

# TOTAL KNEE REPLACEMENT STEP BY STEP - FOR BEGINNERS

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## Introduction

With rapid advancement in technology and materials in total knee arthroplasty (TKA), long-term survival and function of the total knee are increasingly more dependent on optimum surgical technique. Adherence to basic surgical principles ensures a successful outcome. THE AIM OF THE SURGERY is to ensure a well-aligned, well balanced and well-fixed TKA. Ligament balancing is an integral part of TKA, and soft-tissue release should follow a functional and anatomic rationale to achieve correct alignment and ligament balance throughout the range of flexion and extension.

This article describes our institute's protocol for doing total knee arthroplasty.

## Pre-Operative Planning

*In the world of the joint replacement the majority of failures are the result of poor, inappropriate & inadequate or no preoperative planning - Sir John Charnley.*

Knee replacement success depends on:

- Restoration of mechanical axis
- Restoration of joint line
- Equal flexion and extension gaps
- Proper balancing of ligaments
- Restoration of patellofemoral alignment & mechanics
- Proper sizing of components
- Adequate ROM after surgery

### WHAT CAN BE PLANNED PRE OPERATIVELY?

#### THE FEMUR

1. The distal femoral cut
2. The entry point into the femoral canal
3. Adjustments for femoral bowing

#### THE TIBIA

1. The level of the proximal tibial cut and the slope

2. Alignment axis

#### THE PATELLA

1. The thickness of the patella and joint line

#### MISCELLANEOUS

1. The degree of release that needs to be done
2. The probable component sizes
3. The osteophytes that need to be removed
4. The quality of bone (osteoporosis)

#### X-RAYS TO BE TAKEN

- KNEE A-P: SINGLE JOINT WEIGHT BEARING
- KNEE A-P WITH FULL TIBIA: VARUS STRESS VIEW, VALGUS STRESS VIEW
- KNEE LATERAL IN 30° FLEXION
- SCANOGRAM: FULL LENGTH (LL) VIEW
- SKYLINE VIEW PATELLA

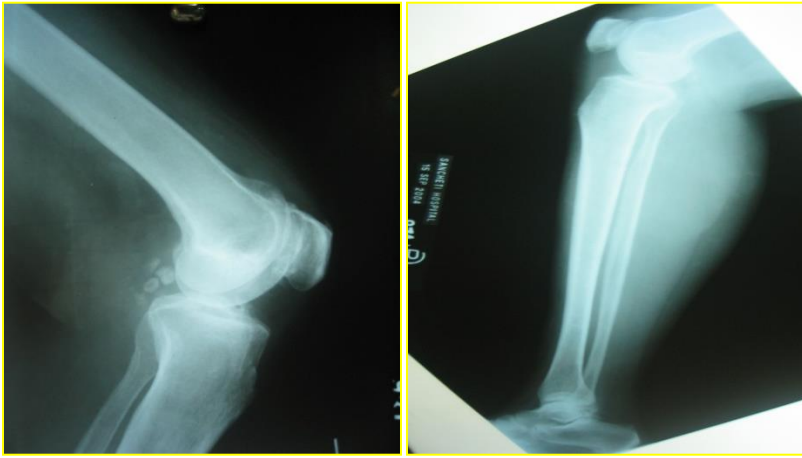
#### KNEE A-P: SINGLE JOINT WEIGHT BEARING VIEW:

1. Status of the laxity of the lateral collateral ligament in varus knees
2. The degree of deformity as seen when the knee is loaded (wt. bearing)
3. The osteophytes
4. Bone quality for osteoporosis



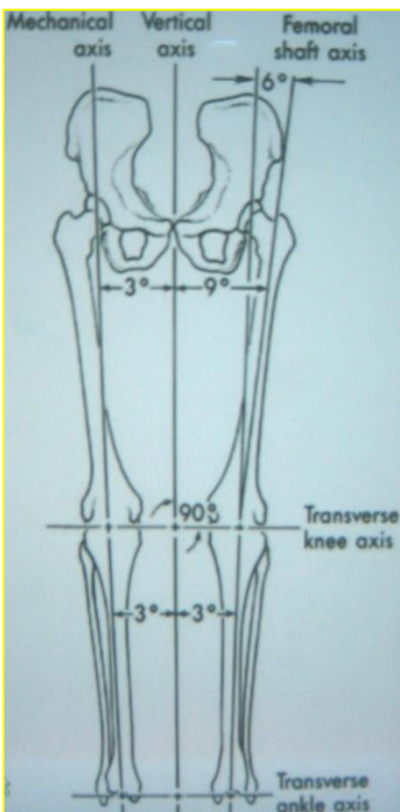
## KNEE LATERAL VIEW

- To calculate posterior slope
- Femoral bowing in sagittal plane
- Patella alta / baja
- Thickness of patella
- Patello-Femoral Compartment
- Patellar Osteophytes
- Posterior Osteophytes



## SCANNOGRAM - FULL LENGTH X-RAY:

- To find out mechanical & anatomical axis.
- To calculate deformity



On the evening prior to surgery a pre-op dose of antibiotic is given:

Inj Cefuroxime 1.5 gm

Inj Teicoplanin 400 mg

## **OPERATIVE:**

### **POSITIONING:**

1. Patient should be in supine position on the operation table
2. One L shaped side support supporting the thigh
3. One bolster to support the foot to maintaining the knee at  $90^{\circ}$  -  $100^{\circ}$  angle of flexion.
4. Tourniquet cuff to be apply upper side of the femur.



### **PART PREPARATION**

1. The limb is prepared by scrubbing with betadine solution and betadine scrub, starting from the knee.
2. The proximal level of scrubbing is up to the tourniquet
3. Distally up to the foot.
4. Foot area has to be prepared last and isolated with a sterile glove to avoid contamination.
5. Then the entire lower limb is painted with betadine and spirit.



