FUNCTIONAL OUTCOME OF MOBILE BEARING TOTAL KNEE ARTHROPLASTY A MINIMUM OF 5 YEARS FOLLOW UP STUDY

A dissertation submitted to the Tamil Nadu Dr. M.G.R Medical University in partial fulfillment of the requirement for the award of M.S (Orthopaedic Surgery) degree batch 2013-2015

CERTIFICATE

This is to certify that this dissertation titled **"FUNCTIONAL OUTCOME OF MOBILE BEARING TOTAL KNEE ARTHROPLASTY A MINIMUM OF 5 YEARS FOLLOW UP STUDY"** is a bonafide work done by Dr. OM PRAKASH YADAV, in the department of Orthopaedic Surgery, Christian Medical College and Hospital, Vellore in partial fulfillment of the rules and regulations of the The Tamil Nadu Dr. M.G.R. Medical University for the award of M.S.Degree Orthopaedic Surgery under the supervision and guidance of Prof. VERNON N. LEE during the period of his post-graduate study from June 2013 to May 2015.

This consolidated report presented herein based on bonafide cases, study by the candidate himself.

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ABBREVIATIONS

1.TKR	-Total Knee Replacement
2.TKA	-Total Knee Arthroplasty
3.RA	-Rheumatoid arthritis
4.OA	-Osteoarthritis
5.BMI	- Body Mass Index
6.ACL	-Anterior cruciate ligament
7.PCL	-Posterior cruciate ligament
8.MB	-Mobile Bearing
9.FB	-Fixed Bearing
10.LCS	-Low Contact Stress
11.PCS-RP	-Posterior cruciate-sacrificing Rotating platform
12.PS-RP	-Posteirior stabilized rotating platform
13.FB-PS	-Fixed –bearing posterior stabilized

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INTRODUCTION

The most commonly performed replacement surgery in lower limb is Total Knee Replacement (TKR)(1). Total knee replacement can treat a variety of pathologic conditions affecting the knee which will lead to pain relief, functional restoration, and finally to mobility. For patients having severe arthritis of the knee, TKR is typically done for relief of symptoms. Knee joint is a ginglymoid joint, permitting the following movements: flexion, extension, gliding movement and some amount of rotation. It comprises three compartments: lateral compartment, medial compartment, and patello-femoral joint. Osteoarthritis results due to damage to the cartilage in the articular surfaces of the knee, which may be idiopathic or post-traumatic. It can also occur in inflammatory arthritis like rheumatoid, psoriatic, etc. Worldwide rates of Patients with osteoarthritis undergoing total knee replacements are about 90 percent.

TKR relieves pain resulting from arthritis. In patients suspected to have arthritis of the knee, radiographic findings must correlate showing severe joint destruction. Prior to considering surgery, conservative treatment measures including anti-inflammatory medications, activity modifications, and physiotherapy should have been tried and failed.

TKR has a limited survival expectancy which is determined by activity levels of the patient. It is indicated for young patients with crippling inflammatory arthritis and in the elderly with degenerative arthritis. Mobile bearing TKR, has a polyethylene insert that articulates with a metallic femoral component on the one side, and a metallic tibial tray on the other.

These implants were designed to provide articulation at dual surfaces. Mobile bearing knee replacement was introduced to decrease polyethylene fatigue tear. Conventional fixed bearing prostheses for the knee have proved successful clinically. Crucial problems with current fixed bearing knee prostheses in more active people are osteolysis and wear of the polyethylene component.

Polyethylene wear is of two types, articular wear is the first type. Articular wear is a complication in TKR surgery. Round-on-flat designs resemble normal motion of the knee joint. High contact stresses are exhibited on the polyethylene. High contact stresses by an unconstrained articulation with sliding and skidding movements results in polyethylene damage and delamination, and osteolysis results from wear particles. Design with more conformity of articulation decreases the articular type of polyethylene wear. Compromise between freedom of movement and conformity within the knee always occurs. Kinematic penalty should be paid if there is reduction in the contact stress at articular surfaces. Rotations will be reduced as a result of increased contact area. Decreased rotations are acceptable in elderly patients but not in young and active patients.

Undersurface wear is the second type of polyethylene wear, occurs between the tibial base plate and the polyethylene bearing. Mono-block construction is a design pattern in which polyethylene is moulded over the tibia base plate at the time of manufacture is the initial design with successful and durable long term results.

Modularity came into existence in order to allow the increased sizing options. Presently polyethylene insert and tibial base plate comes separately. Undersurface wear and polyethylene particles wear result from movement between the tibial base plate and the polyethylene.

Fixed bearing knee design cannot solve the kinematic differences between low stress articulations and free rotation. The options available are either development of a new polyethylene or an alternative which will be resistant to wear.

Success of TKR is guided by an interaction between the soft tissue structures that surround the joint and design geometry of the implant. Mobile bearing TKR provides articulation at the tibial and femoral tray components, with the polyethylene insert. The advantages of this design are reduced stress distributions, and conforming geometry. Interfacial bone stresses are reduced due to mobility between the bearings. It permits load sharing through the displacement relative to the components.

The advantage of load sharing includes reduction in the stress which is transferred to the interface between implant and bone. This promotes strengthening of surrounding soft tissue and contributes to the reduction of articular wear.

AIMS AND OBJECTIVES

AIMS

To evaluate clinical, functional and radiological outcome following mobile bearing TKR performed during period 2001 to August 2009 in Department of Orthopaedics, unit-I, Christian Medical College Hospital, Vellore, with a minimum follow up period of 5 years.

OBJECTIVES

1. To review in detail all patients who satisfy inclusion criteria with in-patient and Out-patient charts
2. To perform detailed history and clinical examination
3. To assess functional outcome using Knee Society Score and Knee Functional Score
4. To perform radiological examination as per standard description
    a) Knee Joint Line
    b) Knee Alignment
    c) Posterior Condyle Offset
5. To assess post op infection
6. To calculate duration of stay in hospital
7. To assess BMI
8. To assess need for Blood transfusion
9. To assess range of movement

METHODOLOGY

Patients who had undergone mobile bearing TKR between 2001 and August 2009 were recruited into the study after informed consent. They were informed by telephone and post, to come for follow up in Ortho OPD. Their current clinical and functional scoring was calculated using the Knee Society Score. Plain Radiograph of knees, AP & lateral views were taken at the follow up visit and radiological assessment of the joint was done .Their pre op American Knee society score was obtained from the Inpatient chart of their admission for the operation. Other variables like Age of the patient, sex, occupation, duration of hospitalisation were also analysed during the follow up visit.

LITERATURE REVIEW

APPLIED ANATOMY- THE KNEE JOINT

The knee joint develops from the leg bud at 28 days with the formation of femur, tibia and fibula by 37 days. Embryologically it arises from blastemal cells with the formation of patella, cruciate ligaments and menisci by 45 days(2) The knee joint comprises a ginglymoid joint between lateral and medial condyles of the femur and lateral and medial condyles of the tibia; and the patello-femoral joint. The articular cartilage surfaces are all covered by hyaline cartilage.

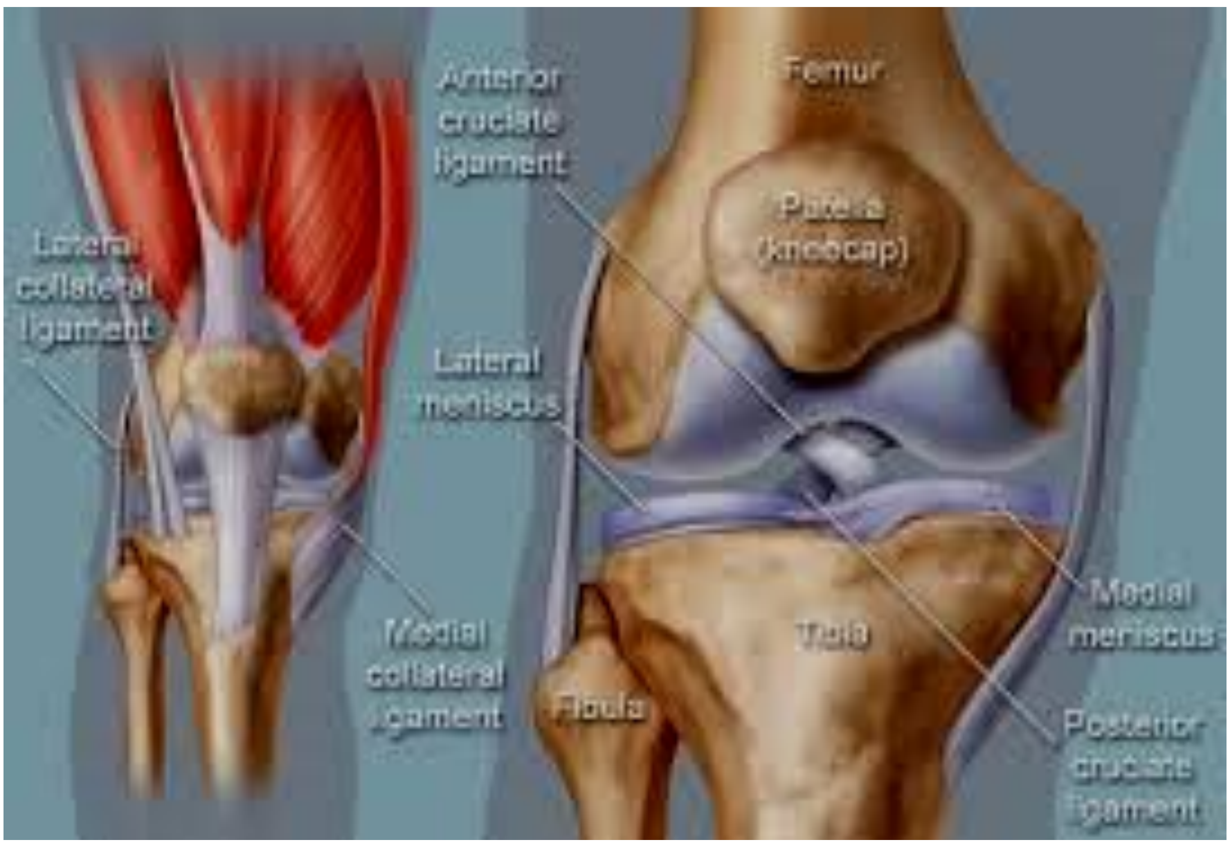


Fig 1

Source:WebMD

Fig-2: Source: www.flindersavephysio.com.au

FEMUR

The condyles of the femur are asymmetric. The medial condyle of the femur is about 1.6 cm longer compared to the lateral condyle. This produces tibial rotation over the femur during flexion. The width of the condyles is similar. In normal weight bearing alignment of the condyles appears to be equal. Mechanical axis is a line drawn from the center of the femoral head, and intersects the centre of the knee joint and the ankle joint. The joint line forms a 6 degree angle with the axis of the femoral shaft. The highest bone strength is found at the posterior aspects of the condyles, with the central area being relatively weak.

TIBIA

The medial plateau of tibia is slightly concave and the lateral condyle of the tibia is slightly convex. In the sagittal plane the tibial condyles slope posteriorly approximately

10 degrees. In the frontal plane the condyles are essentially perpendicular to the long axis of tibia. The highest pressure concentrations are located on the uncovered cartilage of the medial compartment and on the menisci as well as on the uncovered cartilage of the lateral compartment. Trabecular bone of the tibial epiphysis and metaphysis is responsible for the load transmission. The medial tibial plateau is a high strength area especially centrally and anteriorly. Preservation of bone stock of the tibial plateau should be considered in total knee arthroplasty, because optimum support is achieved by resecting 10 mm or less of tibial plateau. Excessive resection results in prosthetic loosening and alteration of desired component position.

PATELLA

The patella is a triangular flat bone situated anterior to the knee joint. It is a sesamoid bone, which develops in the Quadriceps femoris tendon. The anterior surface is convex and perforated by apertures for nutrient vessels to pass. The posterior surface is smooth and oval, and has the articular area which is divided into 2 facets by a vertical ridge, medial and lateral facets. Trabecular structure of the patella and the femoral trochlea is aligned normally to the joint surfaces.

LIGAMENTS

Source:johnquint.net fig-3

EXTRACAPSULAR LIGAMENTS

The patellar ligament is attached superiorly at the inferior border of the patella and inferiorly to the tibial tuberosity. It is the continuation of the quadriceps tendon.

The lateral collateral ligament is attached superiorly to the lateral femoral condyle and inferiorly to the fibular head.

The medial collateral ligament is attached superiorly to the medial femoral condyle and inferiorly to the medial surface of the tibial shaft

INTRACAPSULAR LIGAMENTS

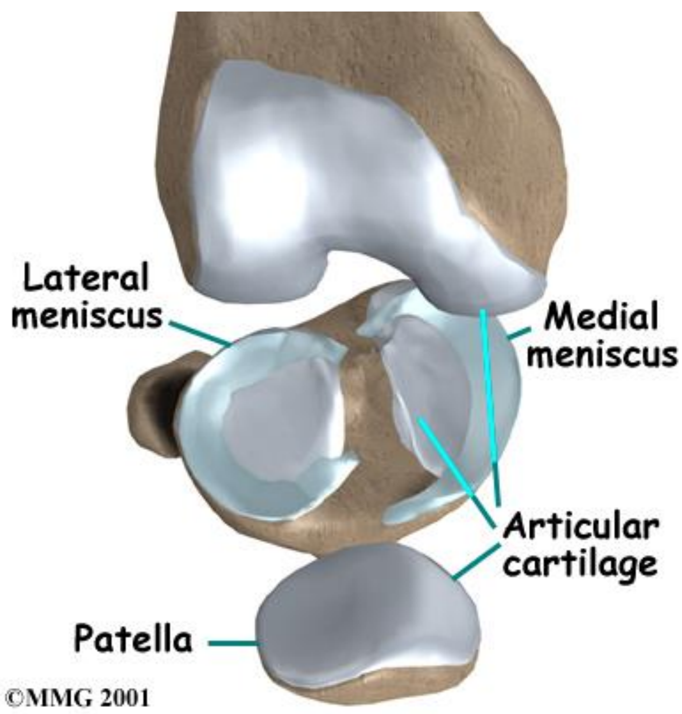
ANTERIOR CRUCIATE LIGAMENT (ACL)

The ACL is attached anteriorly to the inter-condylar region of the tibia. It passes upwards, posteriorly and laterally, and attaches to the posterior part of the medial surface of the lateral femoral condyle. The anterior cruciate ligament prevents anterior tibial displacement on the femur

POSTERIOR CRUCIATE LIGAMENT (PCL)

The PCL is attached posteriorly to the inter-condylar tibia and passes superiorly, anteriorly and medially and attaches to the antero-lateral aspect of the medial femoral condyle. The posterior cruciate ligament prevents posterior tibial displacement on the femur.

MENISCI



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The c-shaped menisci are made of fibrocartilage. They attach to the capsule on the outer aspect; their inner aspect has a free edge. The superior aspect articulates with the condyles of the femur and inferior aspect with the condyles of the tibia.

TIBIO-FEMORAL JOINT ARTICULATING SURFACE MOTION

The planar motion of the two adjacent body segments can be described by the instant centre of motion. As one body segment rotates around another, there is a point where there is no movement, and the velocity is zero. It acts as the centre of rotation. Movement at the articulating surfaces at the knee joint must be understood for understating wear, instability and loosening of implants of TKR. Knee articulating motion is a combination of gliding and rolling between the femoral and tibial surfaces(3). The ratio of rolling to gliding is not constant throughout the range of flexion and is controlled by both the anatomy of the joint surfaces and constraints imposed by the anterior and posterior cruciate ligaments.

KNEE JOINT STABILITY

The muscles, ligaments, menisci, osseous geometry and joint capsule all combine working in coherence to produce joint stability. Malfunction or disruption will cause knee joint instability.

JOINT SURFACE

The femoral and tibial joint surfaces constraints are not adequate for functional stability. The distal femur is convex, where as the proximal tibia is partially flat, slightly concave medially and slightly convex laterally. The tibial inter-condylar eminence and the articular geometry provide some potential for stability.

Hsieh and Walker established that the geometric conformity of the condyles was the most important criteria for decreasing laxity under load bearing(4). In order to perform anterior or posterior, rotatory and medial or lateral movements, the femur must ride upward on the tibial curvature. Similarly, to rotate the femur "screws out", giving an upward movement. Medial/lateral motion produces this effect to an even greater degree because of the tibial spines. This is called the "uphill principle". They concluded that under low loading conditions, the soft structures (ligaments, capsule and meniscus) provided joint stability and that as loading increases; the condylar surface conformity becomes the most important factor.

LIGAMENTOUS STABILITY

The ligament structures are able to resist translational forces and prevent translation of their bony attachments if translation takes place in the direction of ligament fibers. This makes a relevant provision of anterior and posterior translational stability(5) Li et al showed the hamstrings provide an active restraint to anterior displacement in the tibia. The collateral ligaments provide varus and valgus stability of the knee. The rotational forces are not resisted by the ligaments acting alone. Increased compressive force generated at the joint articular surface produce a torque that resists the rotation movement. At full knee extension the knee may be expected to show a balance of compressive forces between the medial and lateral compartments in response to axial loading.

JOINT LOADING

For understanding the knee prosthesis design and preference loads across the knee joint should be studied. The knee muscles are relatively inefficient because of small, effective moment arms compared with the external applied forces and moments, requiring muscles to contract at high forces to maintain joint equilibrium(6). Knee joint shear and contact forces are very high in magnitude. Joint forces during stair ascent and descent are higher than those of walking. The forces increase during isokinetic exercise and in rising from chair and are greatest during downhill walking. Moreover, the peak forces during stair walking and exercise, either isokinetic or cycling, occurs at greater degrees of knee flexion.

HISTORY OF DEVELOPMENT OF KNEE PROSTHESES

Total knee replacement evolution in its modern form is about three and half decades old. The principle of improving function of the knee by modifying articular surfaces came in the 19th century. In 1860, Verneuil advocated interposition of soft tissue to reconstruct a joint. In 1860, Ferguson resected a knee joint, with result that there was mobility. In 1940, Campbell reported the success of metallic interposition femoral mould.

In 1957, Waldius introduced hinged prostheses, which were either acrylic or made of metal. Later it was followed by the development of GUEPAR hinged prosthesis which was a cemented model with axis of rotation placed more posteriorly. Loosening and infection continued to be frequent as in previous hinged designs.

In 1970 Peter Walker, Ranawat CS, Insall JN developed a duo-condylar and unicondylar devices with low conformity and anatomic geometry to allow laxity and freedom of motion and with curved condylar shapes to reduce bone resection. In 1971, Gunston and Charnley, had designed and documented encouraging results with a polycentric knee. In 1972, Coventry et al developed a Geometric knee, which was conforming and provided stability which required preservation of the both cruciate ligaments. Marmor designed a modular knee for uni and bi compartment replacement and published his work in 1973.

The Total Condylar Prosthesis (TCP) design (given by Insall et al) allowed mechanical factors to outweigh reproduction of anatomical kinematics of normal knee range of movement. In this, cruciate ligaments were both sacrificed, and sagittal stability was maintained by the geometry of the articular surface.

MOBILE BEARING PROSTHESES

The meniscal-bearing version of LCS prosthesis that was developed by Buechel-et al and others shared many features with the Oxford knee, with polyethylene meniscus articulating at the femoral component, along with a polished tibial component above and below respectively. Additionally it has dove tailed grooves on the tibia base-plate. This modification reduces posterior excursion of the meniscus during flexion, thus reduces possibility of posterior meniscal extrusion.

LCS implants for TKR have a rotating platform design and they have congruent tibio-femoral geometry in extension; however, the tibial polyethylene can also rotate inside the base plate stem of the tibial component. This design had occasional dislocation of the tibia insert due to insufficient balancing of the flexion and extension gaps, but shows good longevity.

ROLE OF PCL IN TKR

Since the advent of Posterior cruciate-retaining and posterior cruciate-substituting prostheses, they have each been studied for merits of each design. Each has multiple study series with comparable excellent results in follow up of 10-15 years respectively.

Posterior cruciate retaining affords increased mobility by effective femoral roll back and a more flat tibia articular surface. Posterior cruciate substitution obtains femoral roll back by a tibia post and femur cam mechanism. When compared to the original total condylar design, they both attain improved flexion.

Posterior cruciate retaining designs cannot tolerate much elevation of the pre op joint line during balancing flexion and extension gaps, but the PCL substituting design implants often balance along with some joint line elevation. Posterior cruciate retaining prostheses typically show more accelerated wear of the polyethylene due to less conformation in the sagittal geometry of the tibial-femoral components.

INDICATIONS FOR TKR

The main indication for performing TKR is for pain relief in arthritis once other sources of lower limb pain have been sought out and ruled out. Radiologic findings should correlate with the clinical impressions. Conservative means of management should be exhausted prior to planning surgery.

Another indication is deformity with moderate arthritis with less than severe pain, wherein there is the threat of progression of deformity affecting outcomes of arthroplasty if delayed. Progressive flexion contracture beyond 20° hampers gait and precludes attainment of complete range of extension even after TKR. Varus/ valgus plane laxity if high, is also an indication for TKR with constrained prosthesis to prevent future coronal instability and for a more favourable survival to be expected from surgery (6)

CONTRAINDICATIONS FOR TOTAL KNEE REPLACEMENT

An absolute contraindication for total knee replacement is prior history of infection in the affected knee recently or a distant ongoing source of infection in the body. Discontinuity in the extensor apparatus or recurvatum due to muscle weakness is also contraindication. Knee arthrodesis if functioning well and without pain is also a contraindication(6).

Relative contraindications for total knee replacement include medical comorbidities which would reduce the chances of wound healing or make the patient's capacity to withstand the metabolic needs following surgery or to withstand anesthesia. These may warrant significant rehabilitation for ensuring a proper functional outcome.

Relative contraindications also include morbid obesity, skin disease around the operative site, urinary infections, cellulitis, peripheral venous disease causing stasis, osteomyelitis in the region around where surgery is planned.

COMPLICATIONS OF TOTAL KNEE ARTHROPLASTY

THROMBOEMBOLISM

Deep Vein Thrombosis one of the most important, and possibly life-threatening complications of TKR. Risk factors associated with increased development of deep venous thrombosis are age higher than 40 years, prior history of stroke, prior history of cancer, immobilization for long duration, use of oestrogens, prior history of thrombo-embolic events, smoking, varicosities of veins, diabetes mellitus, hypertension, prior history of myocardial infarction, and inflammatory bowel disease.

Clinical detection of deep vein thrombosis is invalidated as it has been found to be mostly without alarming symptoms. Venography is the gold standard in diagnosis of DVT. Duplex ultrasonography is an alternate technique which can be sued for screening patients post arthroplasty for DVT.

INFECTION

Infection is another most direful complication affecting TKR patients. Risk factors for higher rate of infection are prior history of knee surgery, seropositive rheumatoid arthritis, obesity, hinged prosthesis TKR, ulcers over the skin, presence of urinary infection concurrently, renal failure, poor nutritional status, concurrent malignancy, diabetes mellitus, psoriasis.

PATELLOFEMORAL COMPLICATIONS

These include loosening of the patellar component, failure of the patellar component, patellar clunk, fracture patella, instability, and rupture of the extensor apparatus. Advances in design and surgery have reduced these however. Patello-femoral instability is associated with the following factors: imbalance of the extensor apparatus, tight lateral retinaculum, and loose medial soft tissue.(6)

NEUROVASCULAR COMPLICATIONS

Arterial compromise following total knee replacement is rare but it is a devastating complication in some patients, which could result in amputation. Vascular status of the patient must be thoroughly assessed pre op.

Peroneal nerve palsy is sometimes reported following TKR. It occurs following correction of flexion with concurrent correction of fixed valgus deformity especially commonly in patients of rheumatoid arthritis. When discovered post op, dressing must be immediately released and patient's knee must be kept in flexion.

