplasty.

- Indication for the surgery was severe disabling pain due to arthritis which was not relieved by conservative methods of treatment.
- Age of the patients ranged from 46 years to 85 years. Mean age of subjects in the study was 61.87 ± 11.67 years.
- Majority of subjects were in the age group 61 to 70 years (36.7%).
- In this series majority of the patients were females (17 patients, 56.7%)
- Right knee was predominantly involved (19 patients, 63.3%)
- The majority of our subjects had osteoarthritis (19 knees, 70%). The remaining had rheumatoid arthritis (9 patients, 11 knees, 36.6%)
- In this series the mean body mass index of patients was 25.6kg/m^2, 50% of the subjects had normal BMI, 40% were overweight, and the remaining 10% obese.
- In this series, varus deformity was noted in 28 knees, (93.3%) preoperatively. Postoperatively valgus alignment was achieved in all knees except for 3.
- Complications were seen in 2 patients, one had anterior knee pain which was treated by physiotherapy, the other patient's postoperative radiograph showed femoral notching and anterior tibial sloping.

- According to the Knee society clinical score, in this study 70% of the knees had an excellent clinical outcome, 26.7% good, and 3.3% fair.
- According to the functional score, 80%of the knees had an excellent outcome, 16.7% good and 3.2% fair.
- With a low rate of complications if performed meticulously, TKR is a standard procedure for painful and/or deformed arthritic knees.
- We suggest that total knee replacement can be performed in a rural setting with results comparable to other global studies provided there is adequate expertise and follow up by the patient to detect any complications early, before they occur.

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INFORMED CONSENT FORM

STUDY TITLE:

EVALUATION OF THE FUNCTIONAL OUTCOME OF TOTAL KNEE REPLACEMENT

STUDY NUMBER:

Subjects Initials: Subjects Name:

Date of Birth/age: Hospital Number:

Address: Phone number:

1. I confirm that I have read and understood the information sheet dated ( ) for the above study and have had the opportunity to ask questions.
2. I understand that my participation in the study is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected.
3. I understand that the sponsor of the clinical trial, others working on the sponsors behalf, the ethics committee and the regulatory authorities will not need my permission to look at my health records both in respect of the current study and any further research that may be conducted in relation to it, even if I withdraw from the trial. I agree to this access, however, I understand that my identity will not be revealed in any information released to third parties or published.

4. I agree not to restrict the usage of any data or results that arise from this study provided such a use is only for scientific purpose(s).
5. I agree to take part in the above study.
6. I have been explained the nature and purpose of operation/procedure, possible alternate methods of treatment, the risk involved, and the possibility of complications in my own understandable language, I consent to the disposal of any tissues or part which may be necessary to remove from my body, I have been counselled by the surgeon about the functional outcome/expected results and the anaesthesiologist about the nature and risks of anaesthesia. The possible need of higher forms of care have been explained like ICU care and ventilator support and I consent for the same.
7. I unreservedly and in my full senses give complete consent for the performance of the above named procedure and any additional procedures deemed necessary.

Signature (or Thumb impression) of the subject Date:

Legally Acceptable Representative

Signatory's name

Signature of person administering informed consent Date:

Signatory's Name:

I, the operating surgeon have counselled the patient about the proposed operation and possible risks involved in patients own vernacular language. I have counselled the patient about the functional outcome/expected results and alternative treatment.

Signature of the Operating surgeon Date:

Signatory's Name

I, the Anaesthesiologist, have counselled the patient regarding the nature of anaesthesia, the route of anaesthesia and its effects and possible complications.

Signature of the Anaesthesiologist Date:

Signatory's name

Signature of the principal investigator

Signatory's name

Signature of witness

Signatory’s Name

Name and Contact details of persons to be contacted in case of any adverse effects

PRINCIPAL INVESTIGATOR: DR.N.RAJYALAKSHMI REDDY-9741760934

GUIDE: DR. ARUN H. S.