## **DRAPING**

### **2 plastic sheets, 2 plain sheets, 1 O drape 1 sheet for screen**

1. First put one plastic sheet followed by draping sheet (disposable or reusable) under the prepared limb
2. Then one plastic sheet followed by draping sheet (disposable or reusable) on the upper side of the tourniquet. (Over the abdomen)
3. Clamp both the sheets with adhesive sticking or with the towel clip
4. Isolate the foot with a sterile glove to avoid contamination
5. The whole patient to be draped with sterile drapes.
6. Clean the surgical site with Ether.
7. Skin markings are made to facilitate closure.
8. Then final draping should be done with a disposable O drape.
9. The entire leg is then covered from thigh to foot with loban.
10. Apply the cautery wires, suction tubes, pulse lavage tubes on the draping sheets as per facility provided on the "O" drape

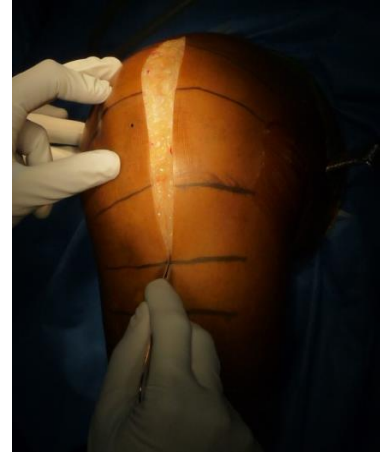


11. Drape one separate sheet which acts as a screen used for separating the anesthesia side from the surgical field.



## **INCISION & EXPOSURE OF THE JOINT**

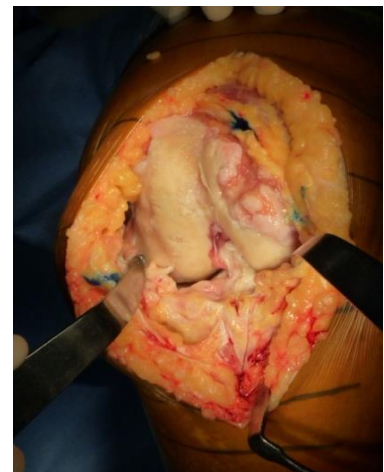
- 1. Anterior midline incision taken over the knee joint. Two retractors to be placed on the medial side only to facilitate subcutaneous dissection on the medial side only.**
- 2. Incision is taken with two different knives. The first knife with 23 no. blade for skin incision. The other knife is used for the subcutaneous dissection and arthrotomy.**



- 3. Medial Para-patellar arthrotomy done. Methylene blue marking done at suprapatellar level and at superior pole of patella to facilitate anatomical capsular closure.**



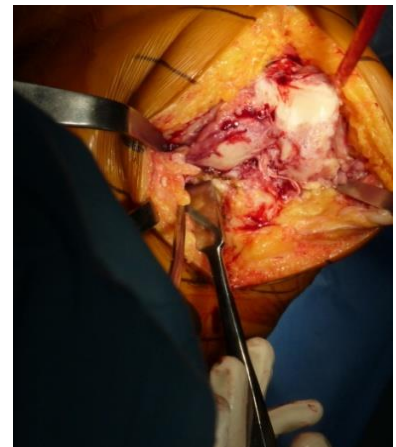
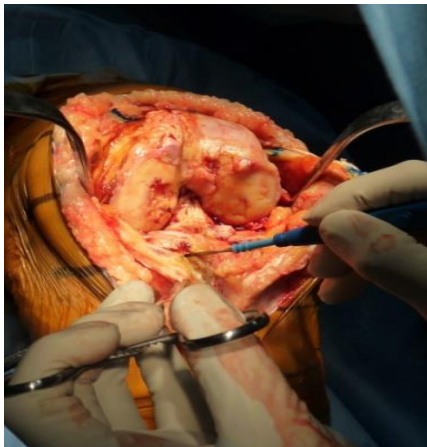
- 4. After exposing the joint, lateral bands are excised, Medial and Lateral spikes are applied to retract the soft tissue.**



5. **Excision of Hoffa's fat pad with knife. About 30% of the fat pad is excised.**



6. **Medial soft tissue release is done by sub-periosteally elevating the superficial MCL with the help of Kocher's forcep and cautery. Periosteal elevator is inserted beneath the superficial MCL to help expose the tibia. All the osteophytes around tibia are removed with the help of nibbler.**



7. **Knee joint is then flexed and anterior horns of both the menisci are excised. Intercondylar notch cleared by excising ACL and PCL in posterior stabilized knees.**