PERIPROSTHETIC FRACTURES

Femoral supra condylar fractures are infrequently encountered following total knee replacement. Risk factors for the same include: use of steroids prior to surgery, anterior notching at the femur, rheumatoid arthritis, female sex, patients undergoing revision surgery, patients with concurrent neurologic disorders, osteoporosis.

DESIGN GOALS

In broad terms, the design goals of any knee replacement are

- Relief of pain
- Good functional ability
- Durability for the life of the patient
- Low cost(6)

The total knee arthroplasty designs can be classified into cruciate-retaining, cruciate-sacrificing, cruciate-substituting, constrained condylar and hinged designs.

Cruciate sacrificing designs compensate for the absence of the posterior cruciate ligament by cupping up of the tibial component, which increases the articular conformity to reduce translation and rotation during knee flexion.

Cruciate retaining designs rely on the integrity of the collateral and posterior cruciate ligaments; require less conforming articular surfaces to allow proper ligament function during knee range of motion.

Posterior stabilized designs evolved from the cruciate sacrificing components with the addition of a tibial post and femoral housing mechanism to prevent posterior subluxation. Posterior stabilized prostheses require the presence of competent collateral ligaments and should not be regarded as a constrained design, which also provides medial-lateral stability.

Constrained condylar prostheses with added height and conformity of the polyethylene tibial spine and the femoral housing render medial-lateral stability and are used primarily in complex arthroplasties with compromised or absent collateral ligaments.

Hinged designs provide the most inherent stability but have an increased incidence of complications, including mechanical loosening. Hinged components are used for unique situations such as tumor excision necessitating resection of the collateral ligaments.

PRINCIPLES OF TOTAL KNEE ARTHROPLASTY

- Proper instrumentation and familiarity with its usage.
- Minimal removal of the plateau of the tibia along a right angle to its longitudinal axis.
- Femoral cuts to be made at 90° to the mechanical axis of the femur
- Maintenance of soft tissue envelope, especially the collateral ligaments, posterior capsule and ilio-tibial band at equal tension both in flexion and extension - providing static stability to the joint and equal flexion and extension gaps.
- Provision of dynamic stability by the quadriceps, hamstrings and gastrocnemius muscles.
- Re-alignment of quadriceps mechanism for stability of the patella.

Mobile bearing knee replacements were designed to create a dual-surface articulation. Dual-surface articulation is provided by a metallic tibial tray and metallic femoral component with a polyethylene insert(7). Dual – suface articulation reduces subsurface and surface level stresses and also at the interface of bone with implant by conforming tibial-femoral components thus permitting mobility. Mobile bearing knee design reduces polyethylene wear and provides load sharing by soft tissues which lessens loosening stress being transferred to the interface between bone and implant(8).

LCS design (Low Contact Stress; DePuy Orthopedics, Inc, Warsaw, Indiana) was introduced by Buechel and Pappas in 1977. The different variants available are meniscal bearing unicondylar knee, PCL retaining meniscal bearing knee, both cruciate retaining meniscal bearing knee and both cruciate-sacrificing rotatory platform knees (8). Greater freedom of motion is provided by the mobile -bearing (MB) TKA compared with the fixed-bearing (FB) variant, because natural femoral components movements are not restricted by the insert(9). Tibial internal rotation during flexion, improves patellofemoral tracking, reduces polyethylene linear wear due to reduction in the contact stresses are assumed to be provided by the mobile-bearing total knee replacement due to no restriction of movement by insert(9). A theoretical advantage is that patient would feel more normal due to more physiological kinematic profile during knee flexion movement(10).

The cemented posterior-stabilized low-contact-stress total knee prosthesis (LCS Rotating Platform; DePuy, Warsaw, Indiana) is the most commonly studied in single mobile bearing rotating-platform implant for TKR. Callaghan et al had no revisions that were treated with the LCS design at ten years in a consecutive series of 116 and 96.5% survival rate at twenty years after radiographic and clinical evaluation. 94% survival rate reported by Sorrells at ten years(11)(12,13)with the similar cemented designs, whereas at fifteen year follow up, Huang et al found a survival rate of 92.1%, while 97% survival rate at ten and twenty years reported by designing surgeons(10)

To reduce polyethylene wear and improve survival in 1977 LCS Mobile bearing knee was introduced. 97.7% survival at 20 years reported by Buechel et al whereas 100% survival at a minimum of 15 years reported by Callaghan et al (12,13) of LCS rotating platform (LCS RP) implant had increased usage over the next two decades with good results whereas dislocation of meniscal bearing is high in other variants(8) Rotational movements occur at the junction of tibial base plate and the tibial insert whereas the femoral component and tibial insert junction provide flexion extension movement (antero-posterior direction) in LCS RP knees(8). This allows greater contact area at the articular surface, reducing contact stresses and thus wear(8) At each surface occurs unidirectional movement due to separation of movements at interfaces in LCS rotating-platform knee whereas multidirectional movement occurs in fixed bearing knee at the tibial polyethylene insert and the femoral component(14,15) Polyethylene stress hardening occurs in the direction of movement due to unidirectional movement which results in minimal wear(16).

Successful clinical results are reported with Conventional fixed-bearing knee prostheses. In a study of 101 TKR with such a prosthesis, it was found that 96% had good or excellent results clinically, reported with conventional fixed- bearing prosthesis in 101 knees whereas prosthesis survival rate after 10 to 15 years (wherein end point was revision arthroplasty) was 96.4%(17). Limitation of the study is that low demands placed on the prosthesis because most of the study groups are elderly patients with low activity levels(18). Very little evidence is available that good results with fixed-bearing prosthesis are replicated in young and active individuals. Fixed bearing knee prosthesis which are currently used have problems with osteolysis and polyethylene wear.

Polyethylene wear is of two types. Articular wear is the first type observed as clinical problem in 1980s and results from Round-on-flat designs which duplicate knee joint normal motion. High contact stresses are generated in the polyethylene in round-on-flat designs. Osteolysis results from particles of polyethylene damage and delamination due to high stresses in round-on-flat design with combined sliding and skidding movements in unconstrained articulation(19,20). Articular wear can be decreased by providing a design with more conformity of the articulation surface which is round-on-round prosthesis. Compromise will always be there between freedom of motion and conformity a kinematic penalty to be paid when there is reduced articular contact stresses. Rotations are reduced by increasing contact area. Decreased rotations may be acceptable in elderly people but not in young and active people(21–26).

Undersurface wear is the second type of polyethylene wear which is recently recognized which occurs between the tibial baseplate and the polyethylene(27) Fixed bearing knee design cannot solve the low-stress articulations and free rotation kinematic conflict(1). Kinematic conflict can be pursued by the innovation of a polyethylene alternative or development of a new polyethylene which is wear impervious(13) or to further search for the mobile bearing polyethylene.

Complex interaction between the soft tissues surrounding the joint and the implant design influences the success of total knee replacement(28) . The complex interaction determines total knee replacement outcome in terms of range of motion, stability and stresses develop at the interface. Dual-surface articulation provides the advantage of distribution of diminished subsurface and surface stress with conformal geometry while interfacial bone stress development is minimized with mobility of the bearings(28).

Promotion of the load sharing is one of the main features in mobile- bearing TKR design through the tibial and femoral component relative displacement. Shear and torque during gait are transferred by mobile-bearing knee designs through displacements to the soft tissues near similar like a normal knee. The potential advantages of load sharing include decreases the implant-bone interface loosening stresses and promotes strengthening of soft-tissues**(7)**. Mobile-bearing knee designs have the capacity to remodel and respond to the expanding activity challenges as rehabilitation started. Articular wear is reduced by load sharing by decreasing the load on the joint.

Dependency on the intrinsic constraints of the condylar geometry can be reduced by encouraging the soft-tissue involvement. Mobile bearing knee design provides soft-tissue involvement by plateau mobility in terms of pure rotation, unconstrained and rotation with anterior-posterior translation.

Ultra-high molecular weight polyethylene (UHMWPE) yielded low volumetric loss in comparison with fixed-plateau designs in LCS meniscal- bearing knee with wear simulator during 10 years of in vivo service(29). Abrasive wear debris generation greatly attenuated with the low contact stresses at the both articulating surfaces even with increased sliding(30). In recent years use of mobile-bearing knee systems is increasing.

Mobile-bearing TKR designs give arthroplastic surgeons the opportunity to restore activity free of pain and normal activity of the knee. The finish of the articulating metallic components and the quality of the polyethylene of the dual-surface articulation will decide the size and volume of ultra high molecular weight polyethylene particles. Same performance cannot be produced by all mobile-bearing knee systems.

Difficulties arise during manufacture of a cobalt-chromium tibia base plate with appropriate intraoperative locking mechanism because the material must not be machined but it must be cast. It is easier to make a cobalt chromium base plate for accommodating the mobile bearing. Then it is possible for providing a smooth and highly polished surface for the mobile bearing to move on.(26)

For a design to permit full range of flexion, it must fulfill two conditions: posterior stabilization for direct predictable roll back of femur; and reduced sagittal radius of the femoral component. There is therefore need for hybrid mobile TKR prostheses.

Axis of Rotation

The axis for the undersuface to rotate is debatable. For a meniscal bearing knee with full conformation, both anterio-posterior and rotation are desirable for mimicking natural knee range of movement.

In vivo kinematics of the knee joint was determined by studies of PCL sacrificing rotating platform and LCS design TKR implants(31,32) It has also been demonstrated by video fluoroscopy during performance of weight bearing(33) Progressive flexion of the knee shows a condylar translation posteriorly- the posterior roll back of femur upto an average of -7.7mm position(34)

As opposed to this, patients with TKR of meniscal bearing type showed posterior contact position during full knee extension. Slight posterior roll back of the femur of 4.8 mm average was noted through the initial 60° of flexion, followed by translation of the femur anteriorly during the further flexion from 60°-90°(31,32,35). The position of medial condyle contact was almost the same- with average being -2.3mm when 0°, and it was-2.2mm when 90° (Fig. 5).

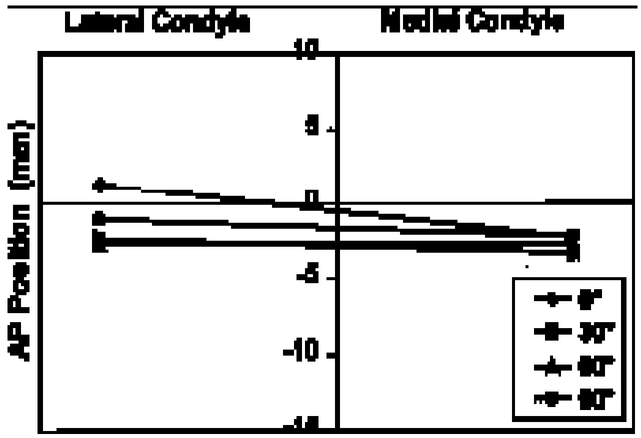

Fig-5

Patients who underwent posterior stabilized TKR with rotating platform showed significant posterior roll back of femoral lateral condyle, with average being 5.9mm while performing the knee bending manoeuvre. Also a minimal change in the position of contact of the medial femoral condyle was noted all through the flexion range, with an average of -0.6mm at 0° and -4.1mm at 30°. At 60°, it was found to be 4.8mm and at 90° it was -6.5mm. (Fig. 6)

;

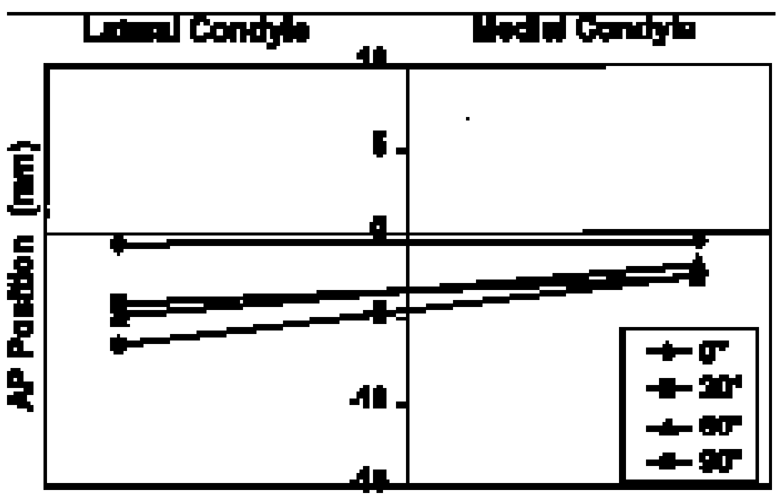

Fig-6

These findings were due to engagement of the cam mechanism with the post. While ambulating, patients who underwent PCS TKR with a rotating platform had minimal alteration in the antero posterior contact position of the lateral femoral condyle with average being 2.2mm; and of the medial femoral condyle, with average being 0.2mm. (Fig. 7)

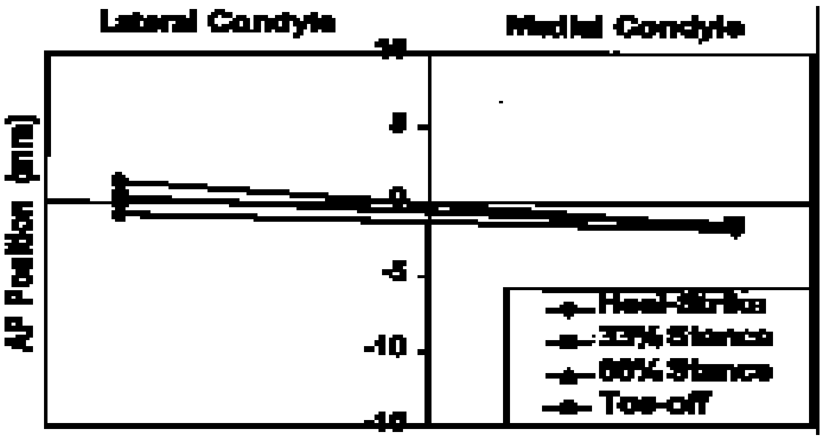

Fig-7

These patients also showed a minimal alteration in the antero posterior contact position of the lateral femoral condyle with average being 1.2mm and in the medial femoral condyle, average being 1.1mm, during ambulation. (Fig. 8)

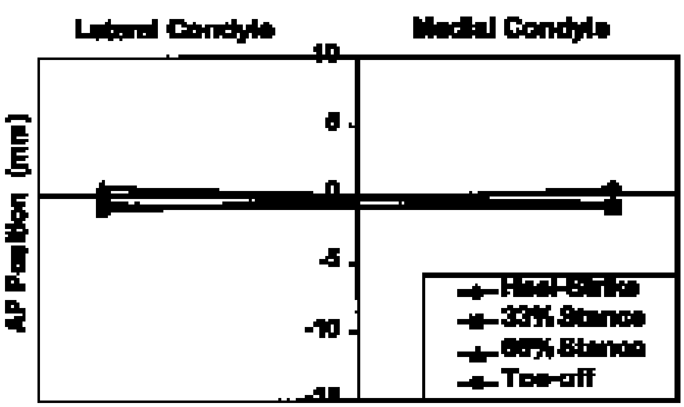

Fig-8

Axial Femorotibial Rotation[table-1]

Table 1
Axial femorotibial rotation in the PCS rotating-platform and posterior stabilized rotating-platform TKRs

Type of TKA*	Activity	Rotation (degrees) Average	Maximum	Minimum
PCS-RP	Deep knee-bend	3.4	9.6	0.5†
PS-RP	Deep knee-bend	5.2	13.9	0.1†
PCS-RP	Gait	2.5†	13.2†	0.1†
PS-RP	Gait	3.0	10.9	0.1

*PCS-RP = posterior cruciate-sacrificing rotating platform, and PS-RP = posterior stabilized rotating platform
†Abnormal, reverse rotational pattern

Femoral Condylar Lift-Off[table 2]

Table 2
Magnitude of femoral condylar lift-off in the PCS rotating-platform and posterior stabilized rotating-platform TKRs

Type of TKA*	Activity	Lift-Off (mm) Average	Maximum	Minimum
PCS-RP	Deep knee-bend	1.4	2.2	1.0
PS-RP	Deep knee-bend	1.9	3.5	1.0
PCS-RP	Gait	1.5	2.2	0.8
PS-RP	Gait	1.5	2.1	0.8

*PCS-RP = posterior cruciate sacrificing rotating platform, and PS-RP = posterior stabilized rotating platform

Range of Motion Following menisceal bearing TKR and rotating platform posterior condyle stabilized TKR; the range of movement has been studied in conditions of non weight bearing, and also during weight bearing. These when compared to prior published data from PCS and PCS implant TKRs, revealed reduced flexion at the time of weight bearing in all patient groups. (Table 3)

Table 3
Range of motion associated with different types of TKRs

Type of TKA*	Testing Condition	Average Range of Motion (degrees)
Meniscal-bearing[17]	Non-weight-bearing	121•
Meniscal-bearing[17]	Weight-bearing	100•
PCS-RP	Non-weight-bearing	108•
PCS-RP	Weight-bearing	99•
FB-PCR	Non-weight-bearing	123•
FB-PCR	Weight-bearing	103•
FB-PS	Non-weight-bearing	127•
FB-PS	Weight-bearing	113•

*PCS-RP = posterior cruciate-sacrificing rotating platform, FB-PCR = fixed-bearing posterior cruciate-retaining, and FB-PS = fixed-bearing posterior stabilized

Design Rationale

Mobility of the joint, along with congruity of design was the rationale for the LCS design mobile bearingTKR(13,19,36,37)

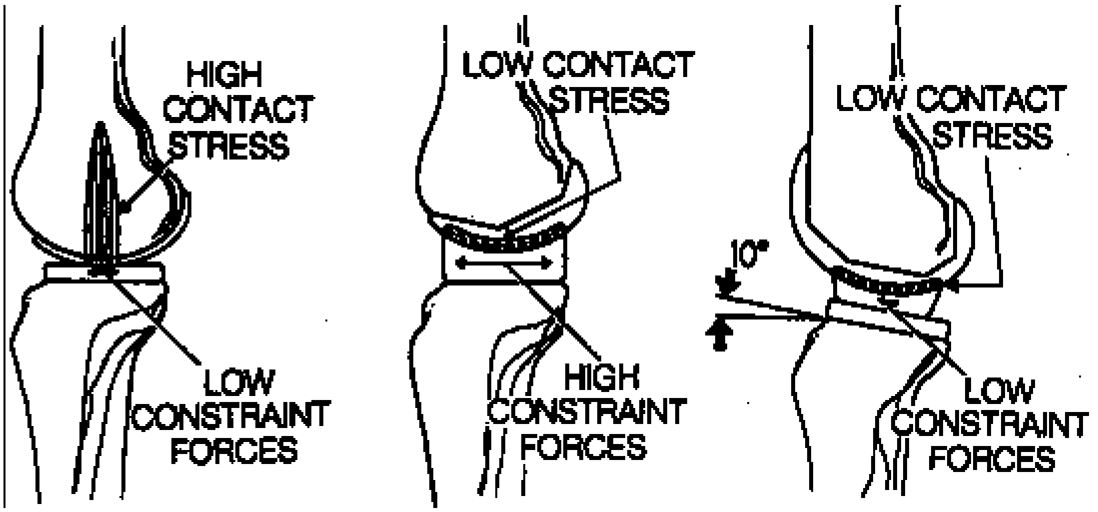

Fig-9

Tibial and femoral components are conforming here, in the sagittal plane during full extension up to 30° flexion. This optimizes area of contact. Further flexion beyond 30° permits more mobility. The geometry of the femur component surface as seen in a sagittal view is shown in figure.10

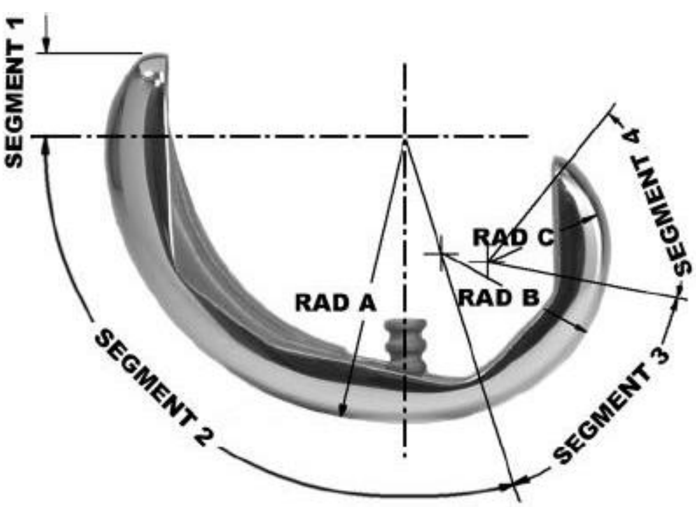

Figure 10

Summary of Surgical Procedure

A midline incision with a medial para patellar arthrotomy was used in all surgeries. All osteophytes were removed. Varus or valgus deformity could be corrected to neutral alignment in full extension.

This approach is based on the principle that creation of equal extension and flexion gaps should be done, at the same time to provide a posterior tibial slope is necessary to preclude shearing at the tibia interface. Initially flexion gap is made by resection of the proximal tibia, with a perpendicular cut to the shaft of the tibia coronally, it is then tilted posteriorly along the sagittal plane by 7°-10°.

Antero posterior dimension of the femur component is sized. Following this resection of the posterior condyle of the femur is done. Assessment of flexion gap is done using spacer block. Then creation of extension gap is done by necessary amount of distal femur to permit equal flexion and extension gaps. These gaps are then assessed for symmetry using spacers. Accommodation of deep patello-femoral groove in the femur implant is done by cutting the femur distally in a 17° slope from anterior to posterior direction. The posterior tibial slope accommodates this slope (Fig.11).