CONSENT FORM IN KANNADA

ಕ್ರಮ ಸಂಖ್ಯೆ :

ರೋಗಿಯ ಹೆಸರು :

ಜನನ :

ವಯಸ್ಸು :

ಆಸ್ಪತ್ರೆಯ ಸಂಖ್ಯೆ :

ವಿಳಾಸ :

ದೂರವಾಣಿ ಸಂಖ್ಯೆ :

* ನಾನು ಈ ವಿಷಯದ ಪತ್ರವನ್ನು ಮೊದಲೇ ಓದಿ ಅರ್ಥ ಮಾಡಿಕೊಂಡು ಹಾಗೂ ಈ ವಿಷಯದ ಬಗ್ಗೆ ಪ್ರಶ್ನೆಗಳನ್ನು ಕೇಳಿ ತಿಳಿದುಕೊಂಡಿರುತ್ತೇನೆ.

* ಈ ಸಂಶೋಧನೆಯಲ್ಲಿ ನನ್ನ ಸ್ವ ಇಚ್ಛೆಯಿಂದ ಸಂಶೋಧನೆಯಲ್ಲಿ ಪಾಲ್ಗೊಂಡಿದ್ದೇನೆ. ಒಂದು ವೇಳೆ ಈ ಸಂಶೋಧನೆಯನ್ನು ಕೈಬಿಡಬೇಕಾಗಿದ್ದಲ್ಲಿ ನನ್ನ ಹಕ್ಕುಗಳಿಗೆ ಯಾವುದೇ ತೊಂದರೆಗಳಿರುವುದಿಲ್ಲ.

* ಈ ಸಂಶೋಧನೆಯಲ್ಲಿ ಪಾಲ್ಗೊಳ್ಳುವ ವೈದ್ಯಕೀಯ ಮೇಲಾಧಿಕಾರಿಗಳಿಗೆ ನನ್ನ ಸಂಶೋಧನೆಯ ಬಗ್ಗೆ ಎಲ್ಲಾ ವಿವರಗಳನ್ನು ತಿಳಿದುಕೊಳ್ಳುವ ಸಂಪೂರ್ಣ ಹಕ್ಕಿದೆ. ಈ ಸಂಶೋಧನೆ ಹಾಗೂ ಇದಕ್ಕೆ ಸಂಬಂಧಿಸಿದ ಇತರೆ ಸಂಶೋಧನೆಯ ವಿವರವನ್ನು ತಿಳಿದುಕೊಳ್ಳಬಹುದು. ಒಂದು ವೇಳೆ ಈ ಸಂಶೋಧನೆಯನ್ನು ಕೈಬಿಟ್ಟಲ್ಲಿಯೇ ಸಹ ಈ ಸಂಶೋಧನೆಯ ಎಲ್ಲಾ ಮಾಹಿತಿಯನ್ನು ಪಡೆಯಬಹುದು. ಆದರೆ ನನ್ನ ವಿವರಗಳನ್ನು ನಮ್ಮಲ್ಲಿ ಬಿಟ್ಟು ಇತರೆ ವ್ಯಕ್ತಿಗಳಿಗೆ ತಿಳಿಸುವಂತಿಲ್ಲ.

* ನಾನು ಈ ಸಂಶೋಧನೆಯಲ್ಲಿ ಯಾವುದೇ ರೀತಿಯ ಮಾಹಿತಿಯನ್ನು ಮುಚ್ಚಿಡುವುದಿಕ್ಲ ಯಾಕೆಂದರೆ, ಇದು ವೈಜ್ಞಾನಿಕ ಸಂಶೋಧನೆ.

* ನನಗೆ ಈ ಶಸ್ತ್ರ ಚಿಕಿತ್ಸೆಯ ಸಂಪೂರ್ಣ ವಿವರಗಳನ್ನು ಹಾಗೂ ಬೇರೆ ಶಸ್ತ್ರ ಚಿಕಿತ್ಸೆಯ ಮಾಹಿತಿಯನ್ನು ಸಹ ತಿಳಿಸಿದ್ದಾರೆ. ಹಾಗೂ ಈ ಶಸ್ತ್ರ ಚಿಕಿತ್ಸೆಯಲ್ಲಾಗುವ ಅಪಾಯಗಳನ್ನು ಸಹ ತಿಳಿಸಿದ್ದಾರೆ. ನನಗೆ ಅರ್ಥವಾಗುವ ಭಾಷೆಯಲ್ಲಿ