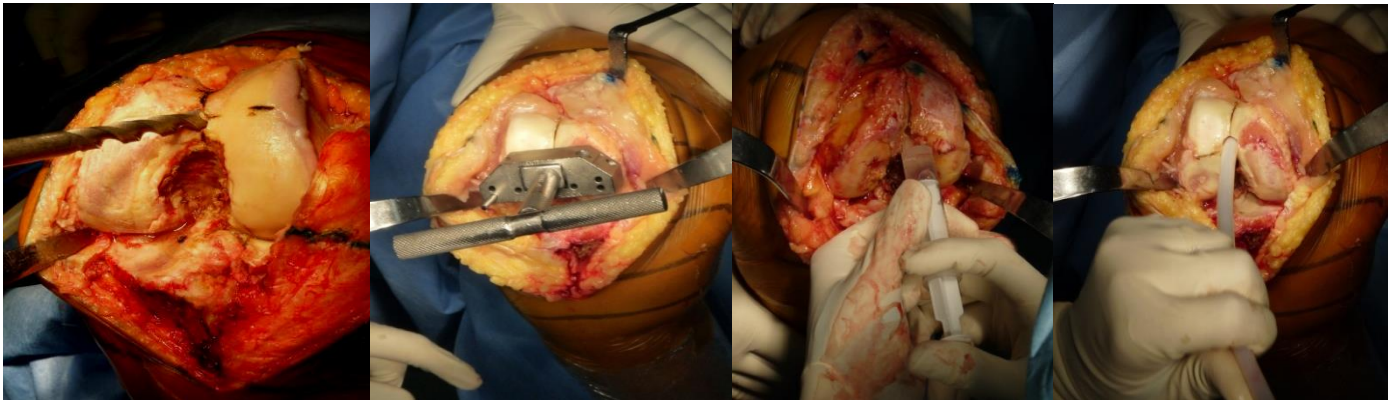




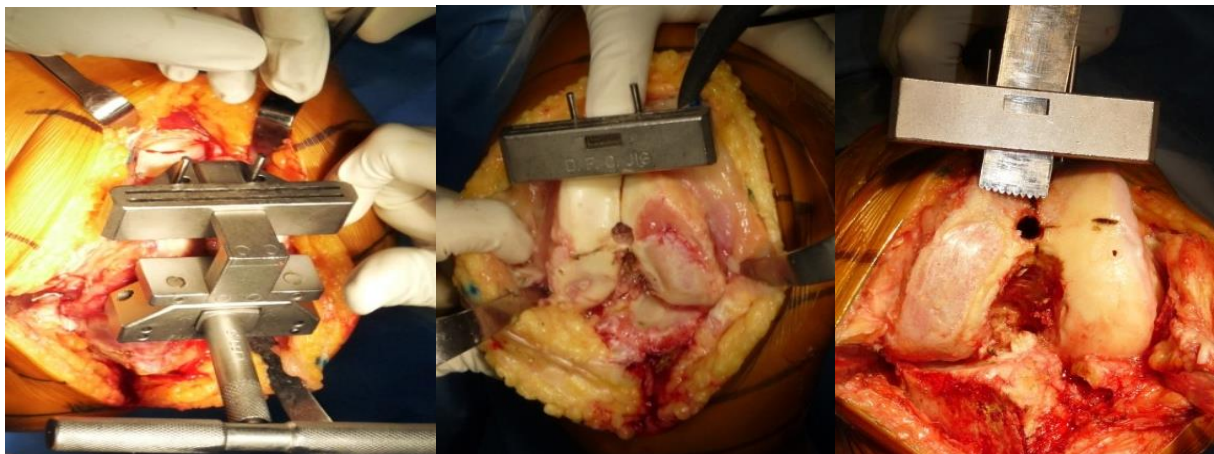
8. Whiteside's line and trans-epicondylar axis are marked using cautery



9. Using the pointed awl femoral canal entry point is marked at meeting point of the above lines. Using a reamer femoral canal is opened. Wash and suctioning done repeatedly at least 4 times to washout the medullary canal in order to prevent fat embolism.



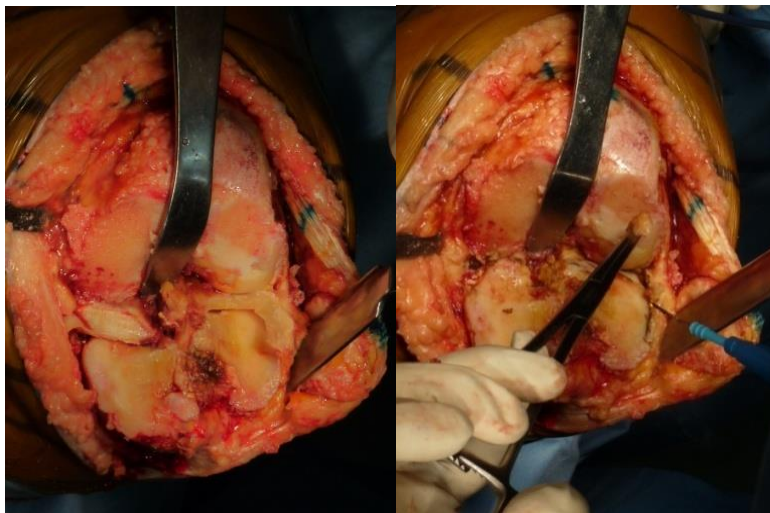
10. Use the valgus rod of the appropriate degree (decide on pre-op templating) for placement of the distal femoral cutting jig. Distal femoral cut jig fixed with pins (central holes) and distal femoral cut taken. 2<sup>nd</sup> assistant to hold the jig flush to the femur.



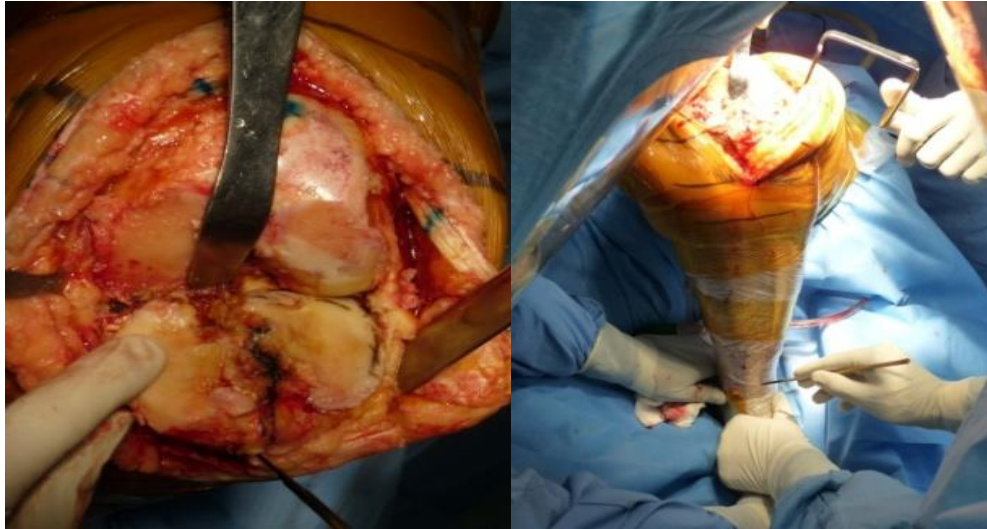
11. Measurement of the medial and lateral femoral cuts to confirm size of the cuts.