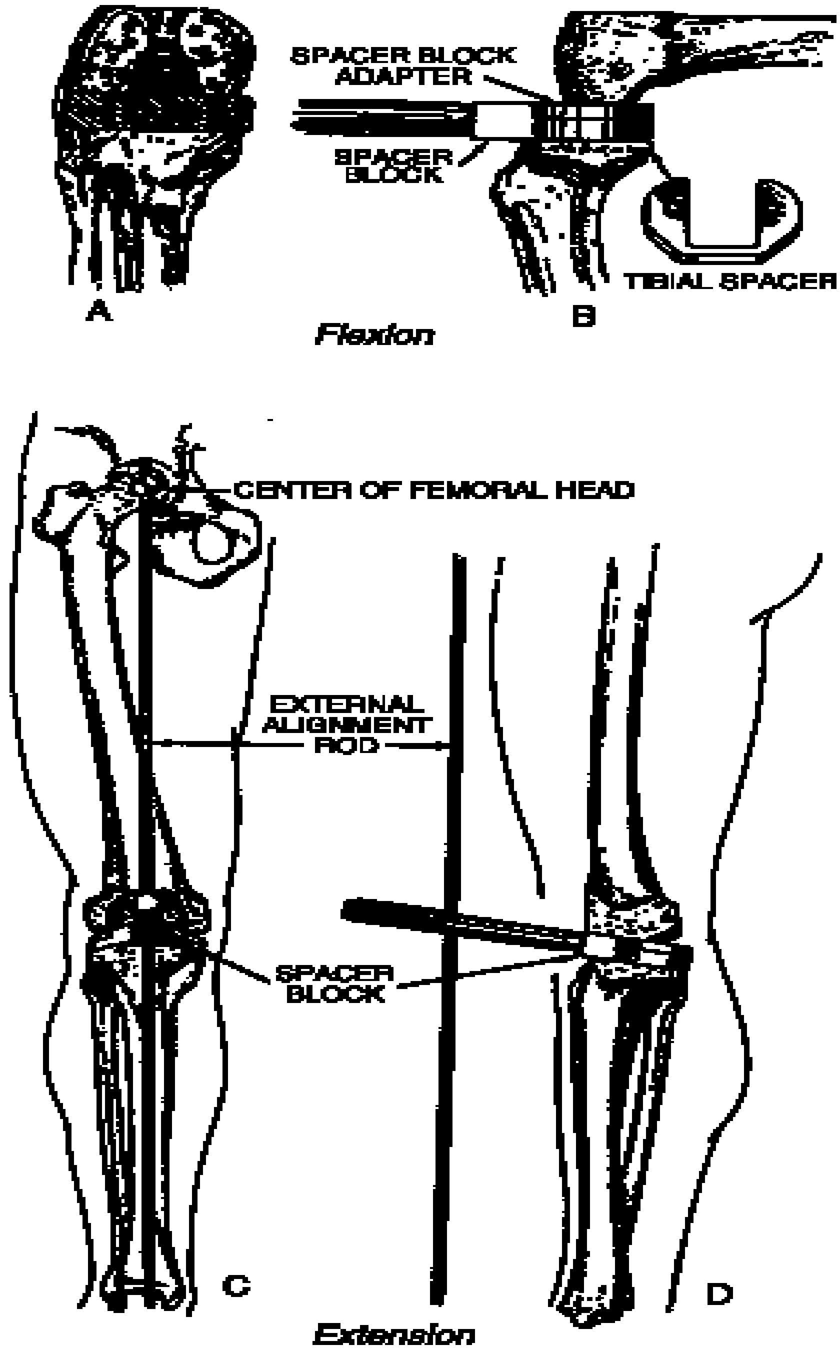

Fig-11

LCS Mobile bearing knee was introduced (1977) with the idea of reducing polyethylene wear and improve survival. Callaghan *et al* reported 100% survival at a minimum of 15 years and Buechel *et al* reported 97.7% survival at 20 years(8). Major changes in the actual position of the joint line of the prosthesis knee or failure to place the tibial component in a posterior position can lead to substantial diminution in the functional results.(38). Joint line elevation affects primarily the patello femoral joint. Increase in joint force upto 60% of body weight of the patient in 10mm elevation of the joint line. It is 90% of the patient's body weight at 15mm elevation of the joint line. This shows the significance of joint line restoration since it is critical particularly for the patello-femoral joint. Joint line elevation caused by managing defects of the distal femur by down sizing the femur component may raise the contact force at the patello-femoral joint. It contributes to post op complications like limitation of function, wear of the polyethylene and pain.(39) It is shown that there is no alteration in the medial femoral condyle following TKR, but there is a significant increase in the lateral condyle size post TKR(40)

Sanchez-Sotelo et al from 1989 to I996, studied 239 primary LCS total knees and following complications noted: (41)

Complication	No. cases (%)	Diagnosed at
Infection	1 (0.99)	2 y
Supracondylar femoral fracture	1 (0.99)	3 y
Patellar component dislodg-ment	1 (0.99)	Postoperatively
Meniscal dislocation	2 (1.98)	4.6 y
Catastrophic wear of polyeth-ylene	1 (0.99)	4.5 y
Progressive osteolysis	2 (1.98)	4.5 y

Tab-4

Insall et al from january1994 to December 1996, 126 TKRs using the LCS implant by Depuy were performed by the same surgeon in 101 patients with an average age of 70.0 years. There were no instances of early infection. Early post op complications included one instance of instability, six instances of patellar pain, and necessity for revision in six surgeries(42)

MATERIALS AND METHODS

TYPE OF STUDY: Retrospective observational cohort study

SCHEME OF RESEARCH:

All patients who underwent Total Knee Replacement between 2001 to August 2009, in Department of Orthopaedics, Unit- I, Christian Medical College Hospital, Vellore were identified from the operation register. All patients who satisfied inclusion criteria were selected and selected patients were recruited into the study after informed consent. Selected patients Out-patient and In-patient charts were studied; all information was gathered and documented in a tabular form.

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Selected patients were informed by telephone and by post to come for follow up in Orthopaedics OPD. Informed consent was taken by the Principal Investigator in the Orthopaedic OPD. A detailed history was obtained and a thorough clinical examination was done. Patients were sent for radiographs which includes both knees standing AP and lateral view and stitch view from both hip to ankle standing. Their current clinical, functional and outcome and radiological parameters were assessed with the aid of American Knee Society Score(42)

Radiological parameters included joint line, alignment (Varus/Valgus) and posterior condyle offset.

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Other variables were also assessed, like-

1. Age of patient
2. Sex of patient
3. BMI
4. Post op infection
5. Duration of hospitalization
6. Need for blood transfusion
7. Etiology of disease

INCLUSION CRITERIA:

Patients who underwent mobile bearing TKR with a minimum of 5 years follow-up.

EXCLUSION CRITERIA:

1. Patients who underwent any other than a mobile bearing total knee replacement
2. Patients who were not willing to participate in the study
3. Patients who had earlier undergone total hip replacement are not excluded.

American Knee Society Score and Functional Score: assessment was done based on the under mentioned questionnaire(42)

Patient category

A. Unilateral or bilateral (opposite knee successfully replaced)
B. Unilateral, other knee symptomatic
C. Multiple arthritis or medical infirmity

Objective Scoring

Pain	Points
None	50
Mild or occasional	45
Stairs only	40
Walking & stairs	30
Moderate	
Occasional	20
Continual	10
Severe	0

Range of motion

(5º = 1 point)	25

Stability
(maximum movement in any position)

Anteroposterior

<5 mm	10

5-10 mm	5
10 mm	0
Mediolateral	
<5°	15
6° -9°	10
10° -14°	5
15°	0
Flexion contracture	
5° -10°	-2
10° -15°	-5
16° -20°	-10
>20°	-15
Extension lag	
<10°	-5
10° -20°	-10
>20°	-15
Alignment	
5° -10°	0
0° -4°	3 points each degree
11° -15°	3 points each degree

Walking	50
Unlimited	40
>10 blocks	30
5-10 blocks	20
<5 blocks	10
Housebound	0
Stairs	
Normal up & down	50
Normal up,down with rail	40
Up & down with rail	30
Up with rail; unable down	15
Unable	0
Functional Deductions	
Cane	-5
Two canes	-10
Crutches or walker	-20
Other	20

*. If total is a minus number, score is 0

MEASUREMENT OF POSTERIOR CONDYLE OFFSET

Pre op and post op posterior condyle offset was assessed from the lateral x-ray by noting maximum thickness of posterior condyle of femur projecting to the tangent of the posterior cortex of the femoral head posteriorly. Pre op and postop measurements were compared(40) This is demonstrated in the following figure 12.

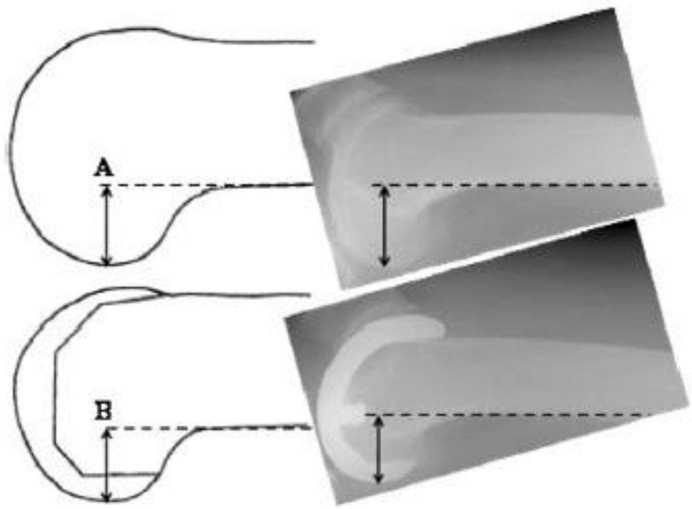


Fig-12: Showing measurement of Posterior Condyle Offset: A- Pre-operative and B- Post-operative

Joint line measurement

The joint line position was measured on the lateral radiograph using the method which was described by Figgie et al(38). Measurement was made from the top of the tibial tuberosity to the superior surface of the tibial component. However, due to radio lucency of the tibial insert, this point was taken to be the most distal part of the femoral component(43)

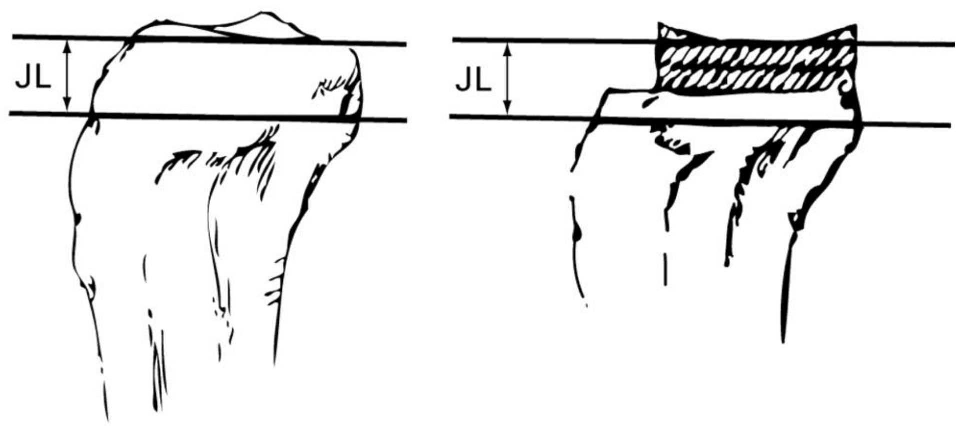


Fig-13

Showing measurement of joint line preop and post op

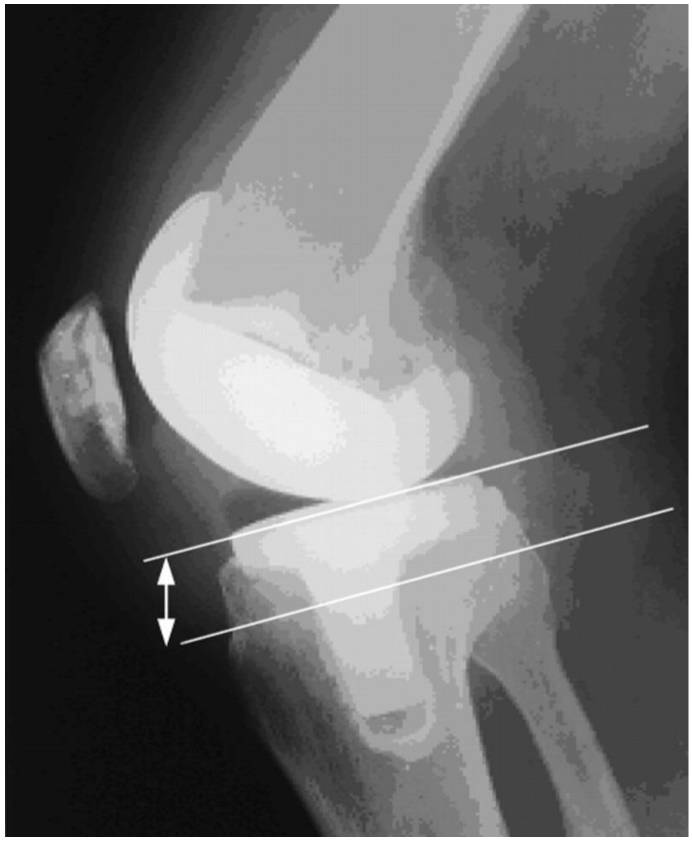
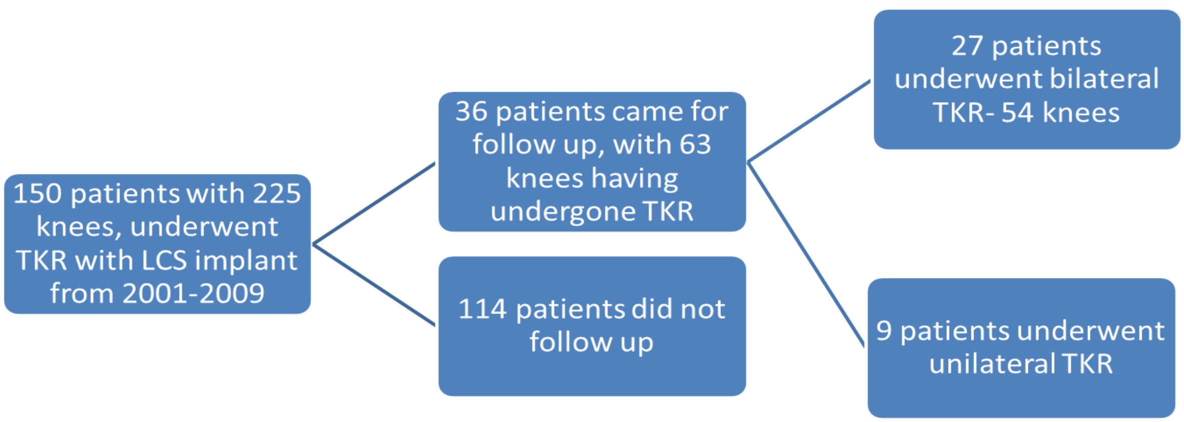


Fig-14

Showing measurement of joint line post op

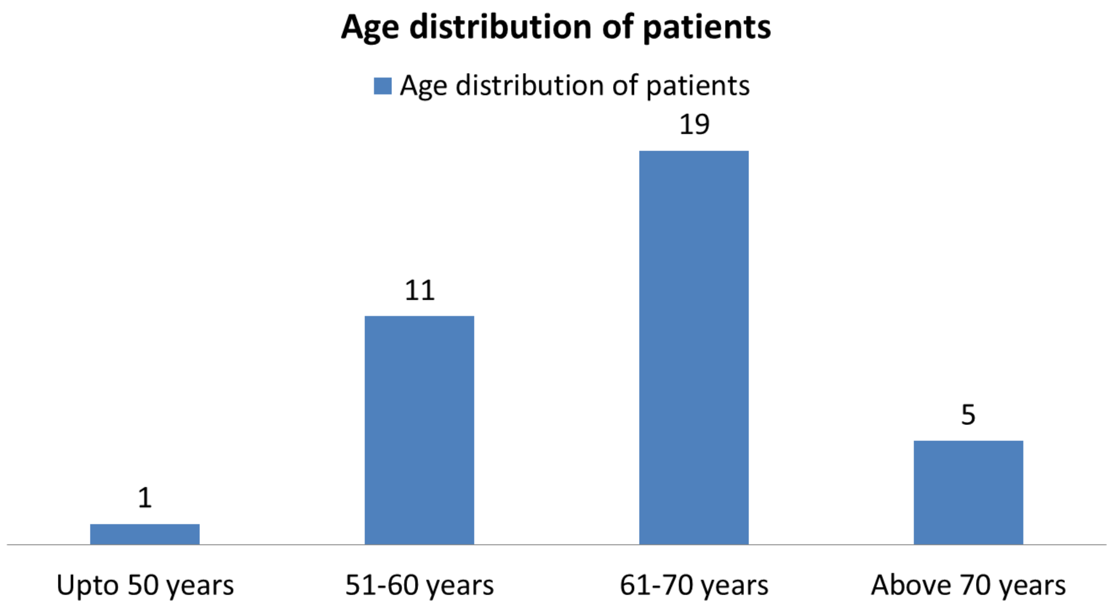
RESULTS

- Data of all patients was entered in Epidata sheet. Analysis was done with SPSS software.
- Mean, median, mode and SD was calculated for continuous variables.
- To determine correlation between age, BMI, Knee Society Score, functional score.
- To see correlation between pre op and post op joint line and posterior condyle offset.
- To determine correlation between duration of follow up and knee society score and functional scores.



Tab-5

Follow charts –tab (5) shows the scheme of recruitment. Among 150(225 knees) patients undergoing LCS implant TKR, 36(63knees) patients responded by mail or phone or letter. All patients were operated by the same team of surgeons.



- Figure. (15) shows age distribution among the 36 patients
- Out of 36 patients, 1(2%) patient was under 50 years age; 11(36%) patients from 51-60; 19 (52%) patients were from 61-70 years; and 5(13%) patients were above 70 years
- 19 (52%) patients were in the 61-70 years group
- Youngest patient was 35 years of age, and oldest patient was 81 years of age

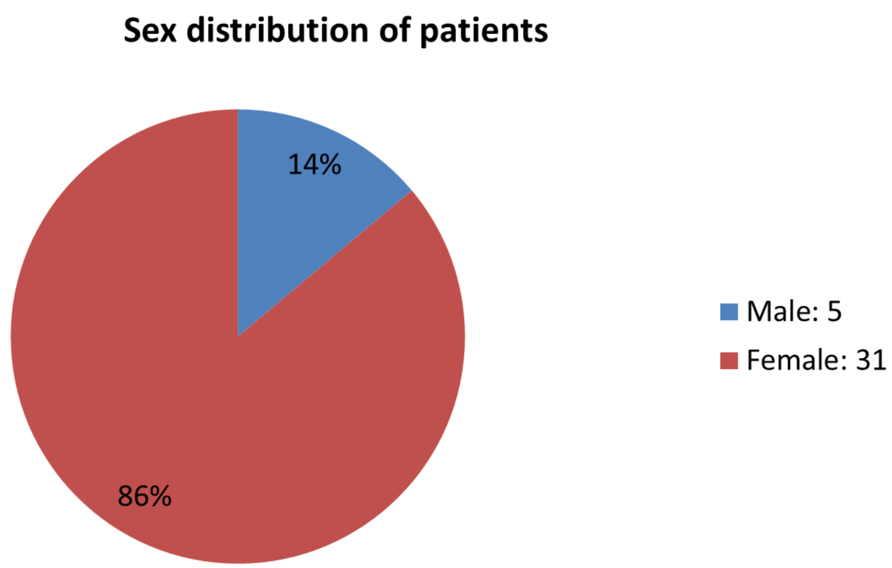


Fig-16

- Figure. (16) shows the sex distribution of the 36 patients
- Majority of the patients were female 31 out of 36 patients (86%) and 5out of 36patients (14%) were male

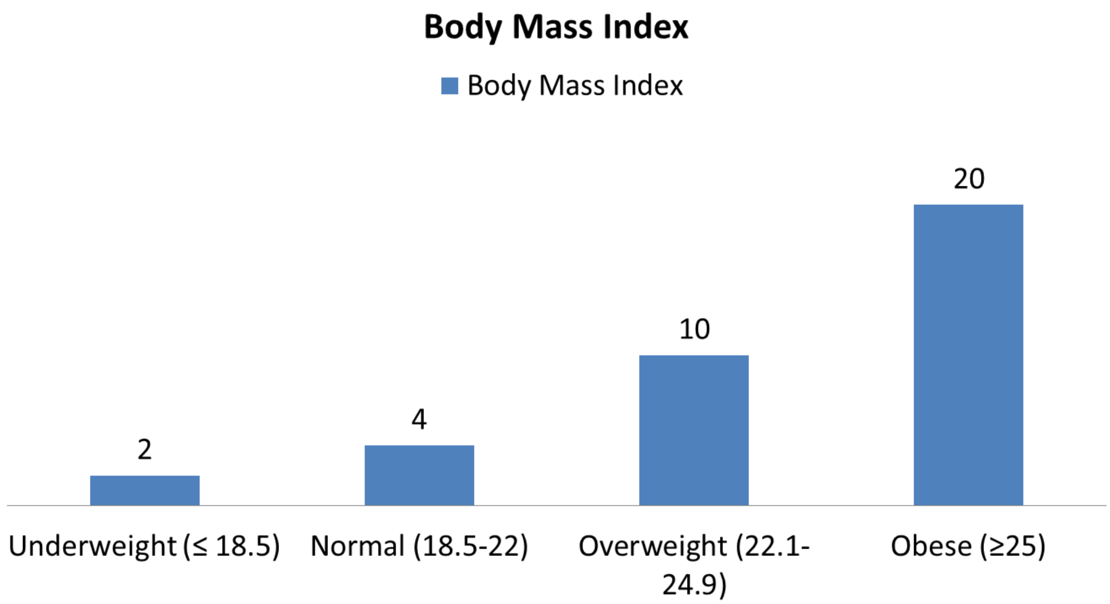


Fig-17

- Figure.(17) shows the BMI of the patients; BMI was assessed by calculation using the formula: weight in Kg/ (height in metres)2
- 2(5%) patients were in the underweight category; 4 (11%) were of normal weight; 10(27%) were overweight and 20 (55%)out of 36 patients were obese .

ETIOLOGY

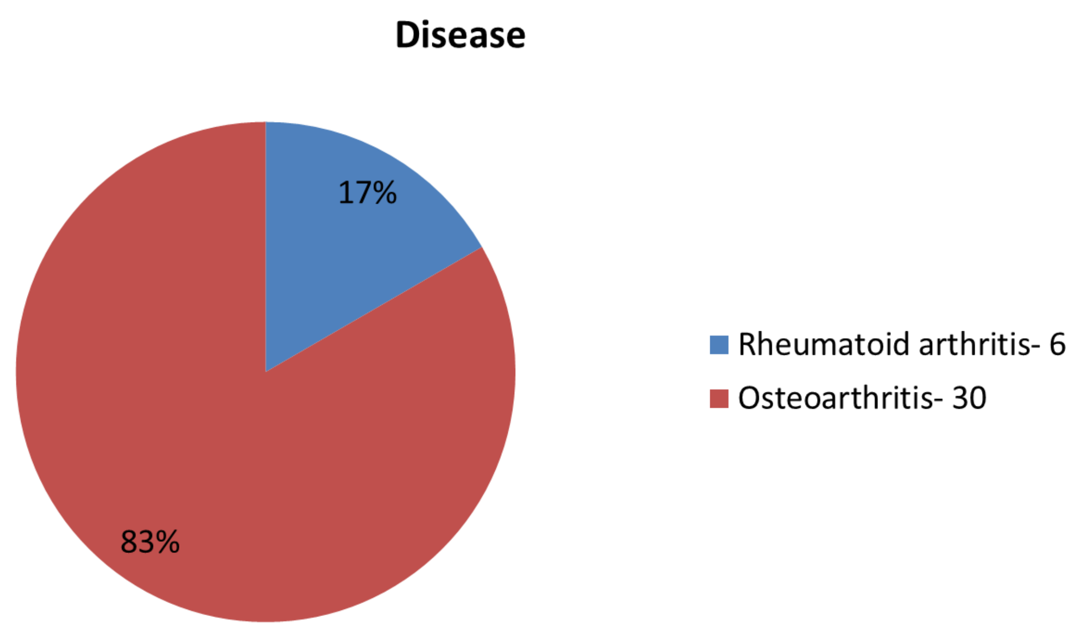


Fig-18

- Figure.(18)shows the disease pattern among the patients
- 30 out of 36patients(83%) had osteoarthritis, which is the majority of patients
- 6 out of 36 patients (17%) had rheumatoid arthritis

SIDE

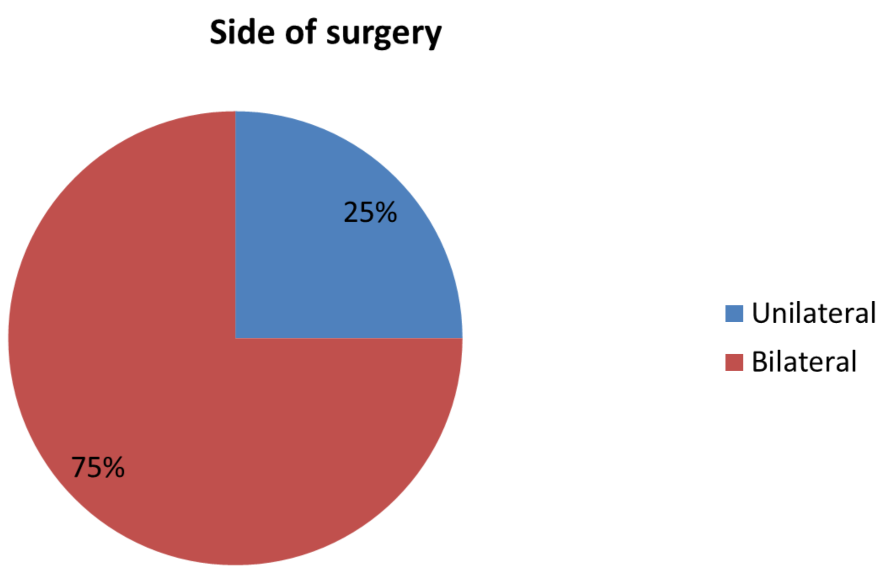


Fig-19

Figure. (19) shows the side of surgery

- 27 out of 36 patients (75%) underwent bilateral TKR
- 9out of 36 patients 25%) underwent unilateral TKR, among them 3 out of 36 patients (8%) underwent right TKR and 6 out of 36 patients (17%) underwent left TKR