* ನನ್ನ ದೇಹದಲ್ಲಿರುವ ಯಾವುದೇ ಅಂಗಾಂಶಗಳನ್ನು ತೆಗೆದುಕೊಳ್ಳುವ ಹಕ್ಕು ವೈದ್ಯರಿಗಿದೆ. ಈ ಶಸ್ತ್ರ ಚಿಕಿತ್ಸೆಯ ನಂತರ ವೈದ್ಯರು ಈ ಶಸ್ತ್ರ ಚಿಕಿತ್ಸೆಯೂ ಎಷ್ಟು ಉತ್ತಮ ಹಾಗೂ ಬರುವ ಫಲಿತಾಂಶ, ತೊಂದರೆಗಳನ್ನು ತಿಳಿಸಿದ್ದಾರೆ.

* ಅನಸ್ತ್ರೇಶಿಯಾ ವೈದ್ಯರು ಖಅಗ ಂಆಒಖಖಖಖಖಔಓ, ಗಿಇಓಖಿಖಖಐಂಖಿಖಔಓ ಹಾಗೂ ಯಾವುದೇ ರೀತಿಯ ತೊಂದರೆಗಳನ್ನು ತಿಳಿಸಿದ್ದಾರೆ ಇದಕ್ಕೆ ನಾನು ಒಪ್ಪಿಕೊಳ್ಳುತ್ತೇನೆ.

  ಈ ಸಂಶೋಧನೆಯಲ್ಲಿ ಪಾಲ್ಗೊಳ್ಳುವುದಕ್ಕೆ ನಾನು ಒಪ್ಪಿಕೊಳ್ಳುತ್ತೇನೆ.

  ರೋಗಿಯ ಹೆಸರು _____ ಮತ್ತು ಸಹಿ

* ಸಂಶೋಧನೆಯ ವೈದ್ಯರಾದ ನಾವು ಶಸ್ತ್ರ ಚಿಕಿತ್ಸೆಯ ಬಗ್ಗೆ ಎಲ್ಲಾ ಮಾಹಿತಿಯನ್ನು ನೀಡಿದ್ದೇವೆ ಹಾಗೂ ಬೇರೆ ವಿಧವಾದ ಶಸ್ತ್ರ ಚಿಕಿತ್ಸೆಯ ಮಾಹಿತಿಯನ್ನು ಸಹ ನೀಡಿದ್ದೇವೆ ಹಾಗೂ ಶಸ್ತ್ರ ಚಿಕಿತ್ಸೆಯ ಫಲಿತಾಂಶದ ಬಗ್ಗೆ ವಿವರಣೆಯನ್ನು ನೀಡಿದ್ದೇವೆ.

  ವೈದ್ಯರ ಹೆಸರು _____ ಮತ್ತು ಸಹಿ

* ಸಂಶೋಧನೆಯ ವೈದ್ಯರಾದ ನಾವು ರೋಗಿಗೆ ಅನಸ್ತ್ರೇಶಿಯಾದ ಮಾಹಿತಿ ಹಾಗೂ ಪರಿಣಾಮದ ಬಗ್ಗೆ ತಿಳಿಸಿದ್ದೇವೆ.

  ಅನಸ್ತ್ರೇಶಿಯಾ ವೈದ್ಯರ ಹೆಸರು _____ ಮತ್ತು ಸಹಿ

* ಸಂಶೋಧನಾ ವೈದ್ಯರ ಹೆಸರು, ಸಹಿ ಮತ್ತು ಸಾಕ್ಷಿದಾರರು

INFORMATION SHEET FOR TOTAL KNEE REPLACEMENT

BEFORE THE SURGERY

Consultation with the treating/operating doctor to evaluate the need for surgery.

Admission must be 2 days prior to the planned date of surgery to allow the necessary investigations to be performed and preanaesthetic evaluation to be done to assess fitness for surgery and other precautions to be taken.

FOR THE SURGERY

Adequate part preparation will be done.