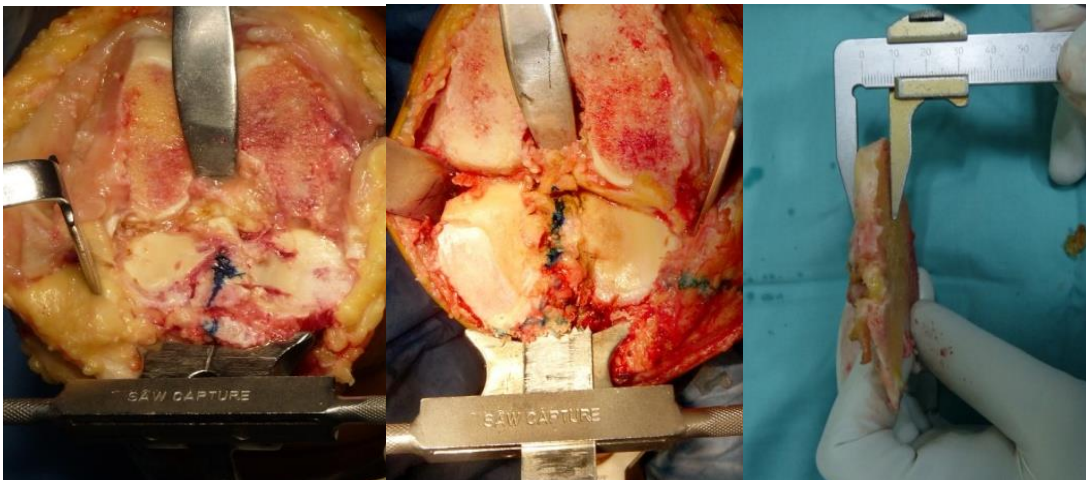
12. Dislocation of knee joint using the posterior spike (Ransall maneuver)  
Remnants of both the menisci and PCL are removed using the cautery.



13. Marking of center of tibia (just lateral to the spine) and center of ankle (1<sup>st</sup> assistant presses the medial malleolus and helps in finding the centre of the ankle) and draw a line connecting these 2 points

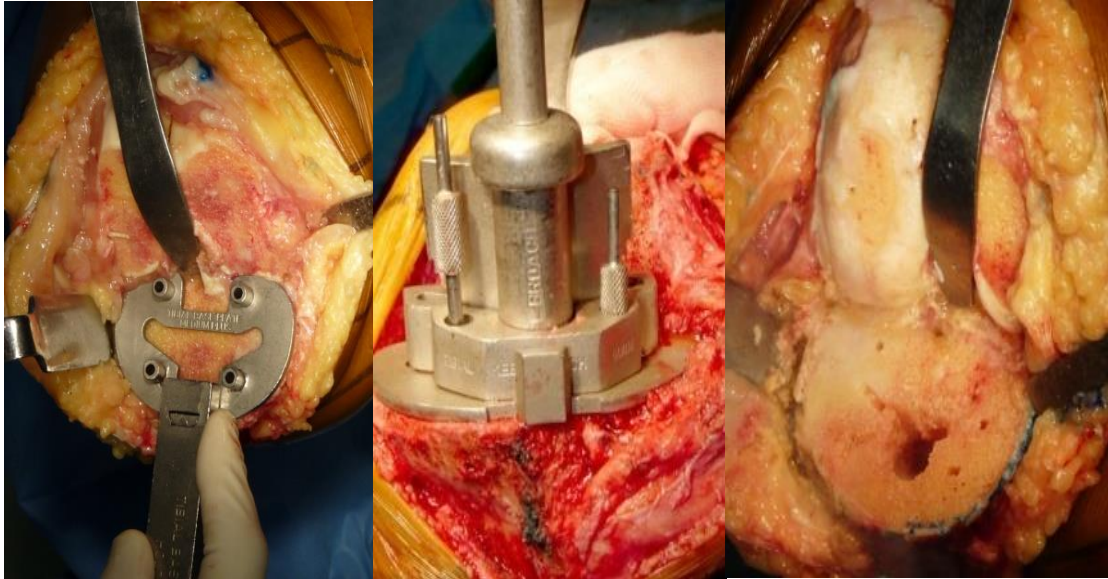


14. Proximal tibial jig applied at centre of the tibial marking. Slope and varus/valgus/neutral cuts are determined using this jig. Saw capture is applied and proximal tibial cut taken. Try not to extend the saw more postero-laterally to protect the popliteus. Measure the resected tibial portion.





15. Tibial sizer used and size of the tibial base plate is determined. Base plate is fixed and broaching done using appropriate size broach. Medial part of the tibia marked with methylene blue to nibble out the remaining medial osteophytes. If the bone is sclerotic multiple drill holes are drilled into tibia at this stage.