Need For Blood Transfusion:

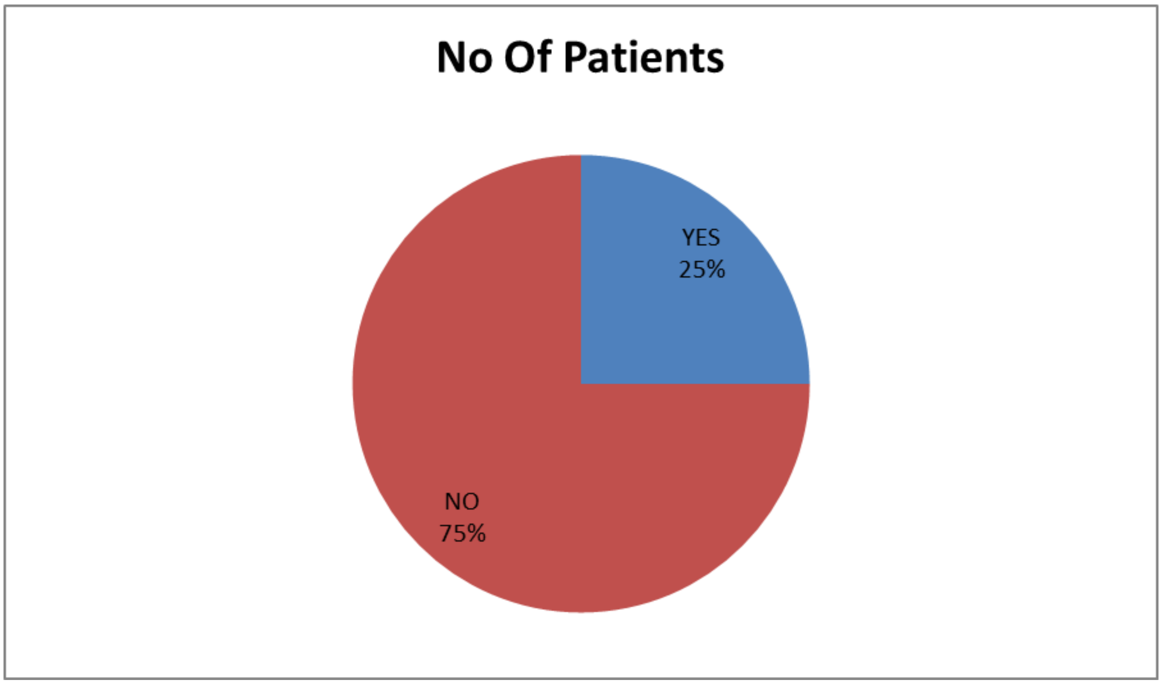


Fig-20

- Figure. (20) shows the percentage of patients who required post operative blood transfusion
- 9 out of 36 patients (25%), required blood transfusion
- All the above patients who needed blood transfusion had undergone bilateral TKR

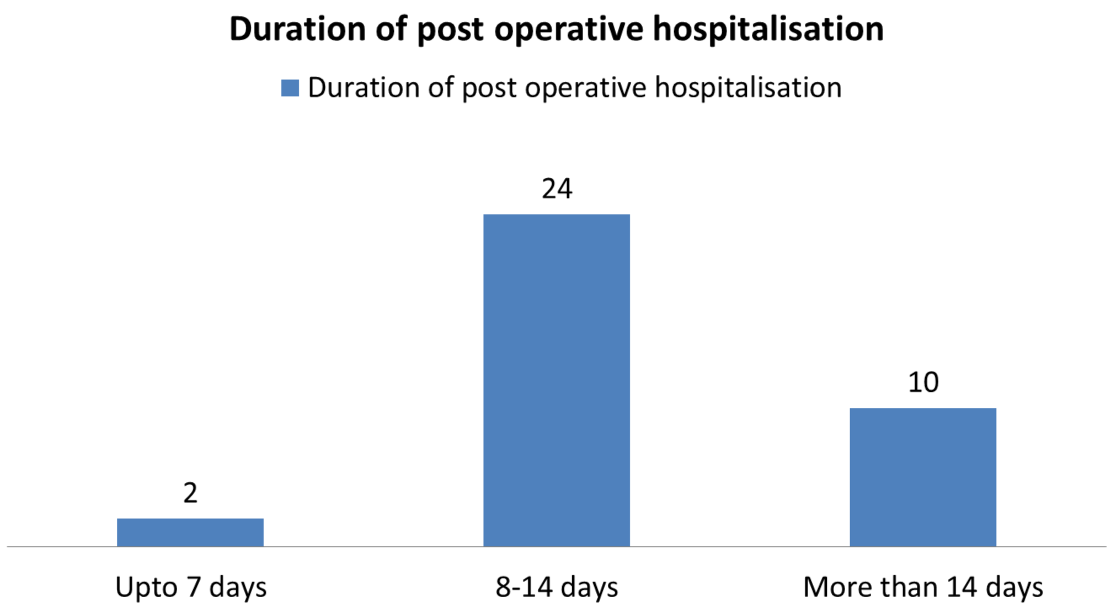


Fig-21

- Figure. (21) shows the bar chart representing duration of post-operative hospitalization.
- 24out of36 patients (66%) were discharged on the 14th post op day.
- 2outof 36 patients (5%) were discharged before 14 days, and 10 out of 36 patients (27%) were discharged after 14 days due to various reasons like erythema and redness around operative site ,medical comorbidity , ICU stay, and ambulation.
- One patient had 23 days of post op stay due to hypotension and tachycardia, for which he was shifted to surgical ICU for monitoring.

Post-operative Infection

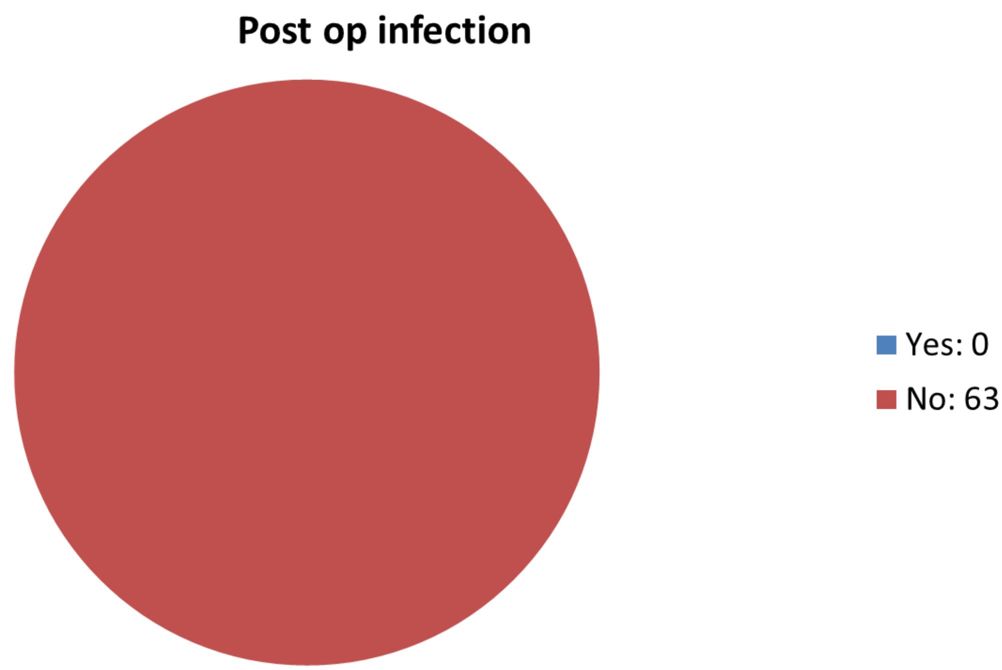


Fig-22

Figure. (22) shows the percentage of patients who had post op infection

- 2 knees out of 63 knees (3%) developed erythema and redness at operative site during immediate post-operative period . Symptoms were resolved within 48 hrs with intra-venous antibiotics. One patient (1.5%) presented with erythema and redness at operative site after 6 years of surgery and symptoms were resolved within 48 hrs with intra venous antibiotics after admission. None of them required further surgical intervention for infection.
- Vogt et al study reported -No early superficial or deep infection noted but 1 out of 101 patients reported deep infection of unknown origin requiring one stage prosthesis

revision and resulted in a satisfactory out- come (knee society sore 70) fter nine years of implantation(44)

- Sanchez et al study reported 1 out of 101 patients reported with infection at 2 years postoperative period(41)

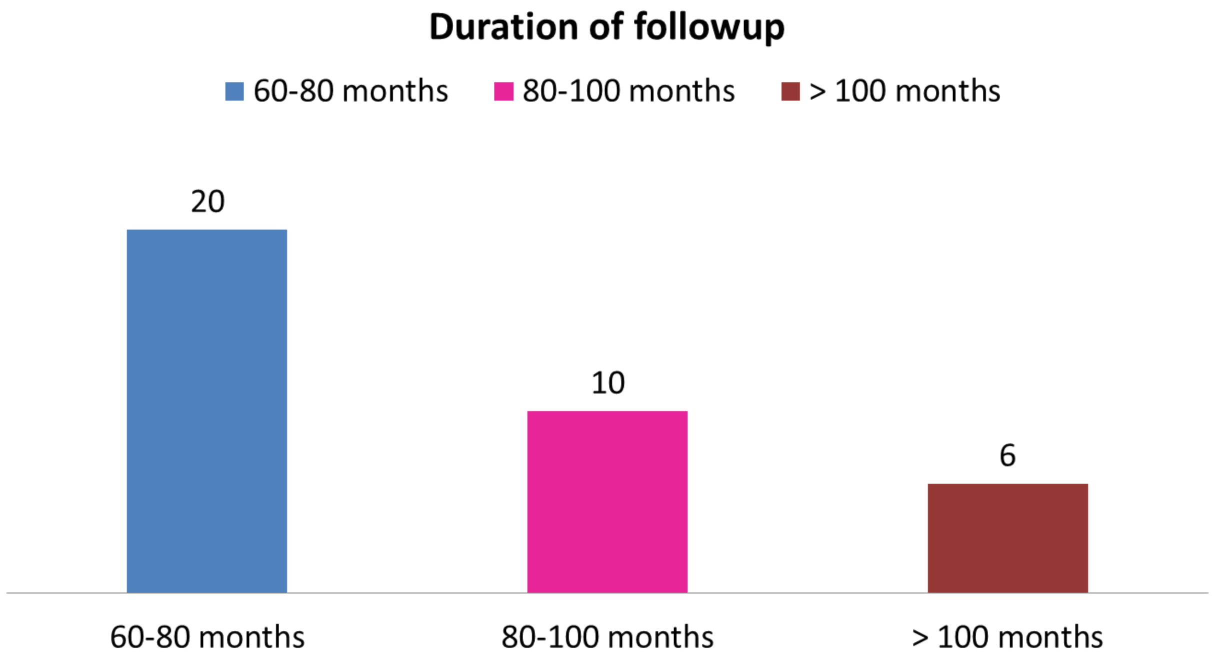


Fig-23

Figure. (23) shows follow duration in months.

Minimum follow up duration is 60 months (5 years) and the maximum is 156 months (13 years).

Mean follow up duration was 80.2 months.

20 out of 36 patients (55%) follow up were 60-80 months.

Only 6 out of 36 patients (16 %) were follow up >100 months.

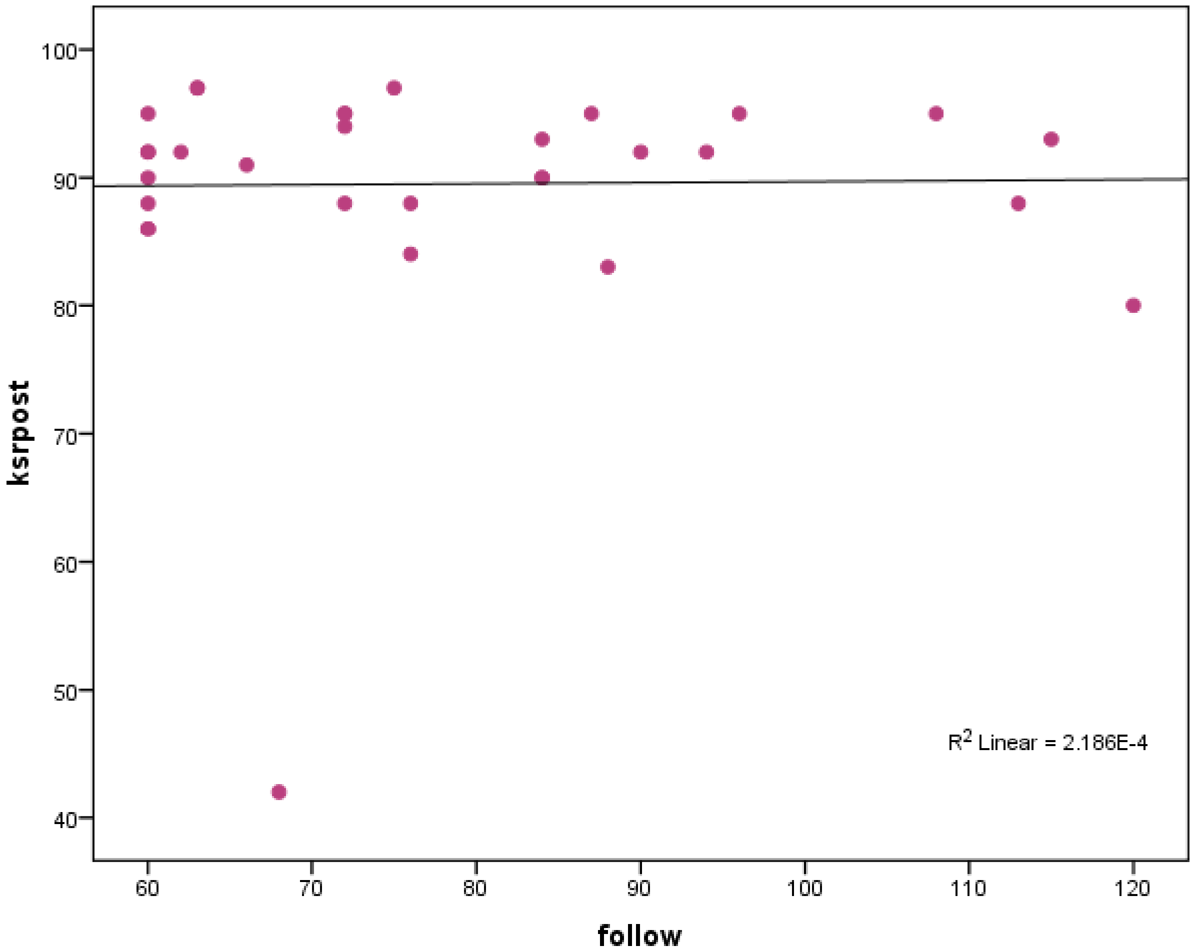


Fig-24

Figure. (24) shows correlation between follow up duration, and American knee society score for right TKR

Ksrpost = knee society score for right side.

Figure shows significant correlation between follow up duration and knee society score. ($P<0.001$)

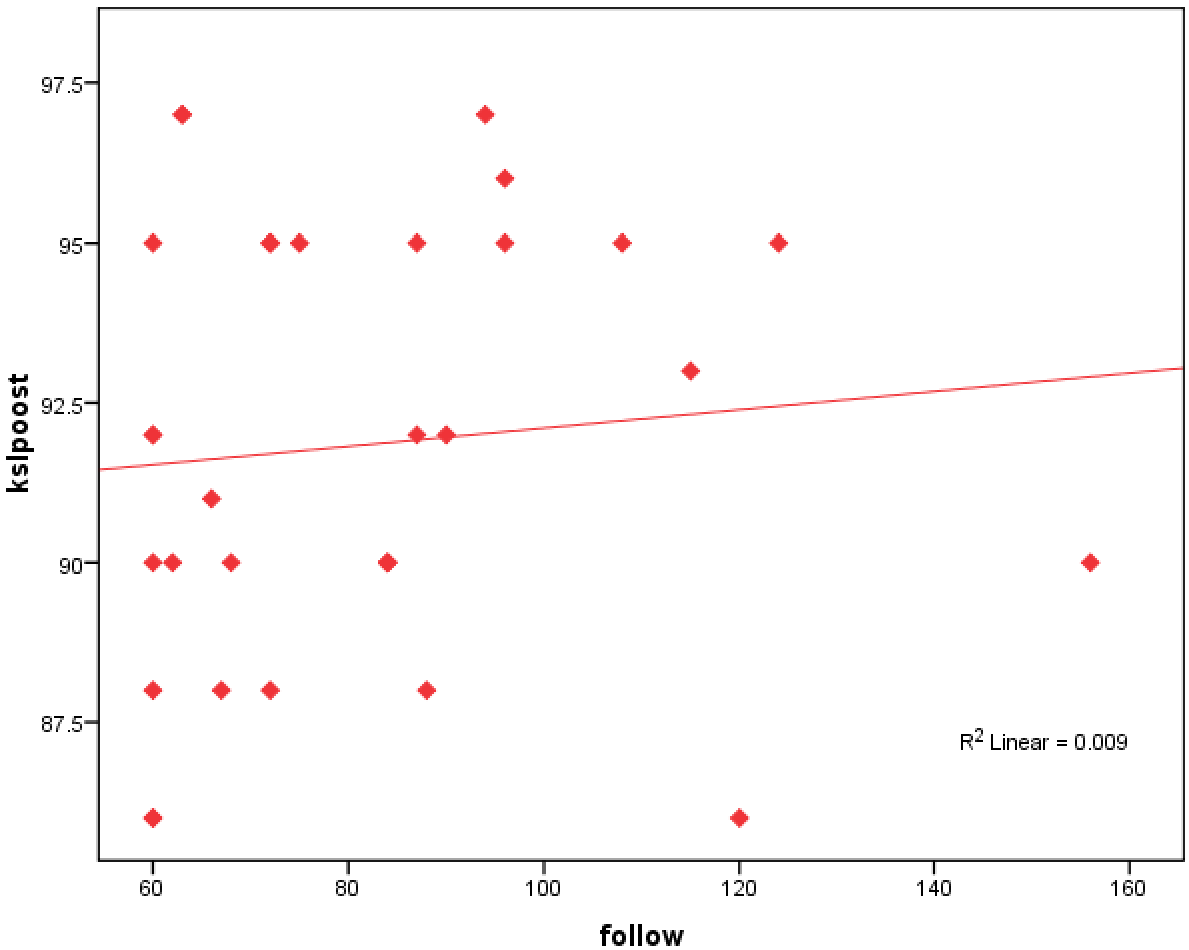


Fig-25

Figure. (25) shows correlation between follow up duration and the American knee society score for left TKR

Kslpost = knee society score for left side.

Figure shows significant correlation between these two. (P<0.001)

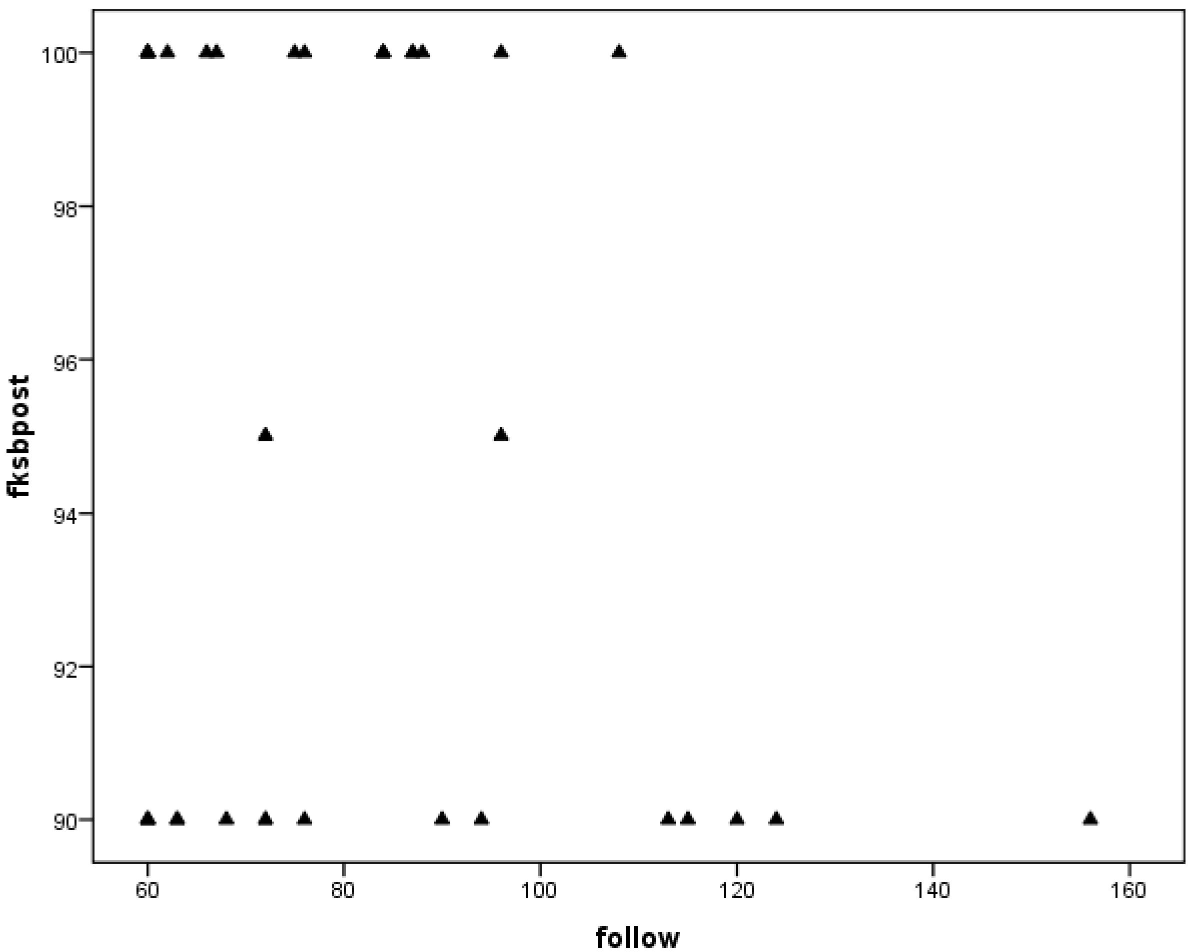


Fig-26

Figure. (26) shows correlation between follow up and functional knee

Fksbpost = functional knee score

Figure shows significant correlation between follow up duration and functional knee score.

Duration of follow up		KSS right side	KSS left side	Functional score
Spearmann	Correlation coefficient	.004	0.225	-0.146
	significance	0.984	0.216	0.394

Tab-6

Tab. (6) shows correlation between duration of follow up with knee society score for right and left sides, and with functional knee scores.

