

# CLINICAL AND OPERATIVE APPROACH FOR TOTAL KNEE REPLACEMENT

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# Evolution of TKR

- In 1860, Verneuil proposed interposition arthroplasty, involving the insertion of soft tissue to reconstruct the joint surface.
- Ferguson attempted resection arthroplasty for ankylosis or severe deformity caused by tuberculosis or infection. This procedure involved resecting cartilage from the knee joint and allowing knee joint movement along the subchondral surface.

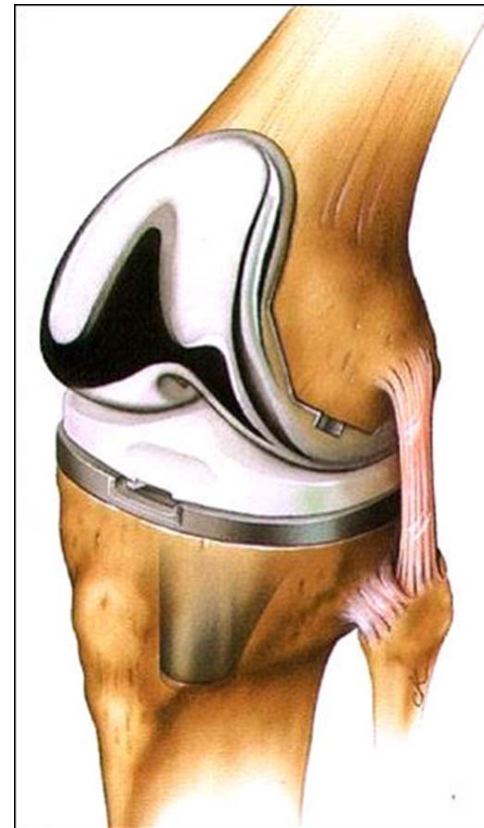
# Evolution of TKR (cont)

- 1940s- first artificial implants were tried when molds were fitted in the femoral condyle
- 1950s- combined femoral and tibial articular surface replacement appeared as simple hinges.
- simple hinged prosthesis cannot replace the complex movements of the knee joint and because of a high failure rate due to early loosening caused by overloading the prosthesis and bone contact surface or by infection.

# Evolution of TKR (cont)

- Frank Gunston(1971), developed a metal on plastic knee replacement.
- John Insall(1973), designed what has become the prototype for current total knee replacements. This was a prosthesis made of three components which would resurface all three surfaces of the knee - the femur, tibia and patella.

# knee prosthesis



# Common Conditions That Lead To TKR

- Severe OSTEoarthritis with varus/ flexion deformity is the main indication.
- It can be of two types :
  - Primary (idiopathic)
  - Secondary :Post traumatic arthritis
- Total knee replacement can be performed to correct mild valgus or varus deformity.

# Common Conditions That Lead To TKR

- Other causes include:
- Inflammation e.g., RHEUMATOID ARTHRITIS
- Trauma (fracture)
- Increased stress e.g., overuse, overweight.
- Infection
- Connective tissue disorders
- Inactive lifestyle e.g., Obesity, as additional weight puts extra force through your joints which can lead to arthritis over a period of time


# Selection criteria of patients for TKR


- Quality of life severely affected
- Daily pain
- Restriction of ordinary activities
- Evidence of significant radiographic changes of the knee