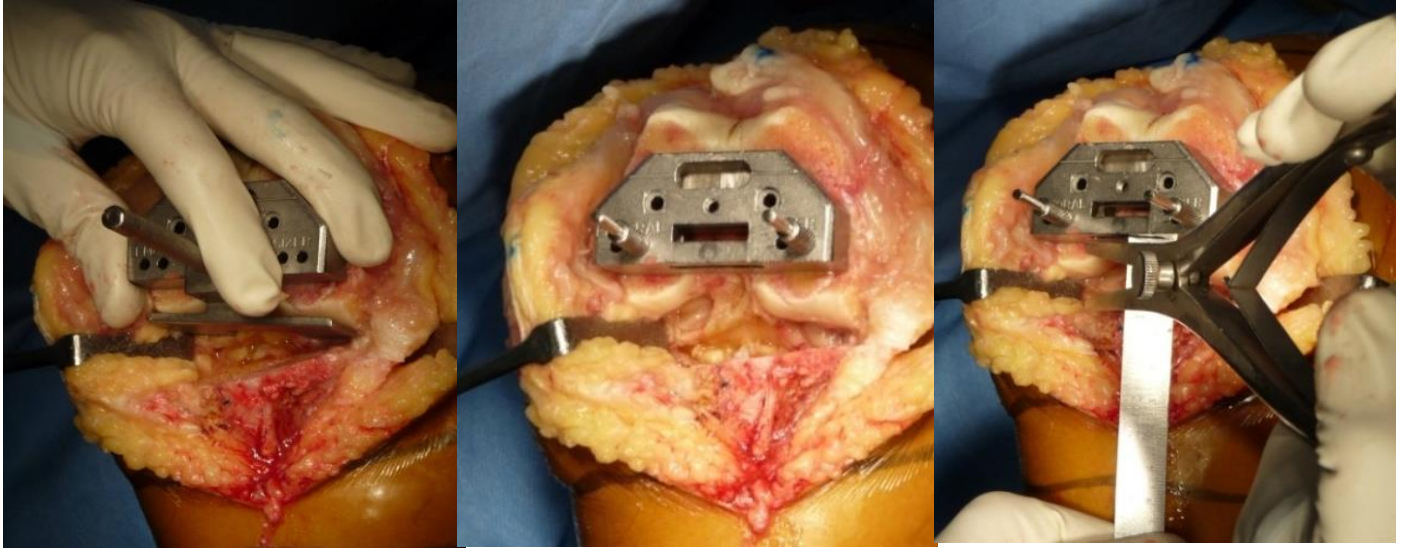


16. Limb is extended, traction given and femoral blocks (usually 10mm) used to assess gap in extension. If the gap is tight medially, then figure of 4 positions is given and postero-medial release of the tibia is done. Any osteophytes or tibial over hang is removed at this point. Reassess the extension gap using femoral block once the release is done.

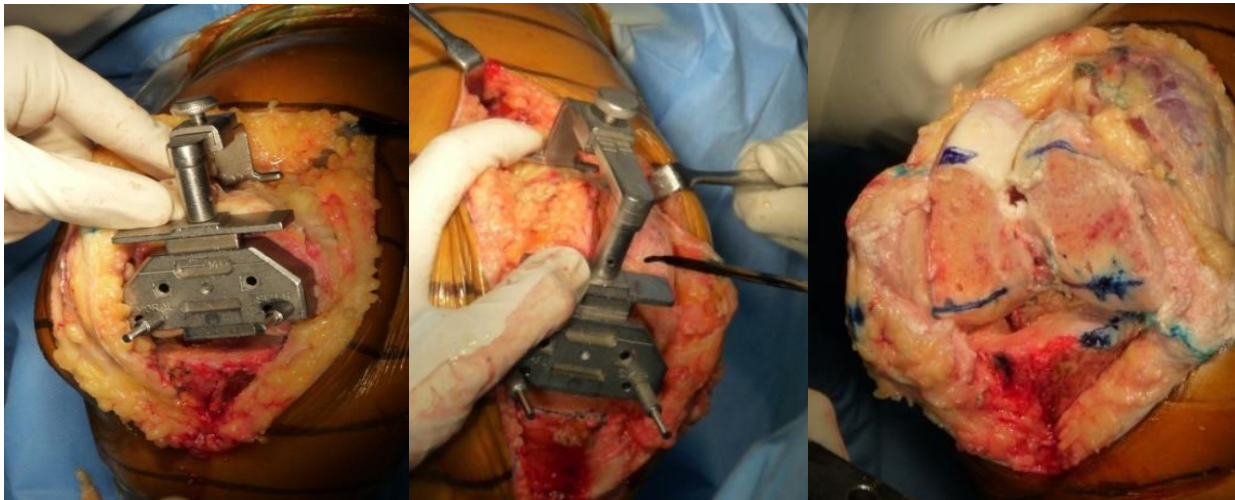




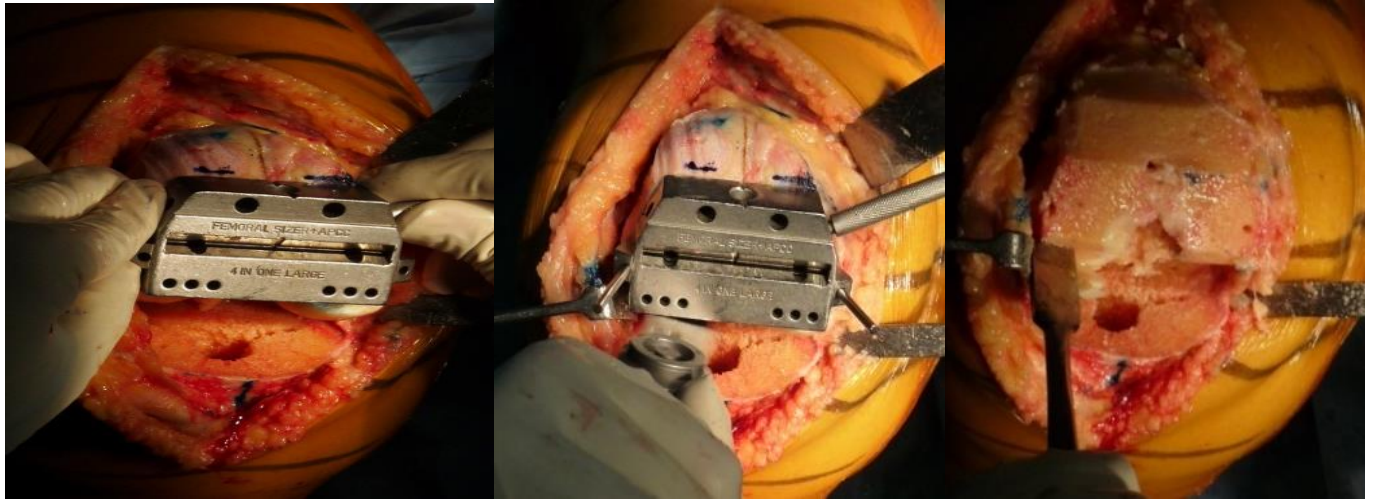
17. Femur lifted by 2<sup>nd</sup> assistant. 3 degree external rotation jig applied. Gap in flexion is assessed using laminar spreaders (GAP IN FLEXION = GAP IN EXTENSION) If the gap is not balanced then the external rotation of the femoral component is increased.