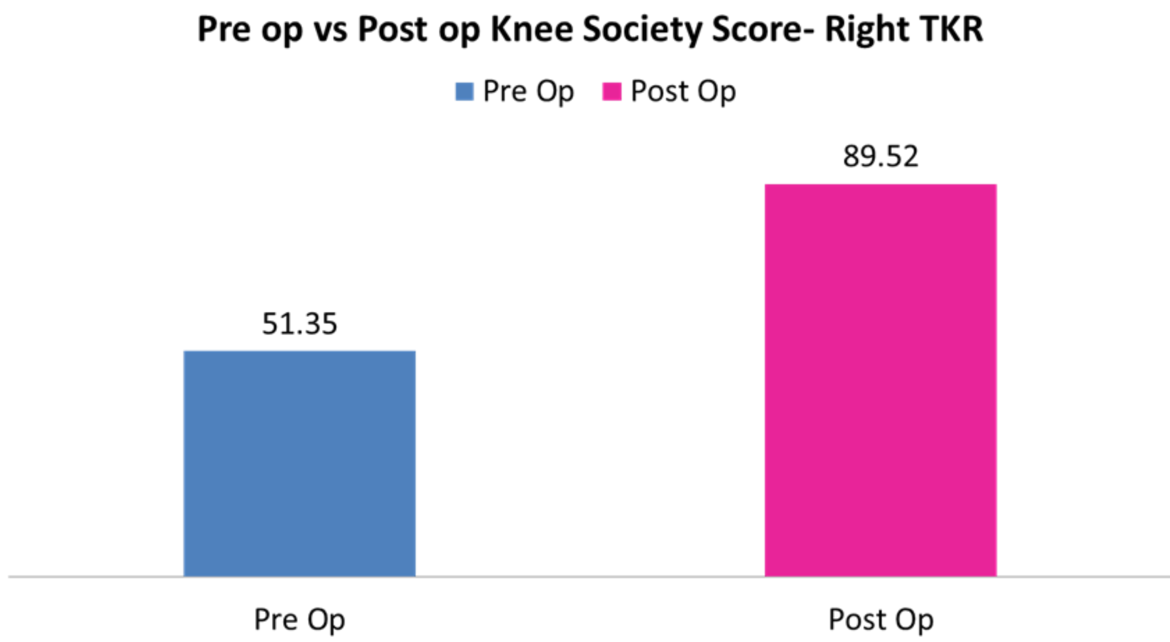


Fig-27

Figure. (27) shows knee society scores for right TKR: pre op vs post op.

Mean pre op score is 51.35, and mean post op score is 89.52. There is significant improvement in the score post operatively compared to pre op.

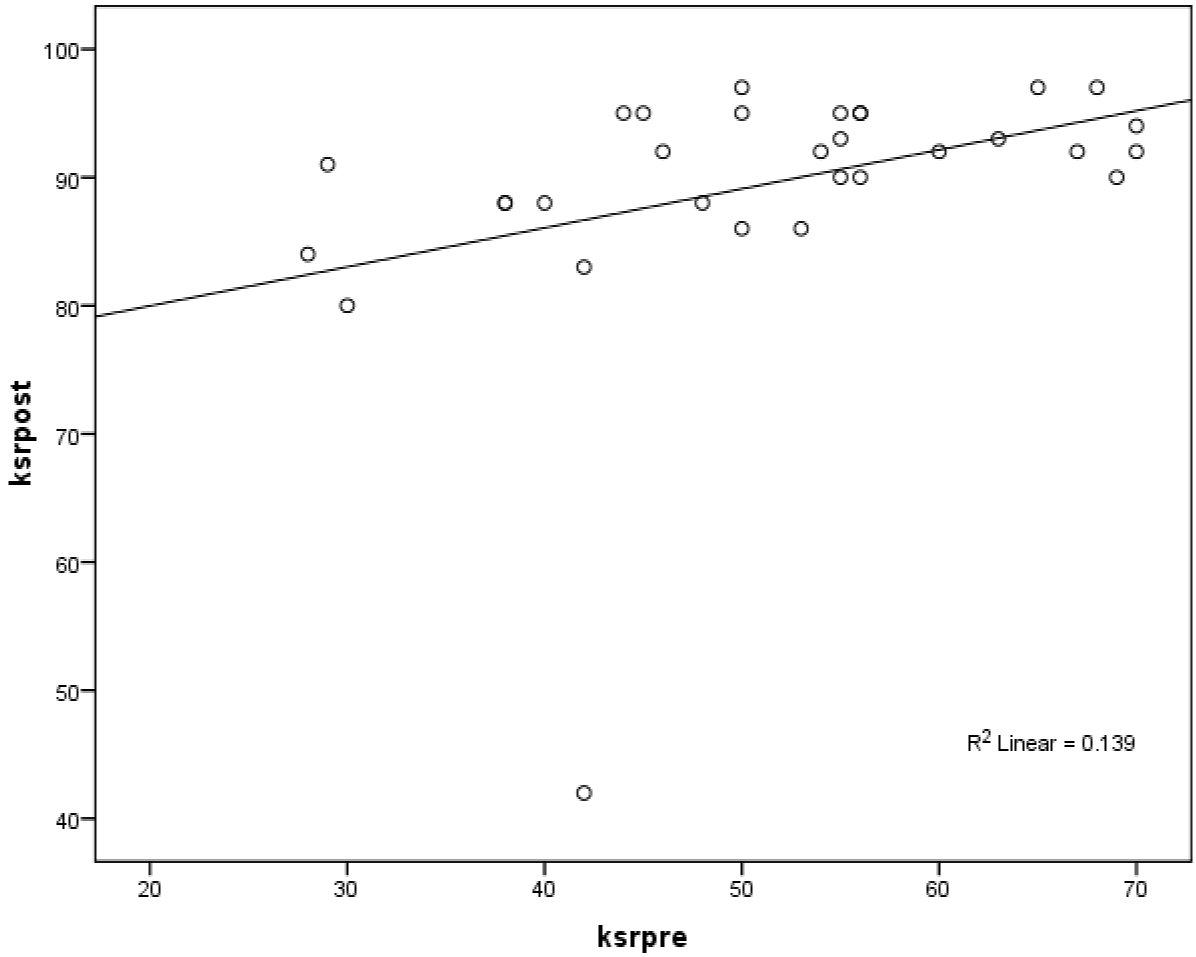


Fig-28

Figure. (28) shows correlation between knee society score pre op vs post op for right TKR

Ksrpre = knee society score pre op right knee; Ksrpost = knee society score post op right knee

Knee Society Score	Mean	Standard Deviation	Miminum	Maximum	P value
Pre Op	51.35	12.029	28	70	P < 0.001
Post Op	89.52	9.801	82	97	

Tab. (7) shows tabulation of mean knee society scores for patients who underwent right TKR pre op vs post op.

P value is < 0.001, which is highly significant.

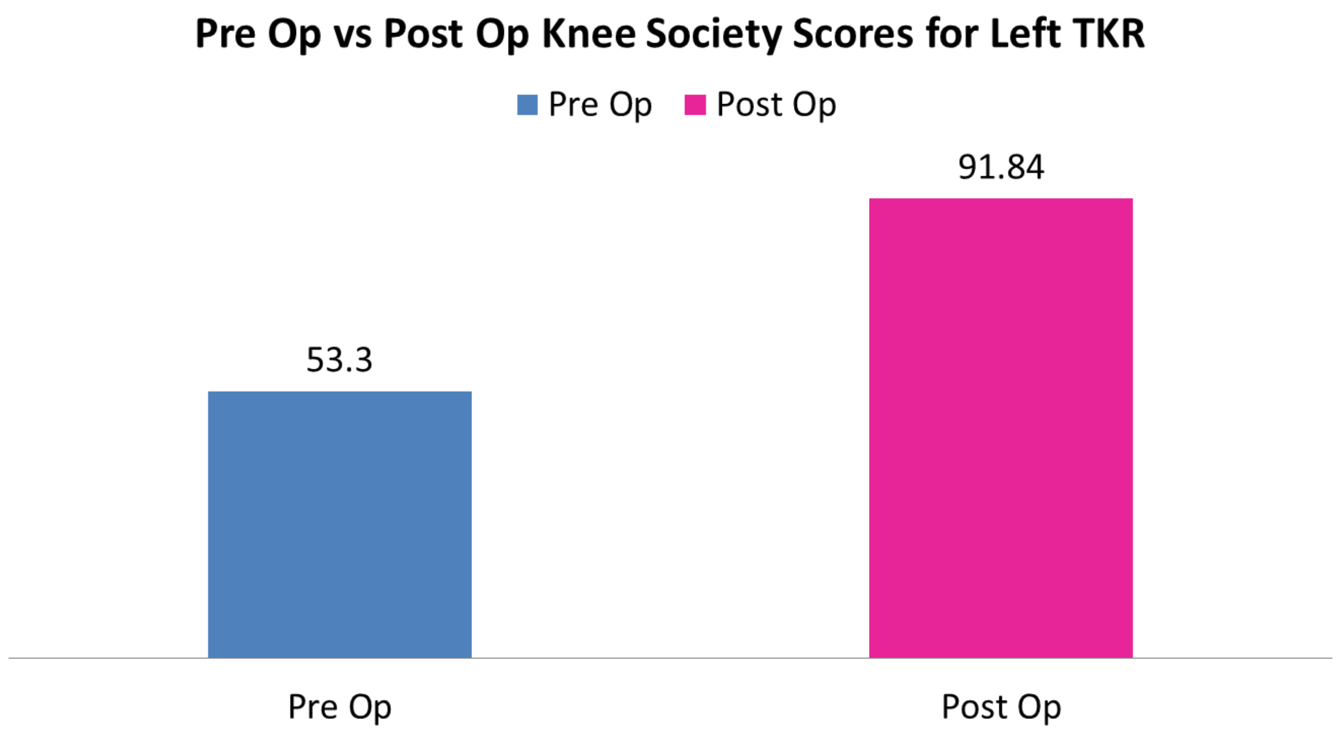


Fig-29

Figure. (29) shows knee society scores for left TKR: pre op vs post op.

Mean pre op score is 53.30, and mean post op score is 91.84. There is significant improvement in the score post operatively compared to pre op.

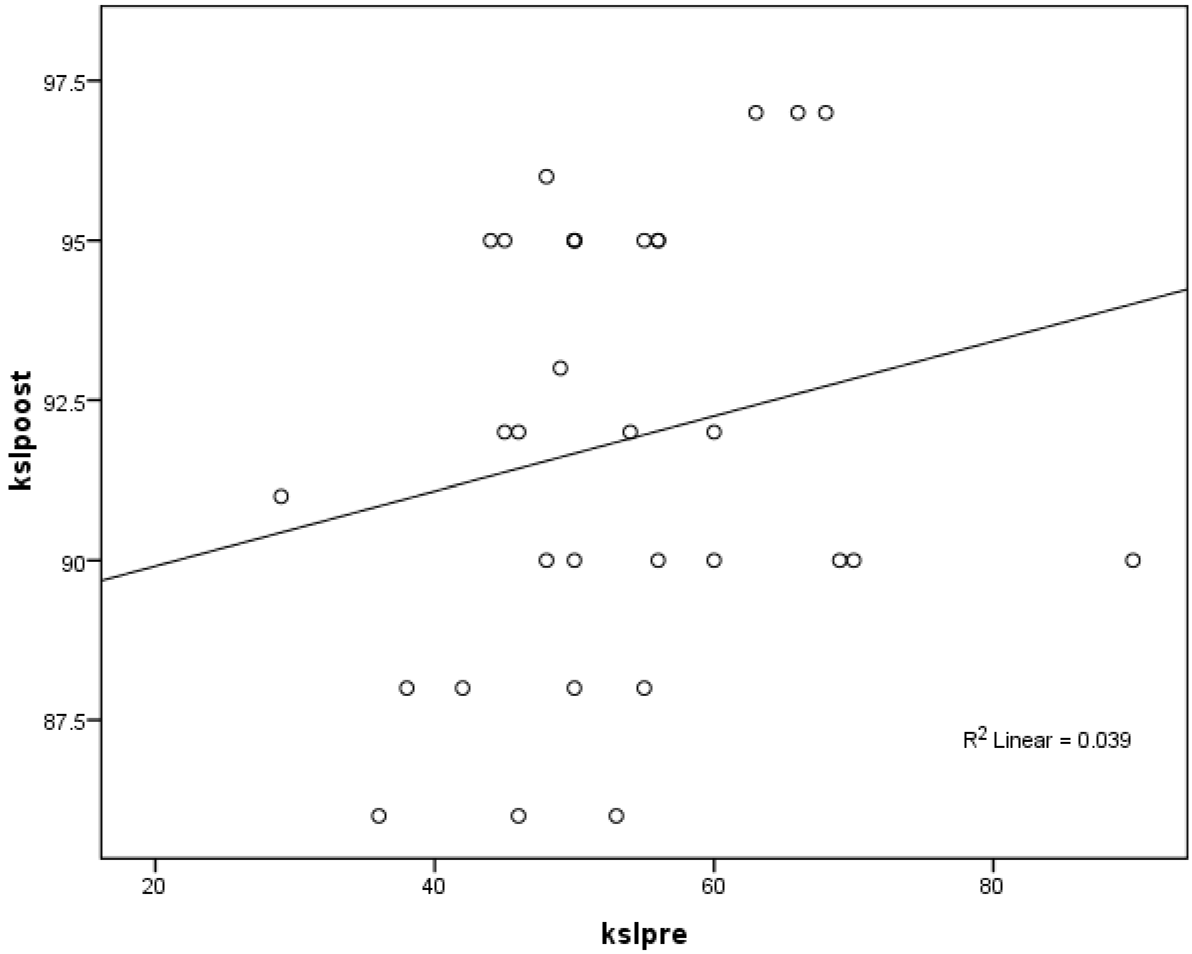


Fig-30

Figure. (30) shows correlation between American knee society score pre op vs post op.

Kslpre = American knee society score pre op left knee; Kslpost = knee society score post op left knee.

Knee Sociey Score	Mean	Standard Deviation	Minimum	Maximum	P value
Pre Op	53.03	11.59	29	90	P < 0.001
Post Op	91.84	3.428	86	97	

Tab-7

Tab- (7) shows tabulation of mean knee society scores for patients who underwent left TKR pre op vs post op.

P value is < 0.001, which is highly significant.

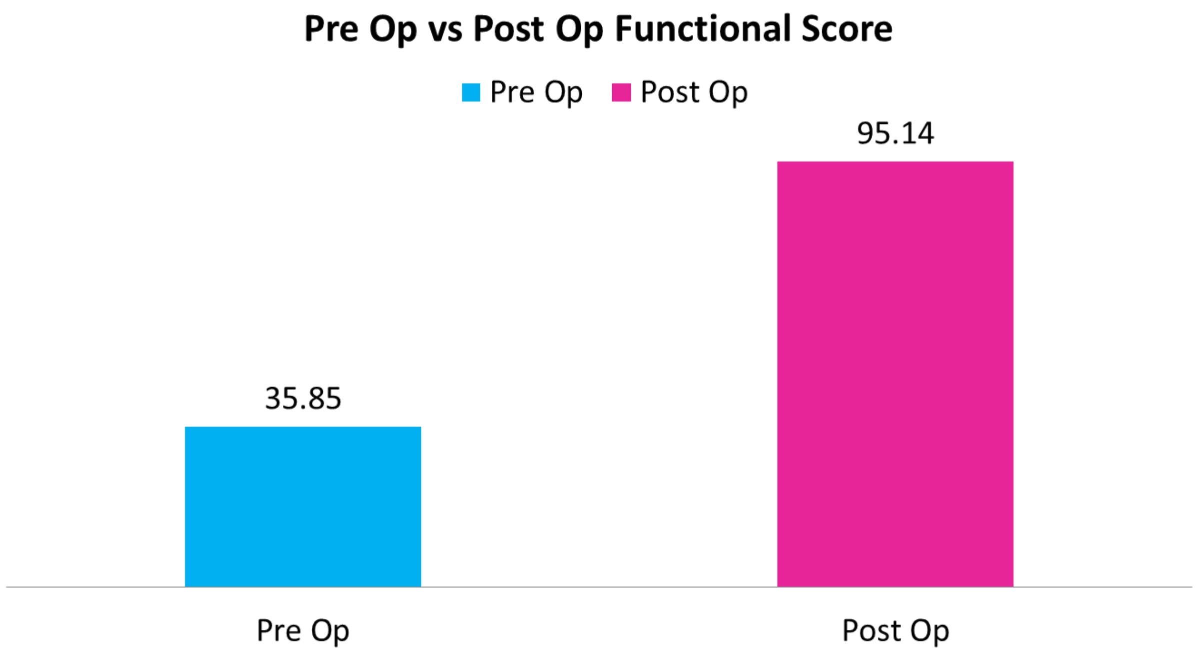


Fig-31

Figure.(31) shows mean pre op vs post op functional scores.

Significant improvement is seen in the post op scores as compared to pre op.

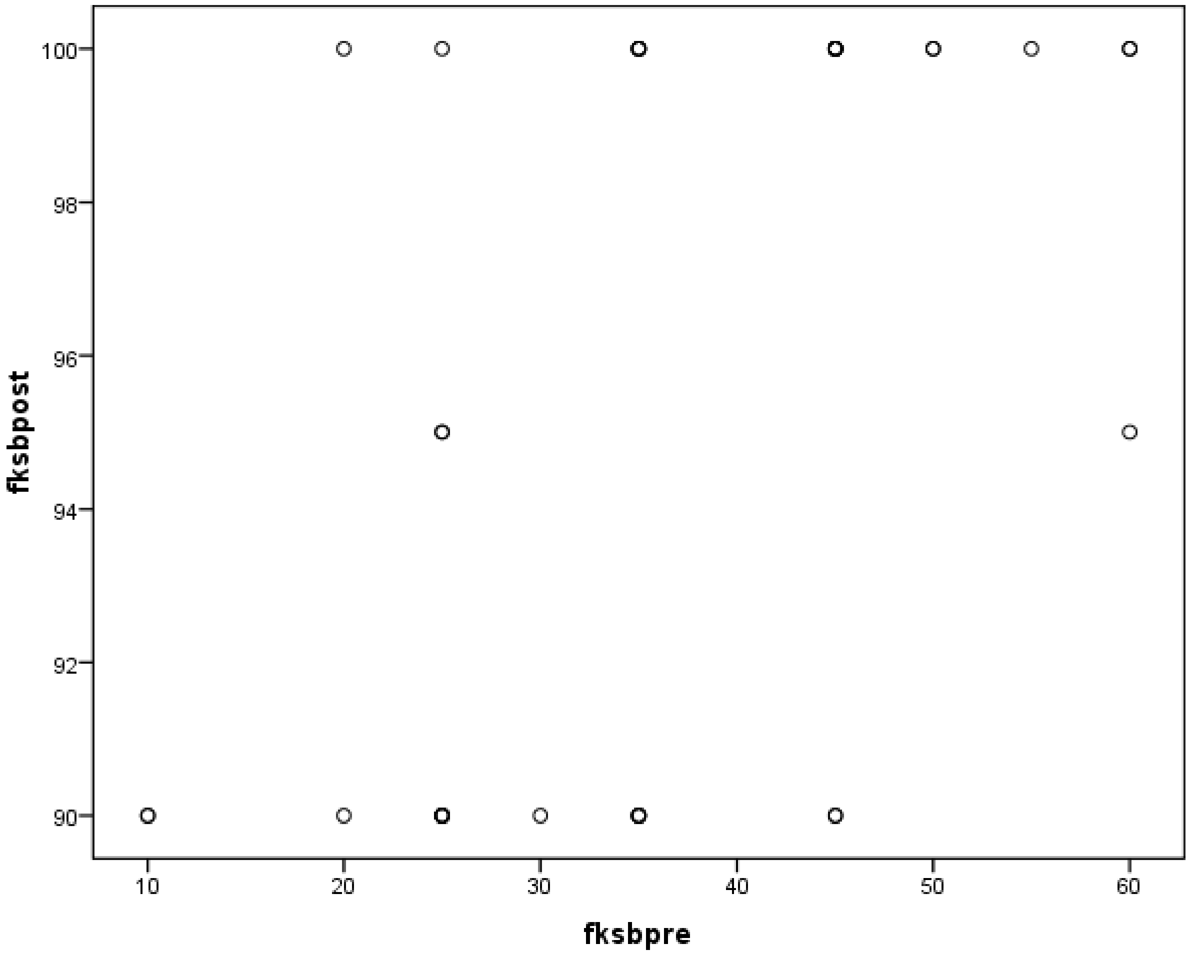


Fig-32

Figure. (32) shows correlation between functional knee score calculated pre op vs post op.

Fksbpre = functional knee score as calculated pre op; Fksbpost = functional knee score as calculated post op.

Functional Score	Mean	Standard Deviation	Minimum	Maximum	P value
Pre Op	35.83	13.229	10	60	P < 0.001
Post Op	95.14	4.85	90	100	

Tab-8

Figure. (8) shows tabulation of mean pre op vs post op functional scores.

P value is < 0.001, which is highly significant.

Significant improvement is seen in the post op scores as compared to pre op.

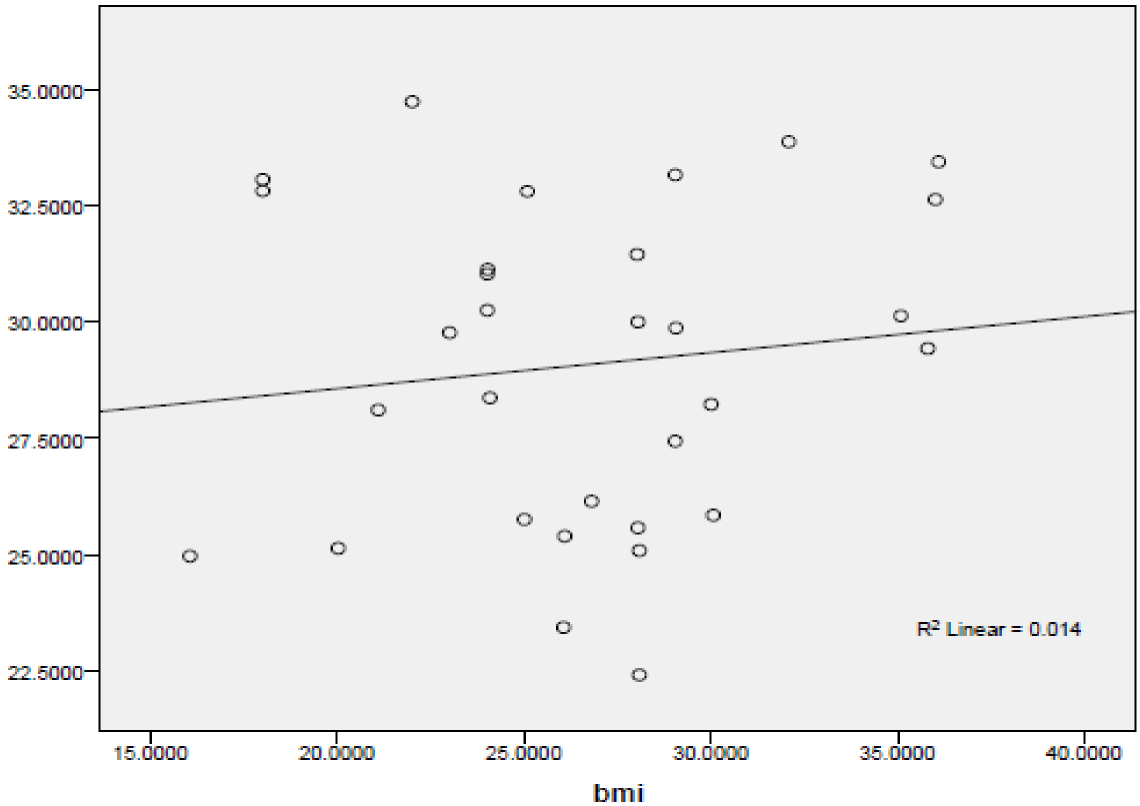


Fig-33

Figure.(33) Diagrammatic representation depicting that with increasing BMI there is decrease in Knee Society Score, but correlation is not statistically significant.