The patient must not consume anything the night before surgery after 10pm and also on the morning of the operation. Fluid maintenance will be started and pre-operative medication started. Insulin will be started in diabetic patients.

Patient will be shifted to the operating theatre by 8 am on the day of surgery.

IN THE OPERATION THEATRE

Anaesthesiologist will administer the suitable medications.

Surgery will start and last for approximately 2-3 hours.

AFTER THE OPERATION

Patient will be kept in the postoperative recovery room till the anaesthesiologist gives approval for shifting the case.

Then the patient will be shifted to the surgical ICU/medical ICU depending on the patients vital parameters, after which the patient will be shifted to the ward/private room as per the patients convenience.

Postoperative check X-rays will be taken along with any other necessary investigations.

Postoperatively patient will be put on injectable medication which will be later changed to oral, based on the decision of the treating doctor.

RECOVERY

Depending on the patient's recovery from the operation, the patient will be mobilized on the 1st postoperative day if there are no other potential complications.

They shall be taught knee range of motion exercises on the 2nd post-operative day after the dressing.

Patient will be evaluated on his/her recovery with knee society score questionnaire by the investigating doctor.

If knee range of motion is not satisfactory patient will be advised for physiotherapy.

Suture removal will be done on the 12th post-operative day.

DISCHARGE

When the range of motion is satisfactory, the patient is ambulating with the help of walker and there are no other complications the patient can be discharged from the hospital.

FOLLOW UP

Patient will be assessed on follow up monthly till 3 months with the help of x-rays, other necessary investigations and the knee society scoring system if there are no complications.

PATIENTS PROFORMA

SERIAL NUMBER

HOSPITAL NUMBER

NAME

AGE

GENDER

RELIGION

NEXT OF KIN

ADDRESS

HEIGHT

WEIGHT

CHIEF COMPLAINTS

BRIEF HISTORY

PAST HISTORY

PERSONAL HISTORY

- BOWEL
- BLADDER
- SLEEP
- APPETITE
- ADDICTIONS

OCCUPATION

FAMILY HISTORY

HISTORY OF ALLERGY

DRUG HISTORY

VITALS

PULSE

BLOOD PRESSURE

RESPIRATORY RATE

TEMPERATURE

SYSTEMIC EXAMINATION

RESPIRATORY SYSTEM

CARDIOVASCULAR SYSTEM

PER ABDOMEN

CENTRAL NERVOUS SYSTEM

MENTAL STATE AND INTELLIGENCE

BUILD AND STATE OF NUTRITION

ATTITUDE OF LIMBS

GAIT

PHYSICAL EXAMINATION

LOCAL EXAMINATION OF KNEE JOINT

INSPECTION

- ATTITUDE
- SWELLING
- DEFORMITY
- PATELLA

PALPATION

- LOCAL RISE OF TEMPERATURE
- TENDERNESS
- CREPITUS
- RETRO PATELLAR CREPITUS
- EFFUSION
- PATELLAR TAP

RANGE OF MOVEMENTS

- FLEXION
- EXTENSOR LAG

SPECIAL TESTS

- DRAWER TESTS
- APLEYS GRINDING TEST

McMURRAY TEST

STRESS TESTS

MEASUREMENTS

NEUROVASCULAR DEFICITS

INVESTIGATIONS

PATHOLOGY

Haemoglobin (Hb)

Packed cell volume (PCV)

Total leucocyte count

Differential count

Platelet count

Prothrombin time (PT)

International Normalised ratio (INR)

Erythrocyte sedimentation rate (ESR)

Absolute eosinophil count (AEC)

Blood grouping and Rh typing

BIOCHEMSITRY

Randomized blood sugar (RBS)

Fasting blood sugar (FBS)

Glycated Haemoglobin (Hb1AC)

Blood urea

Serum creatinine

Sodium

Potassium

Chloride*

Liver function tests*

Lipid Profile*

Cardiac profile*

MICROBIOLOGY

HIV Screening

HbsAg screening

Rheumatoid Factor (RA)

C reactive Protein (CRP)

Anti streptolysin O titres (ASLO)