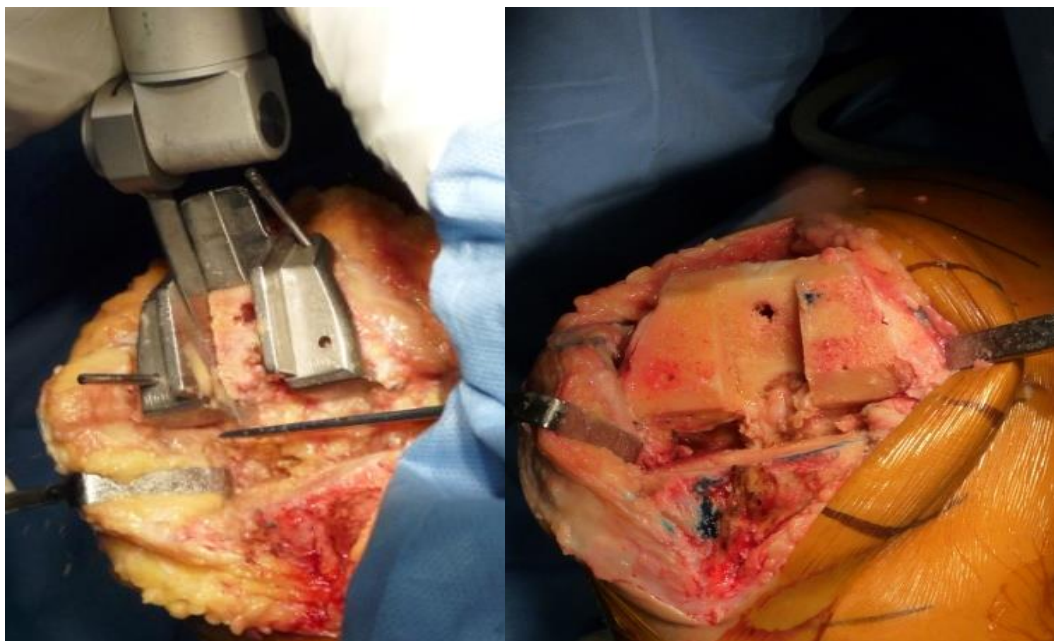
18. Anterior sizing of femur used and anterior referencing done. Size of the femoral component is determined. Markings of anterior referencing done with methylene blue



19. APCC jig is applied. Chamfer cuts are taken. Protect the popliteus laterally and MCL medially with help of protector while taking posterior cuts. Resected posterior femoral condyles removed with the help of Kocher and cautery

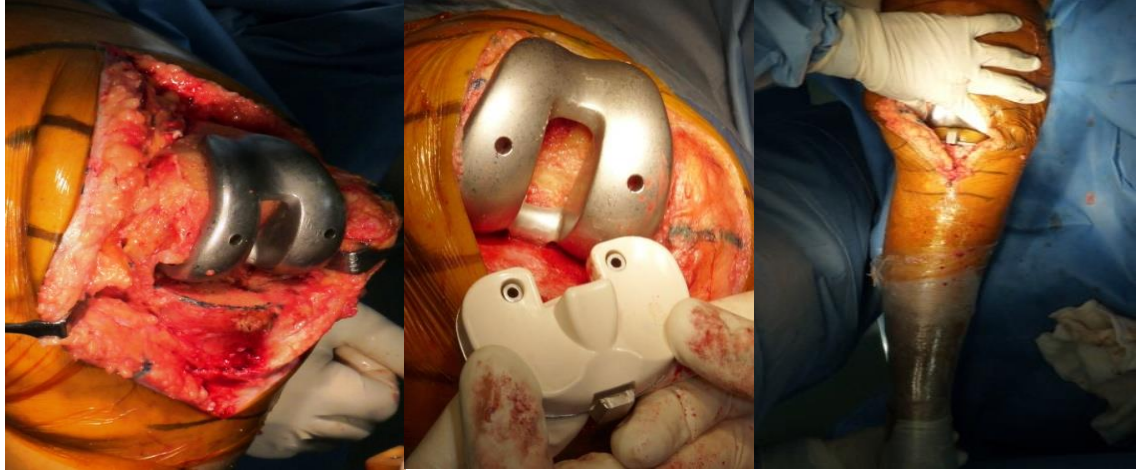


20. Notch cut jig is applied to distal femur (must be flush with the bone). Once the jig is fixed to the bone using a small oscillating saw notch cut is taken. Bone removed from notch cut is used as bone peg later on to close the femoral canal