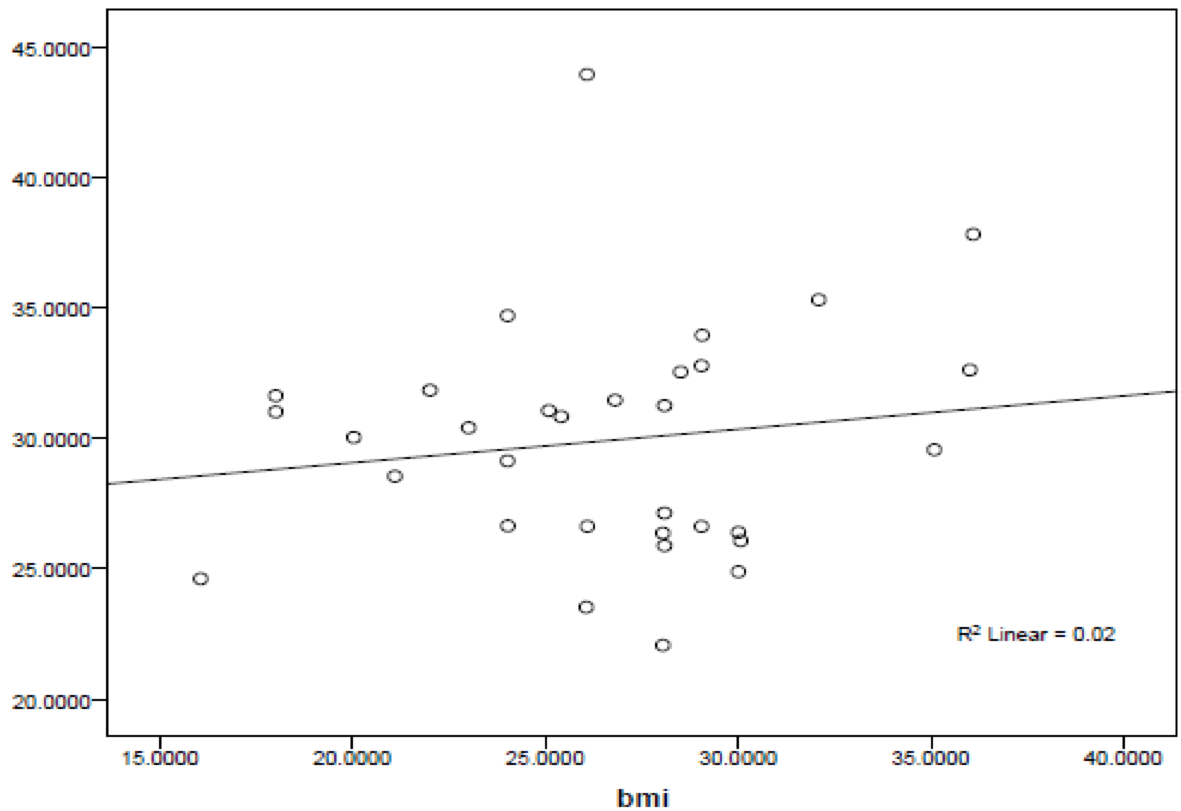


Fig-34

Figure.(34) diagrammatic representation depicting that with increasing BMI there is decrease in Functional Knee Score, but correlation is not statistically significant.

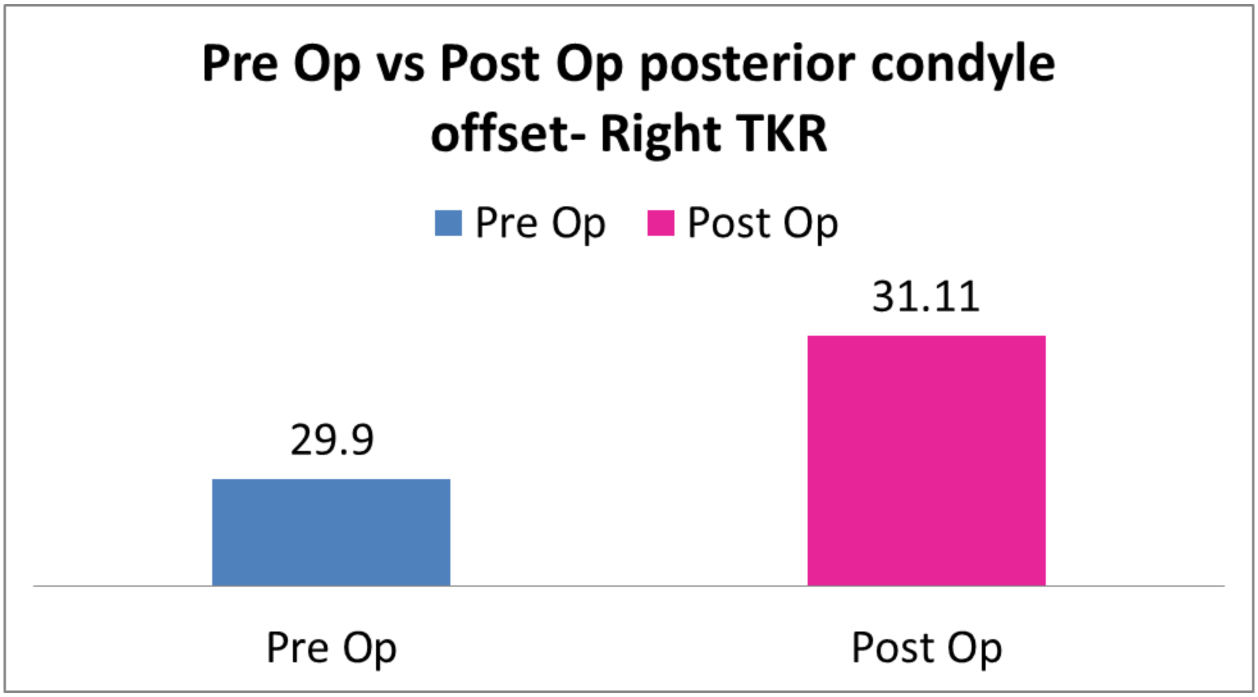


Fig-35

Figure.(35) shows post op vs pre op posterior condyle offset in patients who underwent right sided TKR.

It shows significant correlation between posterior condyle offset pre op and post op. (P<0.001)

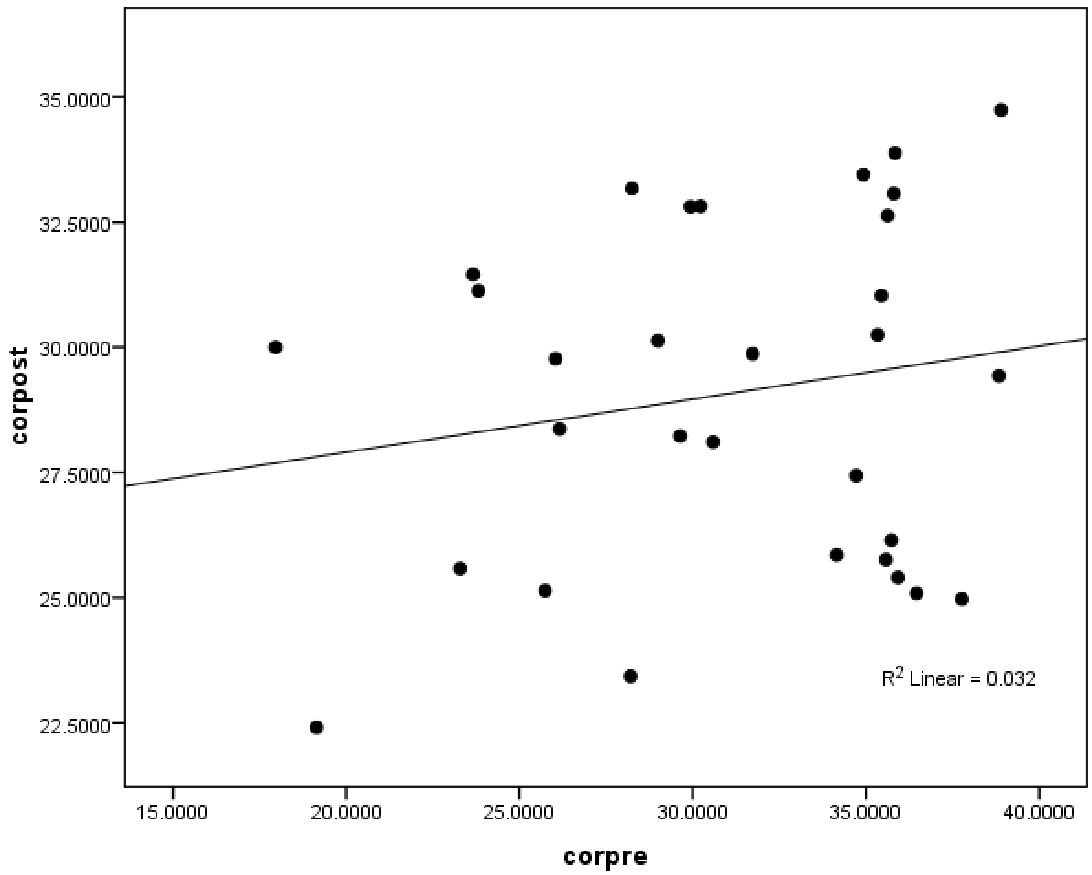


Fig-36

Figure.(36) shows correlation between right posterior condyle offset pre op and post op

Corepre = Right posterior condyle offset pre op; Corpost = Right posterior condyle offset post op.

It shows significant correlation between pre op and post op posterior condyle offset (P<0.001)

Posterior condyle offset	Mean	Standard Deviation	Minimum	Maximum	P value
Pre Op	29.9	5.73	17.96	34.74	P < 0.001
Post Op	31.11	3.420	22.41	38.90	

Tab-9

Tab- (9) shows tabulation of mean pre op vs post op posterior condyle offset in patients who underwent right sided TKR.

It shows significant correlation between pre op and post op posterior condyle offset (P<0.001)

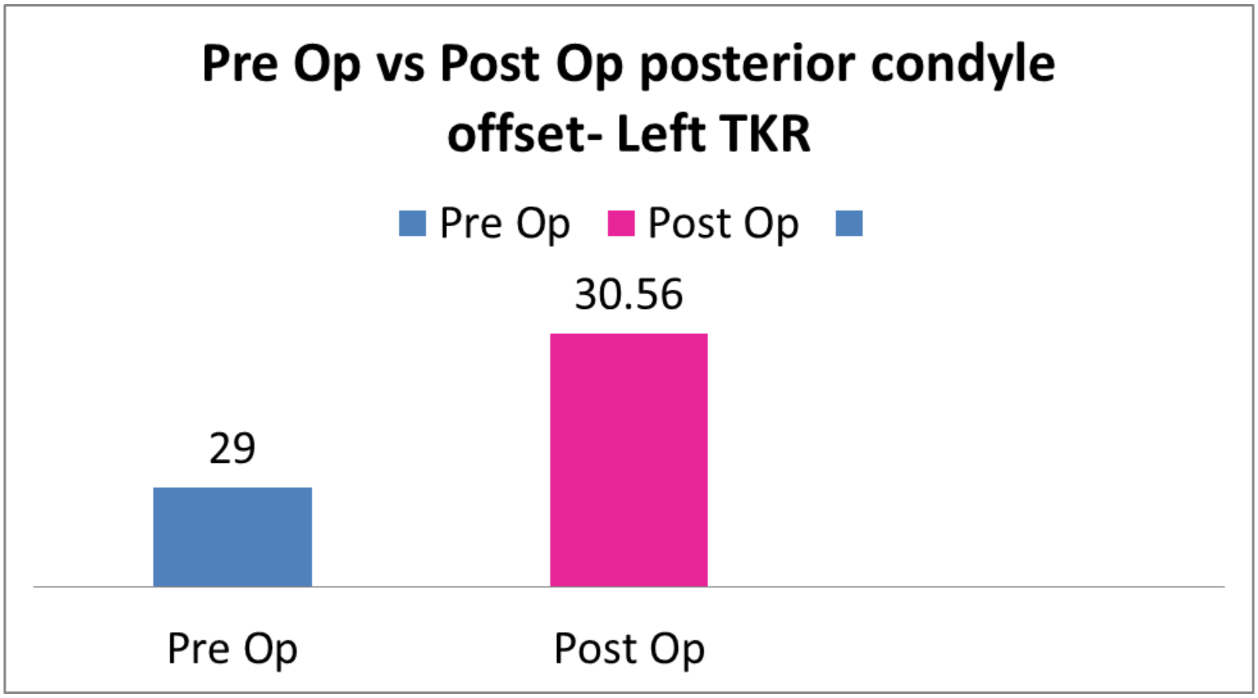


Fig-37

Figure.(37) shows mean post op and pre op posterior condyle offset in patients who underwent left sided TKR

It shows significant correlation between pre op and post op posterior condyle offset (P<0.001)

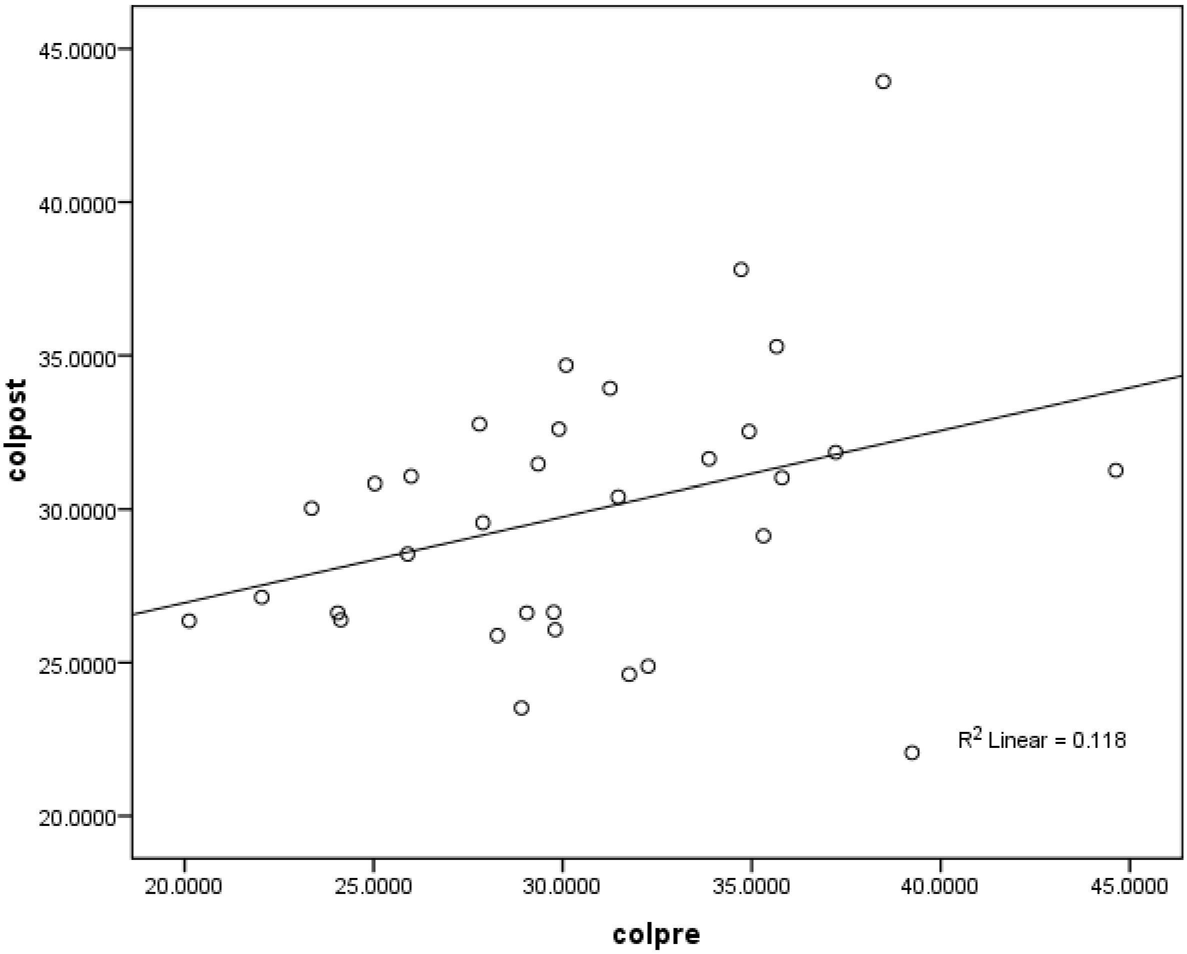


Fig-38

Figure.(38) shows correlation between posterior condyle offset pre op and post op

Colpre = posterior condyle offset left knee pre op; Colpost = posterior condyle offset left knee post op.

It shows significant correlation between pre op and post op posterior condyle offset (P<0.001)

Posterior condyle offset	Mean	Standard Deviation	Minimum	Maximum	P value
Pre Op	29.0	5.47	20.12	43.93	P < 0.001
Post Op	30.56	4.464	22.06	44.63	

Tab-10

Tab- (10) shows tabulation of mean pre op vs post op posterior condyle offset in patients who underwent left sided TKR.

It shows significant correlation between pre op and post op posterior condyle offset (P<0.001)

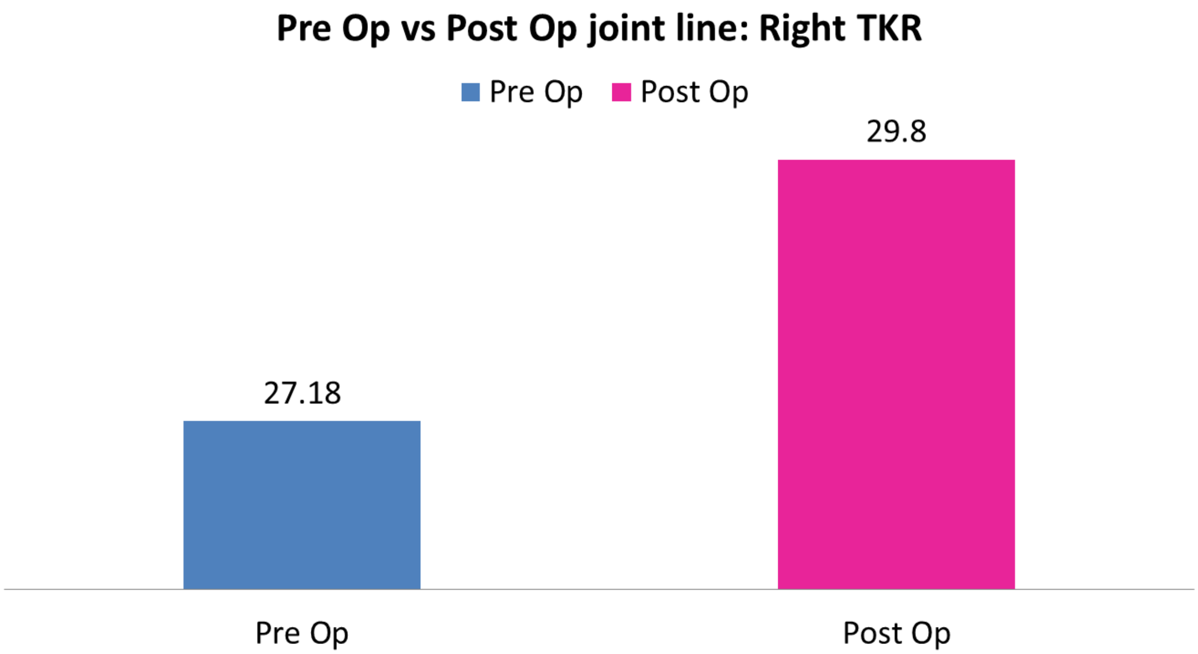


Fig-39

Figure.(39) shows mean pre op vs post op joint line in patients who underwent right sided TKR.

Significant elevation of joint line is seen post operatively as compared to pre op.

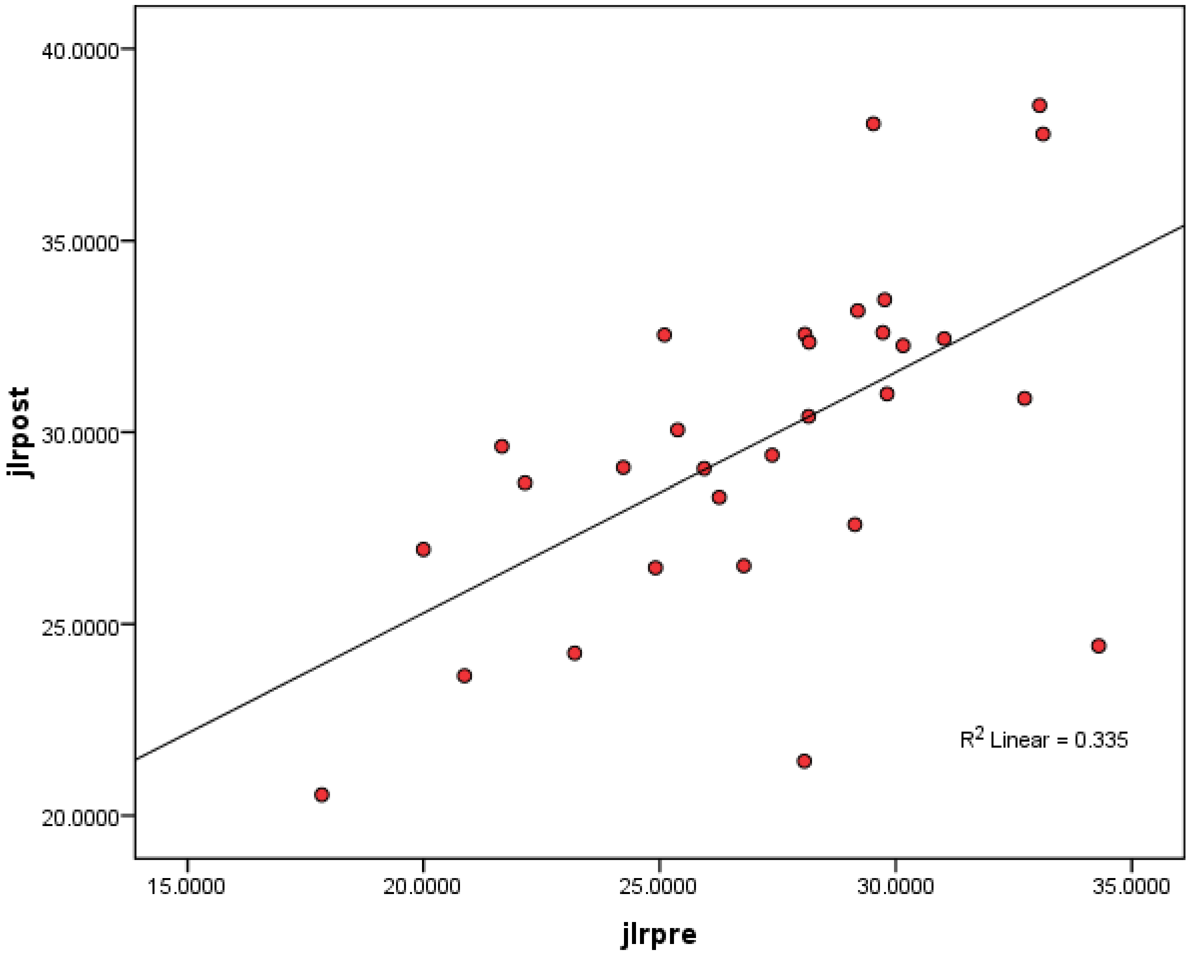


Fig-40

Figure. (40) shows correlation between joint line right knee pre op vs post op

Jlrpre = joint line pre op for right knee; Jlrpost = joint line post op for right knee

Joint Line	Mean	Standard Deviation	Minimum	Maximum	P value
Pre Op	27.18	4.09	17.85	34.30	P = 0.001
Post Op	29.80	4.43	17.90	33.00	

Tab-11

Tab. (11) shows tabulation of mean pre op vs post op joint line in patients who underwent right sided TKR.

P value is < 0.001, which is highly significant.