*- investigations will be done if necessary

KNEE SOCIETY SCORE (KSS)

PATIENT CATEGORY

a. Unilateral or bilateral (opposite knee successfully replaced)

b. Unilateral, other knee symptomatic

c. Multiple arthritis or medical infirmity

PAIN	POINTS	PRE OPERATIVE	POST OPERATIVE
None	50		
Mild or Occasional	45		
Stairs Only	40		
Waking & Stairs	30		
Moderate			
Occasional	20		
Continuous	10		
Severe	0		

RANGE OF MOVEMENTS

5 Degrees = 1 Point	25		

STABILITY (MAXIMUM Movement In Any Position)

ANTEROPOSTERIOR	POINTS	PRE OPERATIVE	POST OPERATIVE
<5 mm			
5-10 mm	10		
>10 mm	5		
	0		
MEDIOLATERAL			
<5 Deg	15		
6-9 Deg	10		
10-14 Deg	5		
15 Deg	0		
SUBTOTAL			

DEDUCTIONS (Minus)

FLEXION CONTRACTURE	POINTS	PRE OPERATIVE	POST OPERATIVE
5-10 Deg	2		
10-15 Deg	5		
16-20 Deg	10		
>20 Deg	15		
EXTENSOR LAG < 4 Deg	2		
5-10 Deg	5		
10-20 Deg	10		
>20 Deg	15		
ALIGNMENT(MALALIGNMENT)			
0-4 Deg	0		
5-10 Deg	3 point each degree		
11-15 Deg	3 point each degree		
OTHERS	20		
TOTAL DEDUCTIONS			

KNEE SCORE (if total is a minus, score is 0) TOTAL- DEDUCTIONS			

FUNCTIONAL SCORE

	POINT	PRE OPERATIVE	POST OPERATIVE
WALKING			
Unlimited	50		
>10 blocks	40		
5-10 blocks	30		
<5 blocks	20		
Housebound	10		
Unable	0		
STAIRS			
Normal up & down	50		
Normal up, down, with rails	40		
Up & down with rails	30		
Up with rails, unable down	15		
Unable	0		
SUB TOTAL			

DEDUCTIONS (Minus)

	POINT	PRE OPERATIVE	POST OPERATIVE
Cane	5		
Two canes	10		
Crutches or walker	20		
TOTAL DEDUCTIONS			

FUNCTIONAL SCORE (Total score- deductions)			

TOTAL SCORES

The knee score and knee functional score are considered separately. Scores between

80-100 – Excellent

70-79 – Good

60-69 – Fair

<60 – Poor

KEY FOR MASTERCHART

S. NO. - Serial number

H. NO. - Hospital number

BMI- Body mass index

OA- Osteoarthritis

RA- Rheumatoid arthritis

E- Excellent

G- Good

F- Fair

P- Poor

A- Unilateral or bilateral (opposite knee successfully replaced)