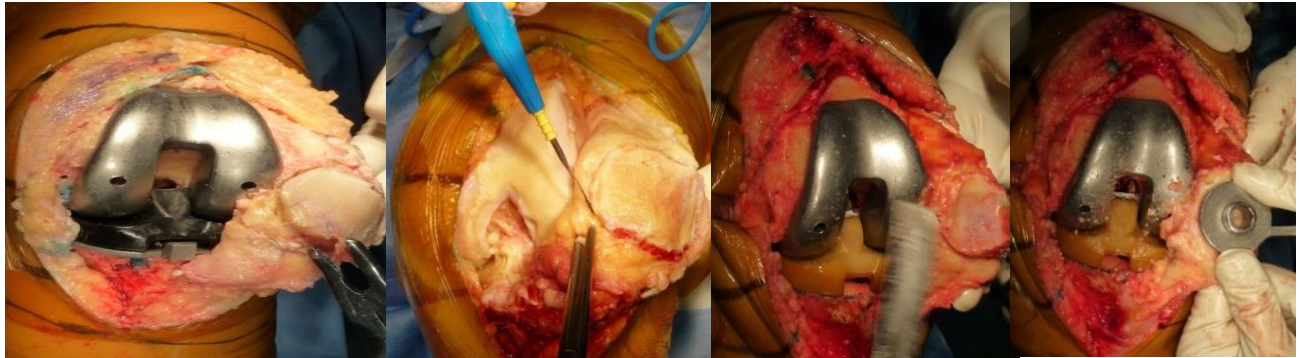




21. Femoral component trial fixed and appropriate tibial insert is used and checked in flexion and extension. A 2-4mm of opening on the medial side is acceptable (In Varus Knees)



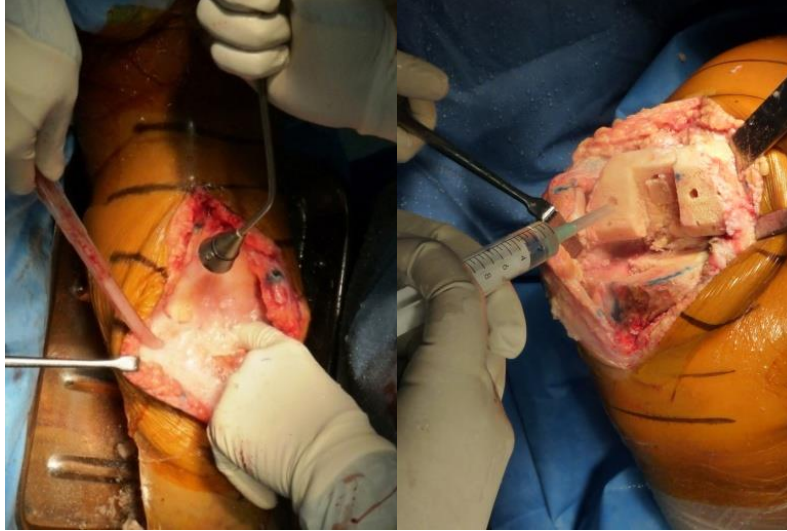
22. Patella everted in flexion and excessive osteophytes are nibbled. Denervation of patella done with cautery. 9 mm patellar cut taken (by eye-balling). Patellar sizing jig used to determine the size of the patellar component. Patellar component holes are drilled using the specified drill. Patellar button applied. Patellar tracking is checked using NO THUMB TECHNIQUE.



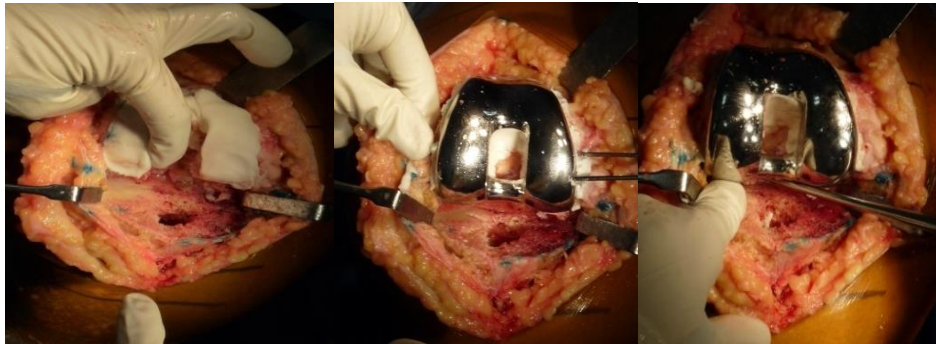
23. Once the size of components is fixed and knee is well balanced, then peg drills are drilled into the distal femur



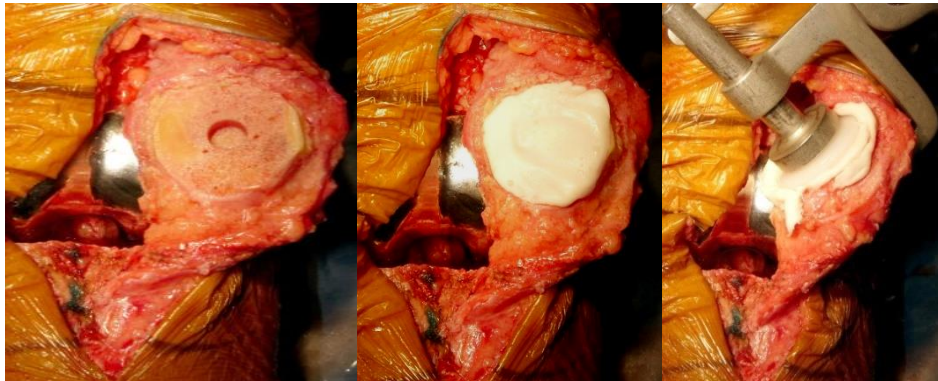
**24. Wash given in extension and flexion. Cement mixing is started at this point of time. Femur made completely dry and gentamycin applied**



**25. Cementing started after 3 -4 minutes of cementing time. Femoral component fixed and excessive cement removed after hammering the component**