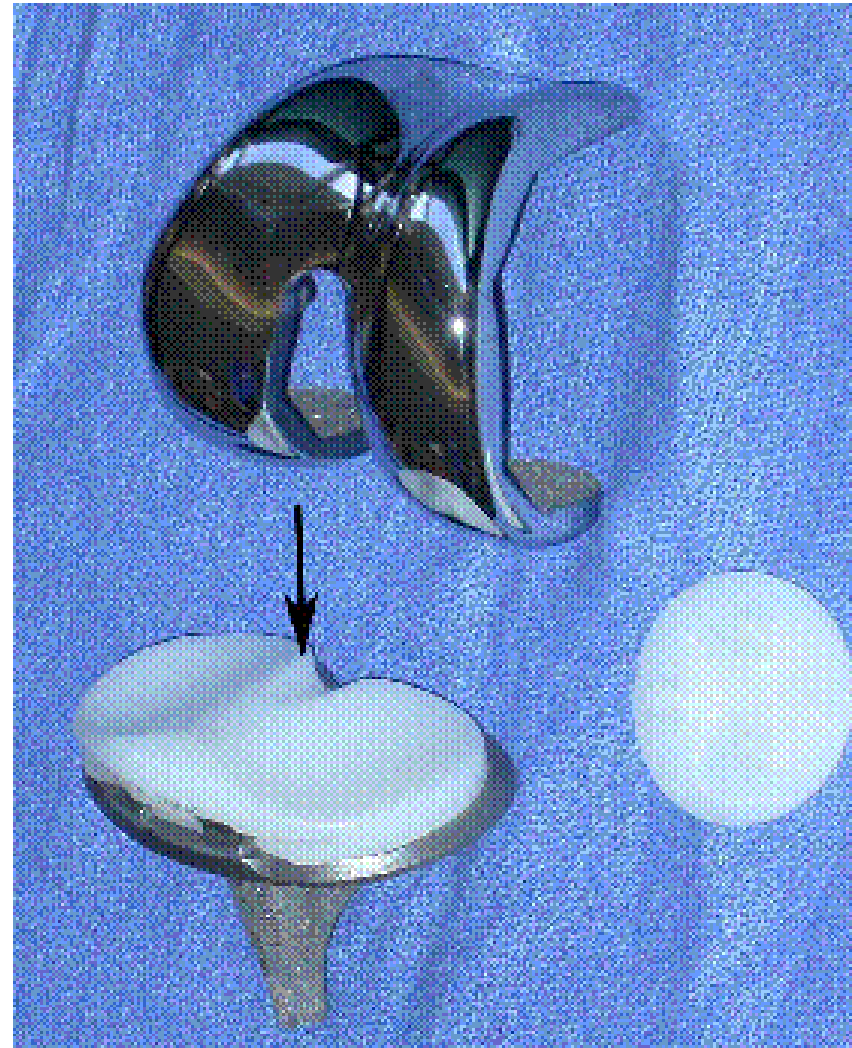
# Contraindications to TKR

- Infection
- Severe vascular disease
- Neuropathic joint
- Obesity
- Skin diseases

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- **Total knee replacements (TKR)** can be further categorized by mechanical stability into:
    - Non-constrained
    - Semi-constrained
    - Constrained or hinged
  - In most patients undergoing total knee replacement, the anterior cruciate ligament is no longer competent. During surgery it is removed. The posterior cruciate ligament (PCL) is frequently competent, and may be retained.

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- **Non-constrained or cruciate retaining prostheses** are designed to use the PCL, and referred to as PCL-sparing prostheses.
  - Non-constrained prostheses are highly successful and the most common type.
  - The components are not linked and rely on the patient's own ligaments and muscles for stability.


- *Non-constrained total knee prosthesis. The femoral and tibial components are independent of each other. A groove is present in the posterior aspect of the tibial prosthesis (arrow) for the native PCL.*



- **Semi-constrained or cruciate substituting prostheses** are used when PCL retention is not possible or if the surgeon prefers to remove it and use a more stable prosthesis.
- These prostheses have large central anterior tibial spine that articulates with a rectangular box-like opening between the condyles of the femoral component.
- The posterior portion of the box is formed by a transverse metal cam that prevents posterior tibial subluxation when the knee is in extension.

*Semi-constrained TKR viewed from the front, back and side.*



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- **Constrained or hinged prostheses** have tibial and femoral components that are linked together with a hinged mechanism.
  - They are used when the knee is highly unstable and the ligaments will be unable to support other types of prostheses.
  - Due to the higher amount of mechanical stress put on hinged prostheses, they are not expected to last as long as other less-constrained designs.

# *Hinged prosthesis*





# Complications—Postoperative

- **INFECTION :**
- Patients with rheumatoid arthritis , diabetes , weakened immune system have a greater risk of infection in the weeks following a procedure.
- An infection in another part of the body at the time of your knee operation—in the oral cavity, kidneys, or prostate could lead to an infection in the knee, even months or years later.

# Complications—Postoperative infection

- In rare cases, infection can occur at the site of the incision or within the prosthesis.
- Risk of infection, in the prosthetic joint persists for the **rest of the patient's life**.
- To reduce this risk, some patients who have undergone knee replacement surgery take preventive prophylactic antibiotic before future surgical or dental procedures.

# Complications—Postoperative infection

- Since the knee implant does not have its own blood supply, it is easier for microorganisms to attach to the device and infect surrounding tissues.
- The surfaces of the implant components are ideal for organisms to adhere to and multiply. Once they multiply, they create a bio-film that acts like a biological shield and protects them from antibiotics.