B- Unilateral, other knee symptomatic

C- Multiple arthritis or medical infirmity

S. NO.	H. NO	ADDRESS	AGE	GENDER	HEIGHT	WEIGHT	BMI	SIDE	DURATION	DIAGNOSIS	PREOPERATIVE DEGREE			KNEE SCORE		POSTOPERATIVE DEGREE			KNEE SCORE		PATIENT	COMPLICATIONS	
											VARUS	VALGUS	ROM	CLINICAL	FUNTIONA	VARUS	VALGUS	ROM	CLINICAL	FUNCTION	CLASSIFICATION		
1	1021649	GULPET	85	F	154	70	29.5	RIGHT	1 YEAR	OA	10		60	26P	45P		6	125	89E	80E	B		
2	54093	KOLAR	65	F	156	72	29.6	RIGHT	1 YEAR	OA	7		50	51P	25P		4	100	70G	80E	B		
3	26448	KOLAR	63	M	160	65	25.3	RIGHT	4 YEARS	RA		10	50	37P	70G		4	125	93E	80E	B		
4	54093	KOLAR	65	F	156	72	29.6	LEFT	1.5 YEARS	OA	7		30	18P	40P		4	110	87E	75G	A		
5	113500	SRINIVASP	64	F	132	65	31.3	RIGHT	2 YEARS	OA	15		50	0P	50P		4	100	60F	70G	B		
6	114066	MULBAGA	67	M	175	90	29.4	LEFT	5 YEARS	OA	4		50	50P	25P		6	120	81E	85E	C		
7	118382	KOLAR	83	M	180	95	29.3	RIGHT	10 YEARS	OA	6		30	43P	25P		4	125	85E	80E	C		
8	121143	KOLAR	68	M	155	45	18.7	RIGHT	5 YEARS	OA	7		35	23P	50P		4	110	76G	85E	B		
9	121644	CHINTAMA	74	F	150	60	26.6	LEFT	2 YEARS	OA	4		60	80E	35P		3	105	91E	100E	B		
10	122334	KOLAR	68	M	165	70	25.7	LEFT	2 YEARS	OA	4		50	33P	35P		5	105	83E	85E	B		
11	125437	MULBAGA	55	M	160	50	19.5	RIGHT	4 YEARS	RA	20		40	10P	25P		5	100	87E	80E	C		
12	130113	KOLAR	63	M	168	67	23.7	LEFT	3 YEARS	OA	7		65	44P	35P		4	120	90E	100E	B		
13	118382	KOLAR	83	M	145	45	21.4	RIGHT	7 YEARS	OA	10		55	28P	35P	5		115	90E	70G	B		
14	132016	NARSAPUR	57	F	145	57	27.1	RIGHT	6 YEARS	RA	15		60	9P	25P	5		100	7OG	85E	C		
15	135366	SRINIVASA	54	M	167	60	21.5	RIGHT	2 YEARS	RA		11	30	0P	35P		8	115	82E	80E	C		
16	135315	MULBAGA	63	M	156	60	24.7	LEFT	1 YEAR	OA	4		40	63F	50P		2	125	90E	100E	B		
17	1021649	GULPET	85	F	154	73	30.8	LEFT	15 YEARS	OA	10		60	12P	25P		4	120	79G	70G	A		
18	1021891	BANGARPE	50	F	165	66	24.2	RIGHT	1.5 YEARS	RA	30		40	0P	25P		5	95	86E	90E	B		
19	162199	KOLAR	50	F	156	58	25.4	LEFT	2 YEARS	RA	5		30	8P	0P		5	105	78G	85E	B	IMPLANT RELATED	
20	1021891	BANGARPE	50	F	165	66	24.2	LEFT	4 YEARS	RA	35		40	0P	25P	5		110	84E	90E	A		
21	162199	KOLAR	50	F	151	58	25.4	RIGHT	2 YEARS	RA	10		25	0P	0P		5	95	76G	65F	A	ANTERIOR KNEE PAIN	
22	176435	KOLAR	70	M	165	65	23.9	RIGHT	2 YEARS	OA	6		75	34P	25P		2	110	97E	80E	B		
23	269086	DODDABA	52	F	151	72	31.6	RIGHT	6 YEARS	RA	6		85	54P	30P		4	120	79G	75G	B		
24	293897	KOLAR	53	F	148	48	21.9	RIGHT	6 MONTHS	OA	15		90	20P	55P		6	100	82E	80E	B		
25	294936	MULBAGA	50	M	167	65	23.3	RIGHT	4 MONTHS	OA	6		120	56P	50P		2	125	95E	95E	B		
26	301069	MALUR	53	F	145	45	21.4	RIGHT	5 YEARS	OA	5		75	52P	45P		4	120	92E	90E	B		
27	301289	KGF	67	M	153	70	29.9	RIGHT	4 YEARS	OA	5		75	25P	45P		4	105	86E	85E	C		
28	302116	KOLAR	57	F	145	50	23.8	LEFT	3 YEARS	OA	5		45	16P	20P		4	100	83E	85E	B		
29	307556	KOLAR	46	F	155	60	24.9	RIGHT	2 YEARS	RA	6		100	47P	70G		4	110	83E	90E	B		
30	307709	BOOPANA	46	F	150	55	24.4	LEFT	1 YEAR	RA	4		70	32P	30P		7	115	79G	90E	B		