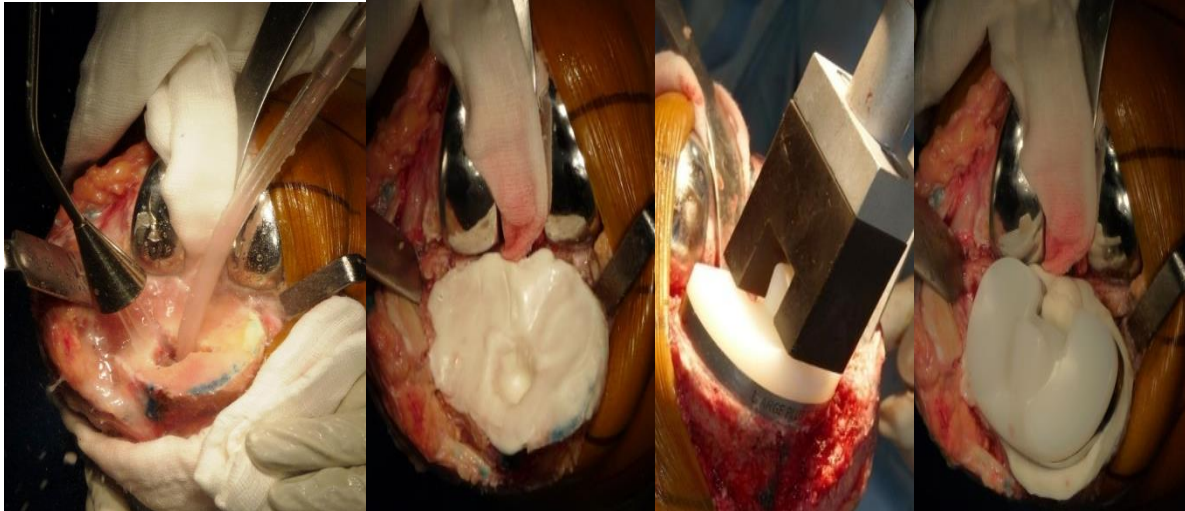


**26. Patella wash and cement application followed by fixation of patella in extension**

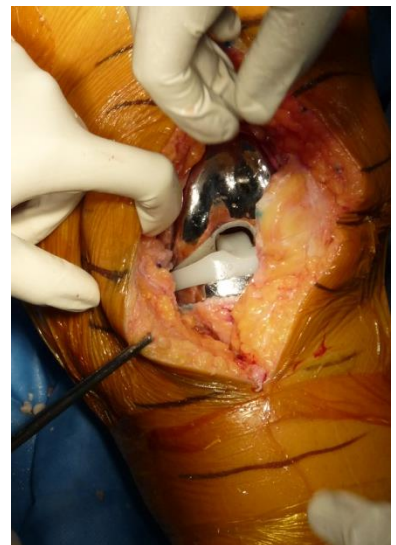




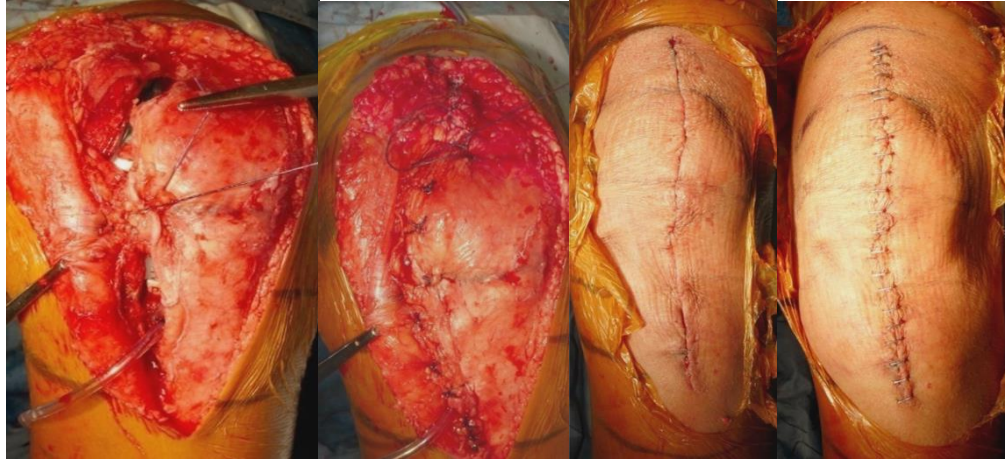
**27. Tibia wash done. Tibia made dry. Gentamycin applied. Cementing done and tibial component fixed to tibia. Excess cement is removed.**



**28. Knee joint reduced and final wash given**



**29. Capsule sutured with interrupted sutures, followed by continuous sutures. Negative suction drain is placed. Sub-cutaneous suture taken with the help of Vicryl 2-0. Skin closed using staples. Sterile dressing is done using Tegaderm. Suction is opened after 4 hours**



### **POST-OPERATIVE PROTOCOL:**

#### **Antibiotics:**

IV Antibiotics continued for 48 hours post-operatively then stopped (Inj Cefuroxime 1500 mg BD)

Then antibiotics are stopped.

#### **Anticoagulants:**

Inj Endoparinux 0.4/0.6 ml (depending on patients weight) given sub-cutaneously till patient is ambulated. (Usually we give it upto 5 days)

#### **Ambulation:**

Patient made to stand and walk on Post-op day1

**Physiotherapy:**

Knee ROM exercises, Static Quadriceps exercises, Hamstring exercises started on the evening of surgery once the anesthesia weans off.

**Supports:**

Walker for 2 weeks.

Tripod stick support after 2 weeks

By end of 1 month patient walks freely without any supports.

**Suture removal:**

Done after 2 weeks post-surgery depending on skin condition and wound healing.