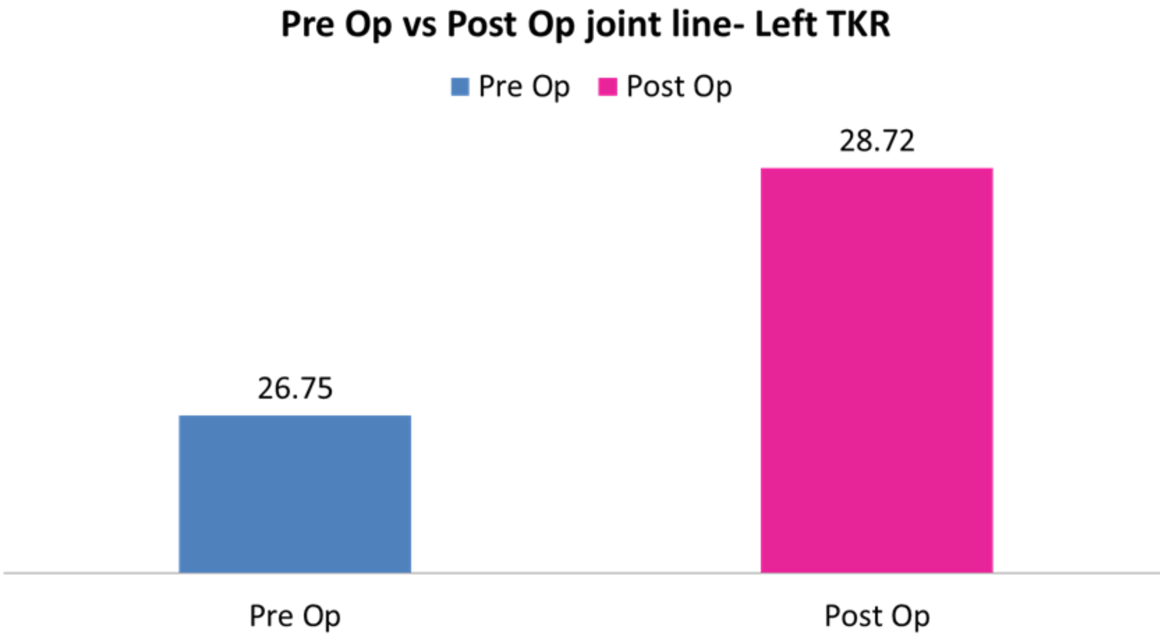


Fig-41

Figure. (41) shows mean pre op vs post op joint line in patients who underwent left sided TKR.

Significant elevation of joint line is seen post operatively as compared to pre op.

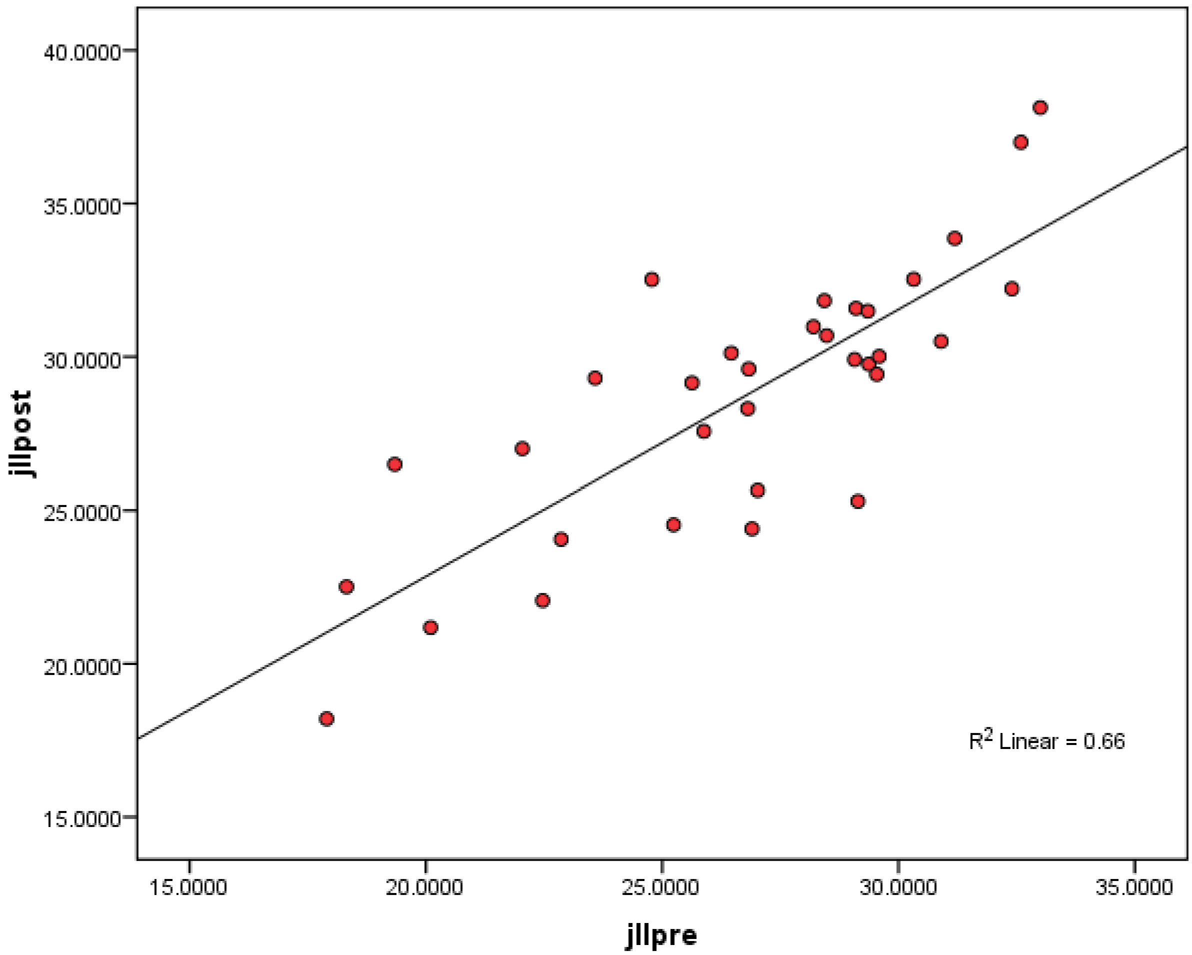


Fig-42

Figure.(42) shows correlation between joint line left knee pre op vs post op.

Jllpre = joint line left knee pre op; Jllpost = joint line left knee post op.

Joint Line	Mean	Standard Deviation	Minimum	Maximum	P value
Pre Op	26.75	4.07	17.90	33.00	P < 0.001
Post Op	28.72	4.36	18.20	38.13	

Tab-12

Tab. (12) shows tabulation of mean pre op vs post op joint line in patients who underwent left sided TKR.

P value is < 0.001, which is highly significant.

CORRELATIONS

AGE		Pre op knee score-right	Post op knee score-right
Spearman	Correlation coefficient	-0.011	0.030
	Significance	0.953	0.873

Tab-13

Tab. (13) shows correlation between age of subject and Knee Society Score.

There was correlation between age of the patient and Knee Society Score. With increasing age, Knee Society Score decreased, but statistically it was not significant. (P = 0.953 pre op and 0.873 post op)

AGE		Pre op knee score-left	Post op knee score-left
Spearman	Correlation coefficient	-0.273	-0.153
	Significance	0.131	0.402

Tab-14

Tab. (14) shows correlation between age of subject and Knee Society Score in patients who underwent left TKR. There was correlation between age of the patient and Knee Society Score. With increasing age, Knee Society Score decreased, but statistically it was not significant. (P = 0.131 pre op and 0.402 post op)

AGE		Pre op functional score	Post op functional score
Spearman	Correlation coefficent	-0.174	-0.203
	Significance	0.310	0.234

Tab-15

Tab. (15) shows correlation between age of subject and Functional Knee Score.

There was correlation between age of the patient and Functional Knee Score. With increasing age, Functional Knee Score decreased, but statistically it was not significant. (P = 0.310 pre op and 0.230 post op)

AGE		Pre op right KSS	Post op right KSS	Pre op left KSS	Post op left KSS	Pre op FS	Post op FS
spearman	Correlation coefficient	-0.011	-0.030	-0.273	-0.153	-0.174	-0.203
	significance	0.953	0.873	0.131	0.402	0.310	0.234

Tab-16

Tab.(16) shows correlation between age, Knee Society Score and the functional score.

There is no statistical significance.

BMI		Pre op right KSS	Post op right KSS
Spearman	Correlation coefficient	-0.207	-0.114
	Significance	0.263	0.542

Tab-17

Tab. (17) shows correlation between BMI and Knee Society Score in patients who underwent right TKR.

With increase in BMI, there was decrease in Knee Society Score, but it was not statistically significant. (P value is 0.263 pre op and 0.542 post op)

BMI		Pre op left KSS	Post op left KSS
Spearman	Correlation coefficient	-0.320	-0.172
	Significance	0.074	0.346

Tab-18

Tab. (18) shows correlation between BMI and Knee Society Score in patients who underwent left TKR.

With increase in BMI, there was decrease in Knee Society Score, but it was not statistically significant. (P value is 0.074 pre op and 0.346 post op)

BMI		Pre op functional score	Post op functional score
Spearman	Correlation coefficient	0.231	0.074
	Significance	0.176	0.668

Tab-19

Tab. (19) shows correlation between BMI and Functional Knee Score in patients who underwent left TKR.

With increase in BMI, there was decrease in Functional Knee Score, but it was not statistically significant. (P value is 0.176 pre op and 0.668 post op)

BMI		Pre op right KSS	Post op right KSS	Pre op left KSS	Post op left KSS	Pre op FS	Post op FS
Spearman	Correlation coefficient	-0.207	-0.114	-0.320	-0.172	0.231	0.074
	significance	0.263	0.542	0.740	0.346	0.176	0.668

Tab-20

Tab. (20) shows correlation between BMI, with Knee Society Score and Functional Knee Score.

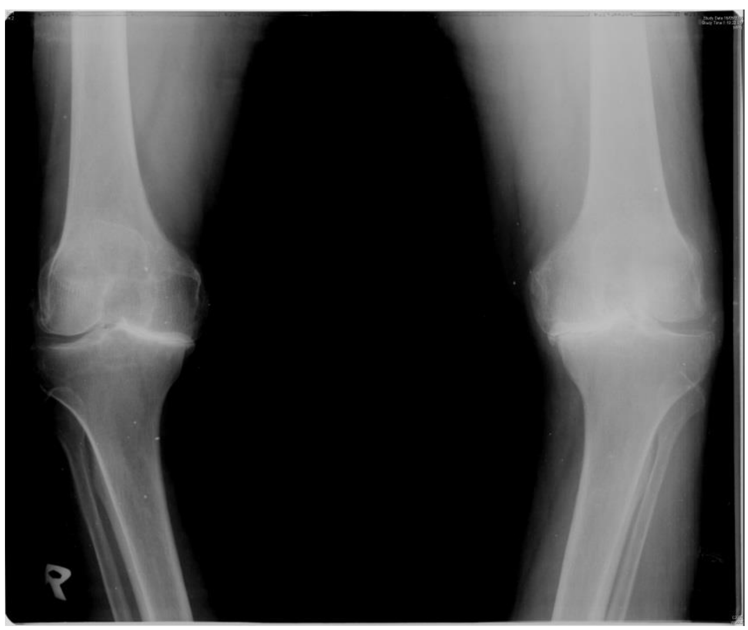
There was no statistical significance found.

CLINICAL PICTURES

1. Following are the images of an 81 year old gentleman, who underwent bilateral total knee replacement for osteoarthritis knee at the same sitting, 7 years back. His pre operative Knee Society Score was 42, and post operatively, Knee Society Score was 90 and functional score was 25 pre operatively with post op score of 95. Active range of movement was 110° at follow up.

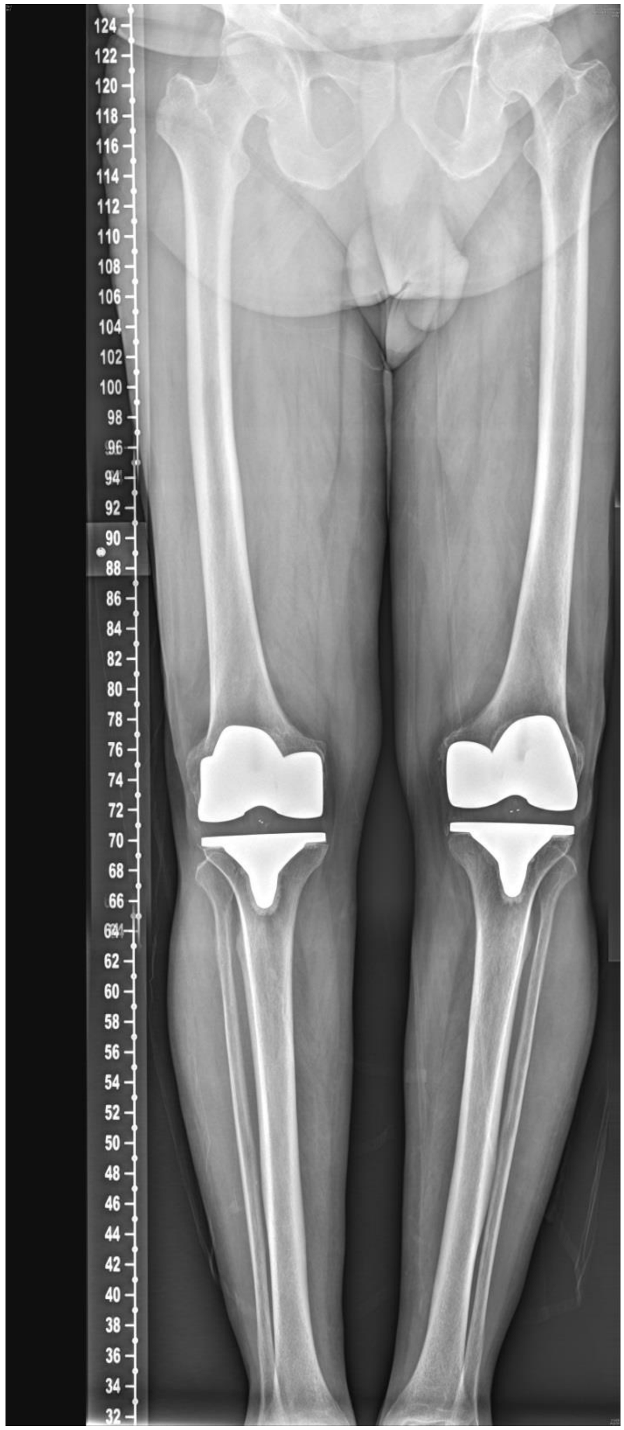
Following are radiographs showing the bilateral knees in standing position (antero posterior view showing varus deformity, and lateral view showing flexion deformity).

Fig. 44 (A,B)



Following are post op radiographic images of the same patient in antero posterior, lateral and stitch views following total knee replacement.

Fig. 44 (C,D,E,F)



2. 71 year old lady presented with osteoarthritis of knees. She underwent left TKR 13 years back. Pre operative Knee Society Score was 46 and post operative it improved to 90. Pre operative functional score was 45, which improved to 100, post operatively at follow up.

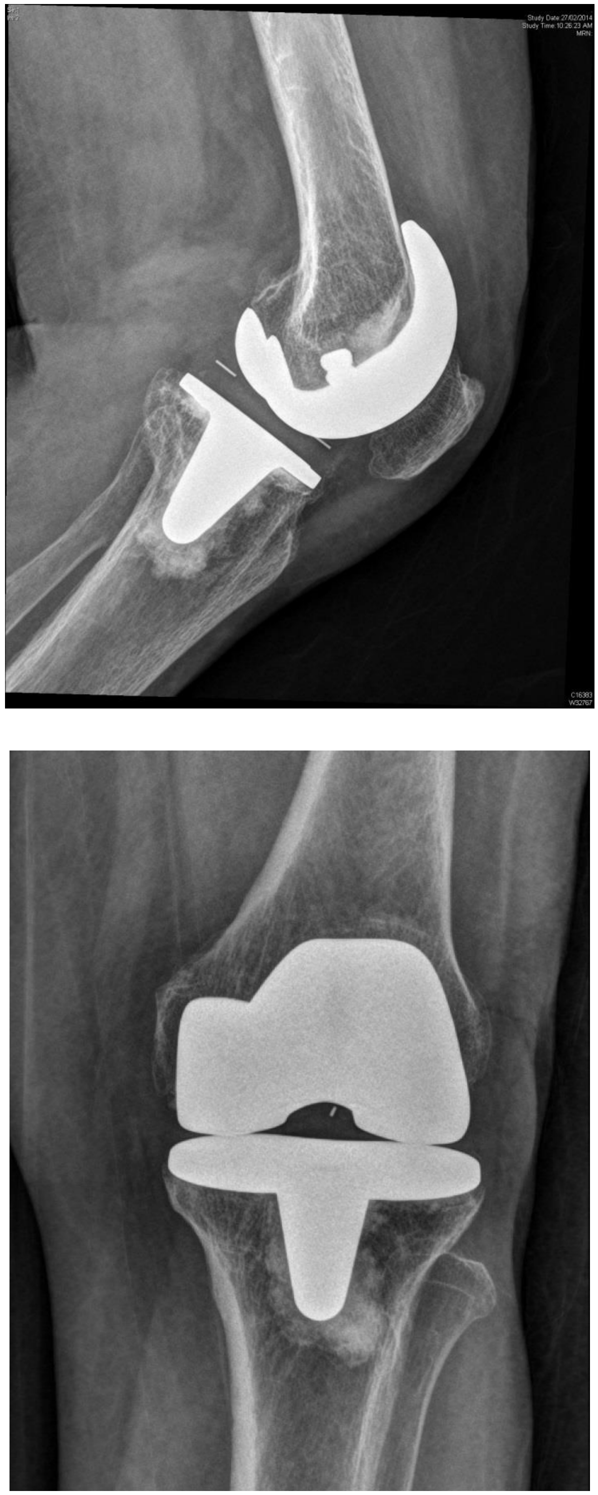
Following are pre op radiographs of the patient taken in antero-posterior and lateral views in standing position.

Fig. 45 (A,B)


L

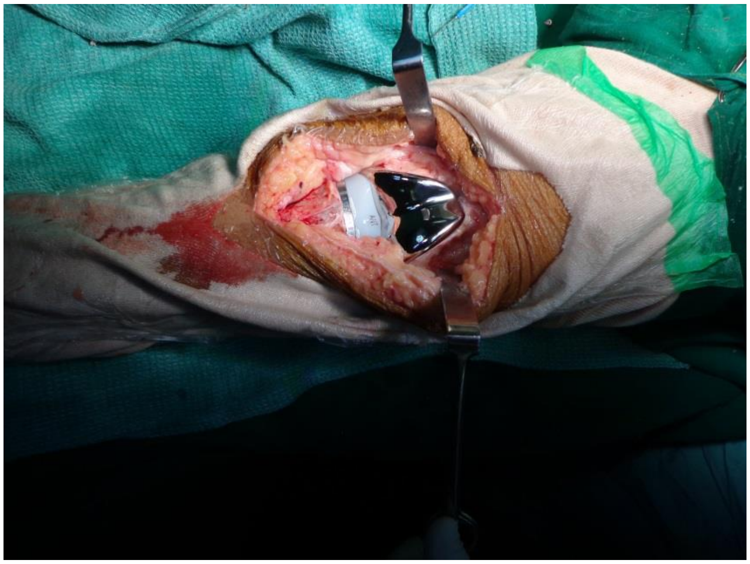
Following are radiographs of the same patient at follow up in antero-posterior and lateral views.

Fig. 45(C,D)



3. Following is an image taken intra operatively during surgery done with LCS implant for total knee arthroplasty.

Fig. 46 (A,B,C,D)



4. 29 year old lady presented with bilateral knee rheumatoid arthritis for which she underwent bilateral TKR. Pre op range of movement was 5°-100° of flexion. Post op, flexion was upto 120°. Following is a clinical image of a 6 year follow up of the patient with rheumatoid arthritis, who underwent bilateral TKR with LCS implant.

   Fig. 47(A,B)

DISCUSSION

DEMOGRAPHIC DETAILS:

36 patients(63 Knees) followed up out of 150 patients (225 knee) from 2001to August 2009. who underwent total knee replacement with mobile bearing (LCS). Our study follow-up is approximately 24 %. In the study done by Vogt et al .39 out of 101 patients (38%) were followed up at 10 years(44).Another study was done by Maniar et al where 37 patients out of 45 patients (80%) were followed-up at 10 years(8) Most of the patients underwent bilateral total knee replacement and 9 underwent unilateral knee replacement (left = 6 and right = 3). The low percentage of follow up in our study probably because 15 out of 150 patients (10%) are currently elderly (>80 years) and 5out of 150 patients (3%) are foreign patients. It is a significant finding to note that 100 out of 150 patients (66%), 165 out of 225 knee (73%) are from West Bengal, Bihar, Delhi, Jharkhand and Orissa with a distance ranging approximately from 1800 kms to 2500 kms from Vellore. This long distance would have made it difficult for patients to come back for follow up.

Average duration of follow up of patients was 80.2 months. Minimum follow up was 60 months and maximum was 156 months. The mean age of patients was 62.71 years. Youngest patient was 35 years old and the oldest was 81 years old. In our study 30 out of 36patients (83%) underwent total knee replacement for osteoarthritis and 6 out of 36 patients (17%) underwent TKR for rheumatoid arthritis. Vogt et al reported that 113 out of 126 (90 %) had presented with osteoarthritis and 13 out of 126 patients (10 %) were with rheumatoid arthritis(44). Maniar et al reported that 30 patients out of 35 patients (85 %) presented with osteoarthritis and rest 5 patients (15 %) presented with rheumatoid arthritis(8)

In our study 31 out of 36 patients (86 %) were women and 5 out of 36 patients (14 %) were men. Vogt et al study had 76 out of 101 patients (75 %) women and rest 25 (25 %) were men(44).

9 out of 36 patients (25%) needed blood transfusion post operatively, all of whom had undergone bilateral total knee replacement.

In our study, 24 out of 36 patients (66%) were discharged in healthy condition at 14th post op days, 2 out of 36patients (5%) were discharged in less than 14 days, and 10 out of 36 patients (27%) were discharged after hospital stay of more than 14 days. Among the patients discharged after 14 days, one patient developed hypotension and tachycardia, for which he was shifted to surgical ICU for monitoring and 2 patients were developed erythema and redness around post operative site and rest of patients discharged delayed due to medical comorbidity like diabetes mellitus.

Age increase showed a decrease in Knee Society Score and Functional Score, but no statistical significance was found.

In our study increase in BMI was associated with decreased Knee Society Score and Functional score, but it was not statistically significant. Body Mass Index and mobility had shown poorly significant negative correlation(44)

KNEE SOCIETY SCORES:

In our study there was considerable improvement in the American Knee Society Score post operatively as compared to calculation done pre operatively. The average pre-operative score was 51.35 for right TKR and 53.3 for left TKR. The average post-operative score was 89.52 for right TKR and 91.84 for left TKR. There was a significant improvement in the knee society score after TKR. Pain, range of motion, and stability were taken into consideration for assessing the Knee Society Score after TKR, and was found to show a significant improvement in score. (p=0.000)

Sanchez-Sotelo et al found that in their study of 101 patients following knee replacement, the average post operative Knee Society Score was 78.

Vogt et al followed up 36 patients who underwent mobile bearing TKR for a mean of 11.4 years, wherein they found that the average post operative Knee Society Score was found to be 78(44).

Trieb et al in their follow up of patients who underwent TKR for rheumatoid arthritis for a mean of 11.2years, found that the average Knee Society Score was 77.2(45).

Maniar et al in their study of mid term results of 45 patients who underwent TKR done with LCS implant in the Indian scenario, found that mean pre op Knee Society Score was 33, which improved to 91 postoperatively(8). This is comparable to our results .our study

average pre-operative score was 51.35 for right TKR and 53.3 for left TKR. The average post-operative score was 89.52 for right TKR and 91.84 for left TKR

FUNCTIONAL SCORES:

In our study there was improvement in the functional knee score post operatively. The average pre op functional score was 35.85, and average post op score was found to be 95.14 showing very significant improvement. Mobilisation of the patient and use of ambulatory aids were taken into consideration in assessing the scores. There was considerable improvement in the scores after TKR. (P=0.000)

Sanchez- Sotelo et al studied results of 101 low contact stress TKR(41). They found that post operative average functional knee score was 93, which is comparable with our results. Vogt et al in their follow up of patients who had undergone TKR found that the average post operative functional score was 66(44)

Sharma et al in their study of surgeries for patients who underwent TKR for rheumatoid arthritis found that the mean clinical and functional scores were 90 and 59(46). Trieb et al in their follow up of patients, who underwent TKR for rheumatoid arthritis for a mean of 11.2years, found that the average functional score was 75.3(45).

Maniar et al in their study of mid term results of 45 patients who underwent TKR done with LCS implant in the Indian scenario, found that mean pre op functional score of 45, which improved to 76, postoperatively(8).

POSTERIOR CONDYLE OFFSET

In our study shows the average posterior condyle offset pre operatively for the right and left sides were 29.08 and 29.90 respectively. The average offset post operatively was found to be 30.56 and 31.11 respectively for right and left TKR. There was significant increases post operatively as compared to pre op, (P=<.001 for right side, and p=<.001 for left side) but no correlation between posterior condyle offset and knee range of movement or knee society score was found.

Ishii et al studied correlation of post operative posterior condyle offset medially and laterally though CT scan imaging and correlated it with x-ray findings, and found no significant correlation. In their study, the pre op mean posterior condyle offset was 29.9 and post op it was a mean of 30.0(40).

Kim et al studied 45 TKR surgeries in 35 patients, to determine the effect of the posterior condyle offset on maximum flexion at the knee in PCL sacrificing TKR, and found that there was a significant relation between them. Their mean pre op posterior condyle offset was 24.78, and mean post op value was 28.11. They found no significant relation between posterior condyle offset and the maximum flexion angle at the knee(47).

Geijsen et al study shows that increase or decrease in posterior condylar offset had no significant influence on range of movement or knee society score(48).

Bauer t et al study shows that no correlation was found between the posterior condylar offset and the postoperative knee flexion(49).

JOINT LINE

In our study the average joint line pre operatively for right and left sides was 27.18 and 26.75 respectively. Post operatively average was 29.8 and 28.72 respectively for right and left TKR. There was significant elevation of the joint line post operatively following TKR.

(P=0.001 for right side, and < 0.001 for left side). None of the patients had chronic instability.

Porteous et al reported that the joint line was restored to within 5mm of the pre op height in 64% of their patients, with an elevation of more than 5mm as compared to the pre op height in 36%, in their study on patients who underwent revision knee replacement(43)

Konig et al studied the joint line elevation in patients who underwent revision TKR and found that elevating joint line by 10mm, led to a rise in contact forces at the patello-femoral joint by 60% of the body weight while climbing stairs, and by 30% while walking normally(39).

COMPLICATIONS:

- In our study no patient developed either superficial or deep infection. In our study 3 out of 36 patients {3 out of 63knees} (4.7%), developed erythema, redness. Out of three patients two patients developed erythema and redness of the operative site during immediate post-operative period and resolved within 48 hrs after treatment with intra venous antibiotics. One patient presented with erythema and redness of the operated knee joint after 6 years of the surgery and resolved within 48 hrs with intra venous antibiotics after admission. All three patients were discharged after symptoms resolved. None of them required further surgical intervention. Sanchez-sotelo et al study shows no early superficial or deep infection but 1 out of 101 patients reported deep infection requiring surgical management after nine years of implantation(41). Vogt et al study shows 1 out of 101 patients reported with infection at 2 years postoperative period(44).

In our study 4.6 % (3 knees out of 63 knees) complained of anterior knee pain.

Maniar et al reported the incidence of knee pain at final follow up was 2 knee out of 44 knees 4.9%(8). Vogt et al reported that 3 out of 39 patients (7.6%) complained of pain and patellar instability(44).

In our study none of the patients had periprosthetic fractures, thromboembolic events, patellar dislodgement, meniscal dislocation, catastrophic wear.

Sanchez-Sotelo et al in their cohort found the following rates of complications: 0.99% rate of infection, 0.99% supra condylar femoral fracture, 0.99% patellar component dislodgment, 1.98% meniscal dislocation, 0.99% catastrophic wear, 1.98% progressive osteolysis(41).

Vogt-Saarbach studied 126 LCS implant TKR with a mean follow up of ten years, in which they found the following complications: deep vein thrombosis in 12 patients, knee stiffness in 7 patients, hydathrosis in 3 knees, patellar instability in 3 patients, supra condylar fracture in 2 patients, aseptic loosening of tibial component in 1 patient, and 3 instances of mechanical failure of implant(44).

Maniar et al in their study of mid term results of 45 patients who underwent TKR done with LCS implant in the Indian scenario, found following complication rates: spinout was 1.8%, anterior knee pain in 4.9%, no evidence of osteolysis in an average duration of follow up of 12.3 years(8).

Buechel -Pappas in their ten year study of mobile bearing TKR with average follow up of 7.6 years, done on 357 knees, found the following complications: 1 patient had dislocation (0.7%) in the patients who had undergone meniscal bearing cemented TKR, and 7 dislocations (3.2%) in patients who underwent rotating platform bearing implants among the rest of the 208 patients(50).This study demonstrated that mobile bearing platform was more efficacious as compared to rotating platform bearing implants.

Callaghan et al studied the clinical results of mobile bearing TKR, and reported the following data: 10 year survivorship rate was reported to be 95%-97% for unicompartmental replacement done with Oxford prosthesis(13). Low contact stress menisceal bearing prosthesis showed a survivorship of 98% after six years and at eight years, it was found to be 94.6%. 95%-100%

survivorships after 12 years follow up of low contact stress TKR with rotating platform type of implants.

Following figure shows a plain radiograph lateral view of a knee post TKR, showing osteolysis around the implant:

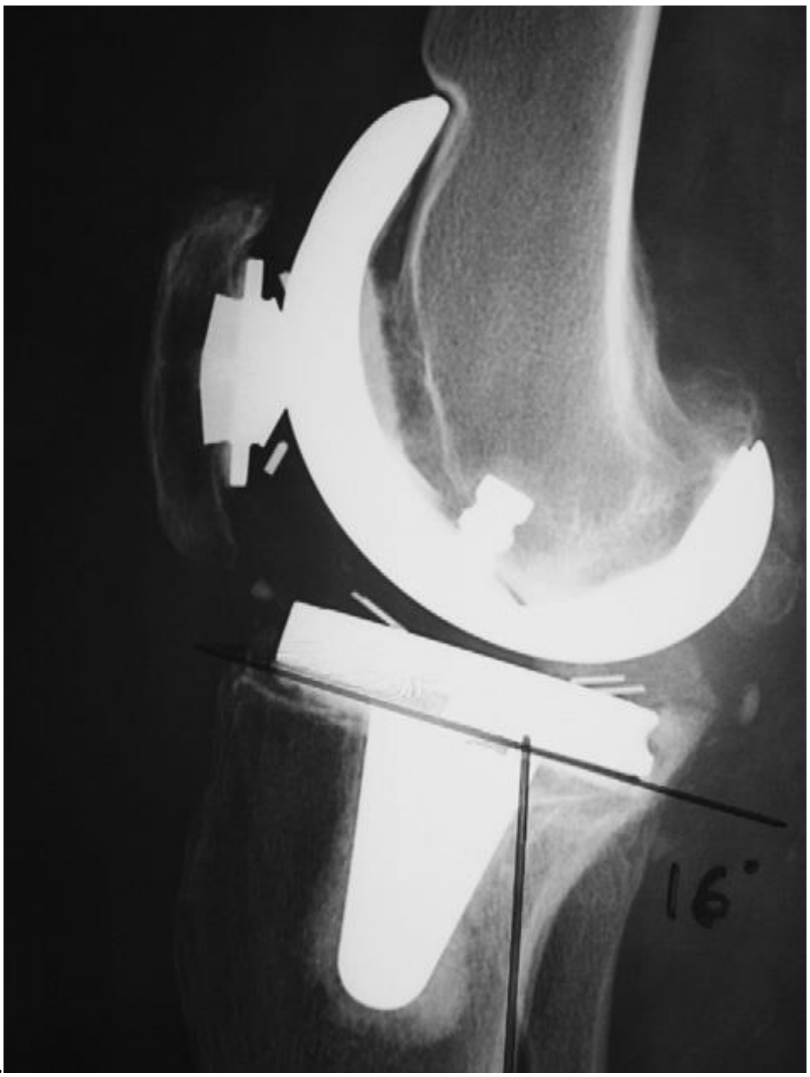


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Fig-47

DATA FROM OTHER STUDIES

S.No.	***Name of study***	***No. of subjects***	***Results***
1.	Buechel and Pappas(12)	338 knees; 10 year follow up	231 showed excellent results 87 showed good results
2.	**Stiehl et al(11,35,51)**	**191 knees** **Average follow up 68 months**	**Pain was absent in 94%** **Range of movement averaged 120° for meniscal bearing TKR and 108° for TKR with rotating platform**
3.	Jordan et al(36)	473 cementless cruciate retaining LCS Average follow up of 5 years	Mechanical failure occurred in 3.6% Dislocation occurred in 2.5%
4.	**Sorrels et al(11)**	**525 knees** **13 years follow up**	**Revision rate was 5%** **Tibial component exchange rate 2%** **Average knee society score was 91**
5.	Callaghan et al(52)	114 patients Followed up for 9-12 years	Average American knee society score was 90 Average functional knee score was 75

			Average active range of motion was 102°
6.	**Keblish et al(35)**	**53 patients with LCS**	**Good to excellent in 94% patients**
7.	Sharma et al(46)	63 knees Mean follow up of 12.9 years	Clinical and functional scores were 90 and 59 respectively Range of movement was 104°
8.	**Rodriguez et al(53)**	**104 knees** **Average follow up of 12.7 years**	**Scores were excellent in 81%** **Fair in 16%** **Poor in 3%**

FACTORS AFFECTING PRE AND POST OPERATIVE SCORES

Bivariate analysis was done using Spearman correlation for finding correlation between age of patient and BMI with Knee Society Score and Functional Knee Score. There was no statistical significance observed. Age increase showed a decrease in Knee Society Score and Functional Score, but no statistical significance was found. Increase in BMI was associated with decreased Knee Society Score as well as Functional knee score, but it was also not statistically significant.

Greater duration of follow up was associated with lowered Knee Society Score and Functional score. Posterior condyle offset was not correlating with knee range of movement and knee society score.

CONCLUSION

1. Average age of patients who underwent TKR was 62.7 years.
2. Majority of the patients were female (86%).
3. Most patients were overweight and obese (82%)
4. There was significant improvement of American Knee Society Score ($P < 0.001$)
5. There was significant improvement of functional score ($P < 0.001$)
6. There was significant increase in the post -operative posterior condyle offset.
7. Posterior condyle offset pre op and post op showed significant improvement ($p<0.001$)
8. Joint line pre op and post op showed significant correlation ($P = 0.001$ and 0.000 for right and left TKR respectively)
9. In our study, there was no instance of loosening, instability. This was probably since most of the patients e follow up was only 60-80 months.

LIMITATIONS

1. Many patients from North India and, Bangladesh, and were not followed up.
2. Statistical correlation was not obtained between posterior condyle offset with age and BMI.
3. Statistical correlation was not obtained between joint line with age and BMI.
4. Post infection sample size was inadequate to be statistically significant.

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FUNCTIONAL OUTCOME OF MOBILE BEARING TOTAL KNEE ARTHROPLASTY A MINIMUM OF 5 YEARS FOLLOW UP STUDY

A dissertation submitted to the Tamil Nadu Dr. M.G.R Medical University in partial fulfillment of the requirement for the award of M.S (Orthopaedic Surgery) degree batch 2013-2015

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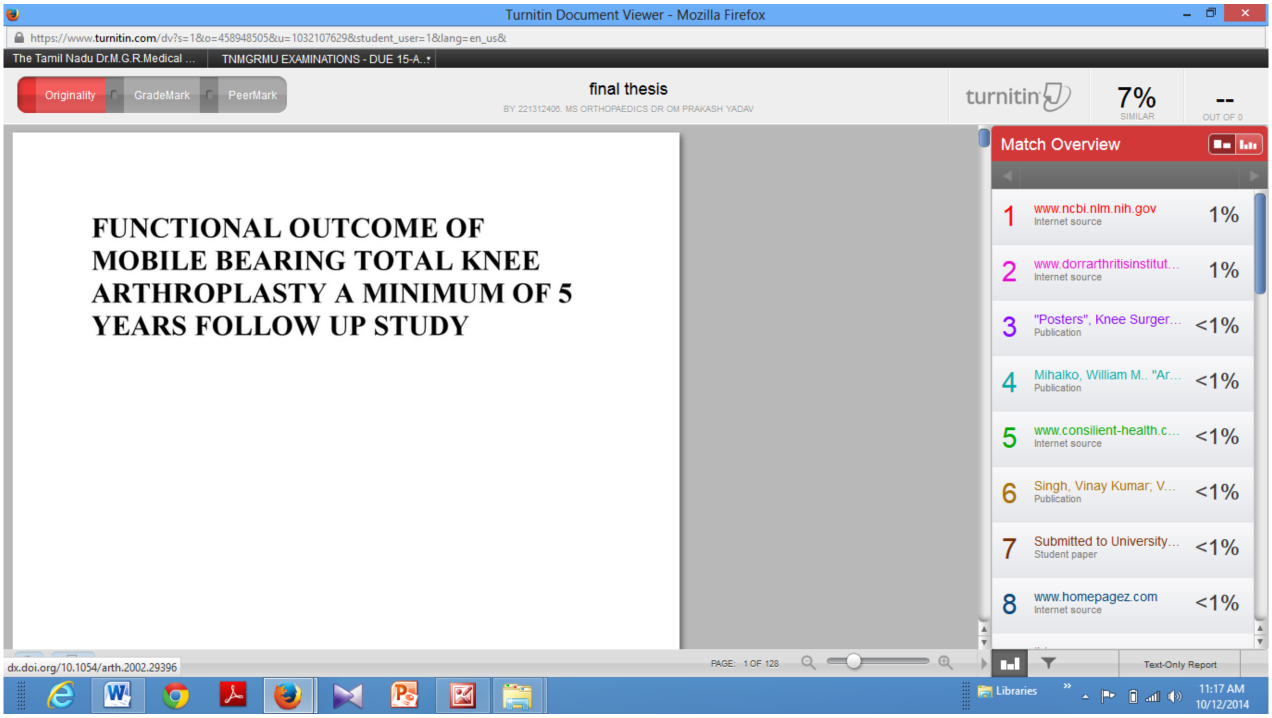
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APPENDIX 2

Proforma for assessing functional outcome of mobile bearing total knee arthroplasty for a minimum of 5 years follow up:

1. **Name:**
2. **Age:**
3. **Sex:**
4. **Duration of follow up:**
5. **Site of surgery:**
6. **BMI:**
7. **Duration of hospitalization:**
8. **Post op infection:**
9. **Need for blood transfusion:**
10. **Range of movement:**
11. **Varus/ valgus:**

APPENDIX 3: Characteristics of patients enrolled in the study

sno	hospno	age	hs	follow	sex	BMI	infectior	transfi	disease	kneel	kneer	kneeb	ksrpre	ksrpost	kslpre	kslpoost	fksbpre	fksbpost	jlrpre	jlrpost	jllpre	jllpost	corpre	corpost	colpre	colpost
1	482975c	56	14	113	2	25	2	2	1		2		38	88			25	90	25.1	32.54			35.58	25.76		
2	130808c	60	14	84	2	23	2	2	1			3	69	90	69	90	20	100	29.13	27.6	29.54	29.43	26.04	29.77	31.47	30.4
3	422282c	60	14	124	2	25.4	2	2	1			1			50	95	20	90			28.43	31.83			25.03	30.83
4	399641d	54	14	63	2	24.01	2	2	1			3	68	97	68	97	35	90	29.72	32.6	30.32	32.53	35.44	31.03	35.31	29.13
5	620134c	57	14	108	2	30.06	2	2	2			3	50	95	50	95	60	100	29.81	31	30.9	30.5	34.15	25.85	29.8	26.07
6	038730d	59	14	72	2	28.04	2	2	2				55	95	55	95	25	90	23.2	24.24	25.24	24.53	23.29	25.58	39.24	22.06
7	296402d	58	15	60	2	26.8	2	2	1			3	48	88	48	90	45	100	24.91	26.47	26.46	30.12	35.73	26.15	29.35	31.46
8	30549	67	14	96	2	32.08	1	2	1			3	56	95	56	95	45	100	24.23	29.08	27.02	25.65	35.84	33.88	35.66	35.29
9	961041c	70	12	87	1	28.5	2	1	1			3			45	92	25	100			29.07	29.91			34.93	32.52
10	910964c	54	14	76	1	35.8	2	2	1		2		28	84			50	100			22.04	27	38.84	29.43		
11	882739c	56	14	67	2	28.08	2	2	1	1					50	88	35	100			24.78	32.52			28.27	25.88
12	897995b	71	14	156	2	30	2	2	1	1					50	90	45	90			20.1	21.18			24.13	26.39
13	011568d	64	15	88	2	28.08	2	1	2			3	42	83	42	88	35	100	21.66	29.63	26.81	28.31	19.14	22.41	22.04	27.13
14	991829c	52	16	84	2	24.02	2	2	1			3	63	93	60	90	45	100	20.87	23.65	18.32	22.51	23.81	31.13	29.76	26.64
15	959420c	35	15	60	2	20.02	2	2	2			3	54	92	54	92	35	100	25.38	30.06	23.58	29.3	25.74	25.14	23.36	30.03
16	961041c	70	12	87	1	18	2	2	1			3	45	95	45	95	45	100	32.73	30.88	29.14	25.3	30.23	32.82	33.87	31.63
17	454678b	76	14	63	1	16.05	2	2	1			3	65	97	63	97	30	90	34.3	24.43	26.9	24.4	37.77	24.97	31.76	24.61
18	138307d	66	14	66	2	36.09	2	2	1			3	29	91	29	91	45	100	26.26	28.31	26.83	29.6	34.93	33.45	34.72	37.8
19	151149d	62	14	60	2	30	2	2	1			3	44	95	44	95	45	100	28.06	21.42	32.4	32.22	29.64	28.23	32.26	24.88
20	938270c	66	14	60	2	29.06	2	2	1				55	90	55	88	25	90	17.85	20.54	17.9	18.2	31.73	29.87	31.25	33.93
21	551509c	65	20	72	2	28.04	2	1	1	1			38	88	38	88	35	90	20	26.95	19.34	26.49	17.96	30	20.12	26.36
22	558459b	75	14	120	2	21.09	2	2	1			3	30	80	36	86	10	90	26.78	26.52	22.47	22.06	30.59	28.11	25.9	28.54
23	719395c	64	13	84		22	2	2	1			3	56	90	56	90	35	100	28.07	32.56	25.88	27.57	38.9	34.74	37.22	31.84
24	492489c	58	16	60		26.08	2	2	1			3	60	92	60	92	60	100	22.15	28.68	22.86	24.06	35.93	25.4	29.05	26.62
25	421522d	66	15	60	2	35.08	2	2	1			3	50	86	46	86	45	90	28.15	30.41	28.2	30.98	29	30.13	27.89	29.56
26		66	14	72	2	24.08	2	2	1		2		70	94			60	95	29.19	33.17			26.16	28.37		
27	544983c	62	14	115	2	36	2	2	2			3	55	93	49	93	25	90	28.16	32.35	29.59	30.01	35.63	32.63	29.9	32.6
28	807025c	62	15	96	2	26.07	2	1	1	1					48	96	25	95			29.1	31.58			38.48	43.93
29	181256c	65	14	75	1	25.08	2	2	1			3	50	97	50	95	55	100	29.76	33.46	29.37	29.76	29.94	32.81	25.99	31.06
30	857947c	62	18	94	2	28.08	2	2	1			3	67	92	66	97	25	90	27.38	29.4	28.48	30.69	36.46	25.09	44.63	31.25
31	483026d	75	14	60	2	29.04	2	2	1			3	53	86	53	86	10	90	31.03	32.44	29.35	31.49	28.24	33.17	27.8	32.76
32	406641d	62	14	62	2	29.04	2	2	1			3	70	92	70	90	50	100	30.16	32.26	31.19	33.86	34.72	27.44	24.05	26.62
33	899464c	63	14	68	2	18	2	2	1			3	42	42	90	90	35	90	33.05	38.52	33	38.13	35.8	33.07	35.8	31.01
34	338688c	81	14	72	1	24.01	2	2	1			3	56	95	56	95	25	95	33.12	37.77	32.59	37	35.34	30.25	30.09	34.68
35	958724a	63	7	90	2	26.05	2	2	1			3	46	92	46	92	25	90	25.94	29.05	25.63	29.15	28.2	23.43	28.91	23.52
36	182910d	56	14	76	2	28.02	2	2	2		2		40	88			35	90	29.52	38.04			23.66	31.45		

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May 27, 2014

Dr. Om Prakash Yadav
PG registrar
Department of Orthopaedics
Christian Medical College,
Vellore 632 004

Sub: **Fluid Research grant project:**
Research-Functional outcome of mobile bearing total knee arthroplasty a minimum of 5 yrs follow up study.
Dr. Om Prakash Yadav, PG Registrar, Dr. V. N LEE, Dr. Alfred Cyril Roy, Orthopaedics unit 1 and Spinal Disorders Unit, CMC, Vellore.

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Dear Dr. Om Prakash Yadav,

I enclose the following documents:

1. Institutional Review Board approval 2. Agreement

Could you please sign the agreement and send it to Dr. Nihal Thomas, Addl. Vice Principal (Research), so that the grant money can be released.

With best wishes,

Dr. Nihal Thomas
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ABSTRACT

Title of Thesis: Functional outcome of mobile bearing total knee arthroplasty a minimum of 5 years follow up study.

Department: Orthopaedic unit, Christian Medical College Hospital, Vellore

Name of Candidate: Dr Om Prakash Yadav

Degree and Subject: Masters in Orthopaedics (Two year, Post Diploma)

Name of Guide: Dr. Vernon N. Lee

AIMS: To evaluate clinical, functional and radiological outcome following mobile bearing TKR performed in Department of Orthopaedics Christian Medical College, Vellore, for a follow up period of 5 years or more.

OBJECTIVES:

To assess post op infection

To calculate duration of stay in hospital

To assess BMI

To assess need for Blood transfusion

To assess range of movement

To assess posterior condyle offset

To assess joint line

To assess alignment

To assess pain

To assess functional outcome with knee society score

METHODS: Retrospective observational study. Patients who had undergone mobile bearing TKR between 2001 and August 2009 were recruited into the study after informed consent. They were informed by telephone and post, to come for follow up in Ortho OPD. Their current clinical and functional scoring was calculated using the Knee Society Score. Plain Radiograph of knees, AP & lateral views were taken at the follow up visit and radiological assessment of the joint was done .Their pre op American Knee society score was obtained from the Inpatient chart of their admission for the operation. Other variables like Age of the patient, sex, occupation, duration of hospitalisation were also analysed during the follow up visit.

RESULTS AND CONCLUSION: Age increase showed a decrease in Knee Society Score and Functional Score, but no statistical significance was found. BMI was associated with decreased Knee Society Score and Functional score, but it was not statistically significant. BMI and mobility had shown poorly significant negative correlation. There was considerable improvement in the American Knee Society Score and functional score post operatively. No correlation between posterior condyle offset and knee range of movement or knee society score was found. There was significant elevation of the joint line post operatively. Very few patients developed erythema, redness and resolved after treatment with intra venous antibiotics.