# Complications—Postoperative infection



# X ray findings in post-op infection of TKR

- It is hard to identify infection in early stages on x ray.
- Findings are :
- Peri implant osteolysis
- Implant loosening
- It may lead to implant failure



# ANTIBIOTIC PROPHYLAXIS

- CHOICE OF AGENT

Active against common pathogens

- Take into account drug allergy and sensitivity  
cefazolin/cefotaxim preferred-long duration.
- clindamycin/vancomycin in penicillin allergy pts.
- Modification according culture report.

- TIMING

Within 15-60 mins prior to incision

Vancomycin should be given 2 hrs before  
incision

Infusion should complete before incision

# Antibiotic bone cement

- Gentamicin and tobramycin are the most often used and studied antibiotic added to cement .
- Dosage : effective at doses of at least 3.6 g of antibiotic per 40 g of cement.

# OT requirements for TKR

- Minimize personnel traffic during operations
- **Vertical laminar air flow - The most efficient way of controlling microbe levels in an operating theatre**
- Laminar Air Flow means that the flow of air is continuous, steady, uni-directional and in parallel planes.
- Any contaminated particles will be carried away from the working area to the exhaust Point.



# Complications—Postoperative

- Other complications:
- Hypovolemic shock
- Atelectasis
- Pneumonia
- Urinary retention
- Infection
- Thromboembolism—DVT or PE
- Constipation or fecal impaction

# Complications specific to knee replacement surgery

- Injury to nerves or blood vessels in the leg
- loosening or dislocation of the prosthesis
- difference in leg length following the surgery
- stiffness in the joint
- pain that persists or worsens after surgery
- allergic reaction to the cement used to affix the prosthesis

# Surgical technique

- The knee joint is usually approached anteriorly through a medial parapatellar approach.
- Bone cuts in the distal femur are made perpendicular to the mechanical axis, typically using an intramedullary alignment system (which is then checked against the center of the hip)
- The proximal tibia is cut perpendicular to the mechanical axis of the tibia using either intramedullary or extramedullary alignment rods

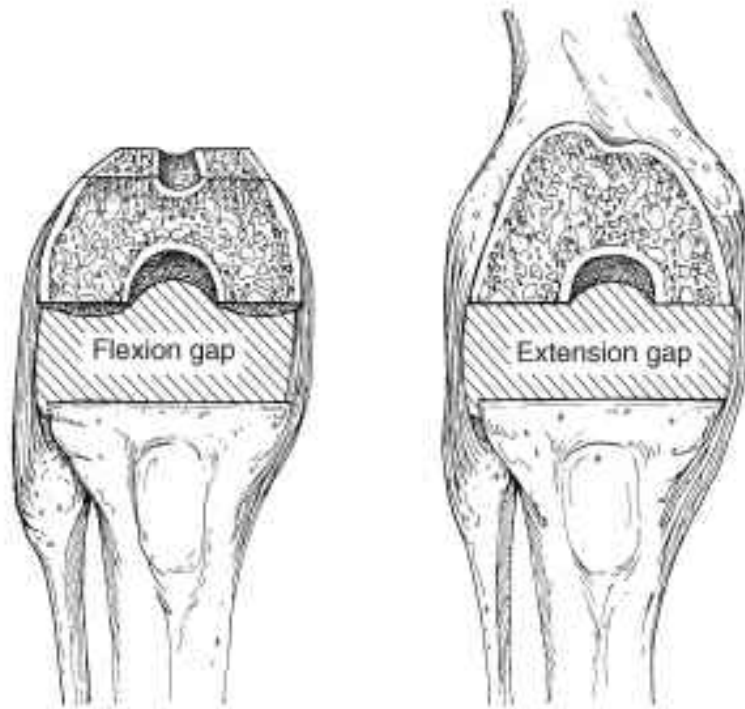
# Surgical technique


- Restoration of mechanical alignment is important to allow optimum load sharing and prevent eccentric loading through the prosthesis
- Sufficient bone is removed so that the prosthesis recreates the level of the joint line
- Ligaments around the knee that are contracted because of preoperative deformity are carefully released in a stepwise fashion

# Surgical technique

- If the patellofemoral joint is significantly diseased, it can be resurfaced with a polyethylene button
- Once the definitive prosthetic components have been selected, they are cemented into place with polymethyl methacrylate cement
- Foot pulses are checked at the end of the procedure

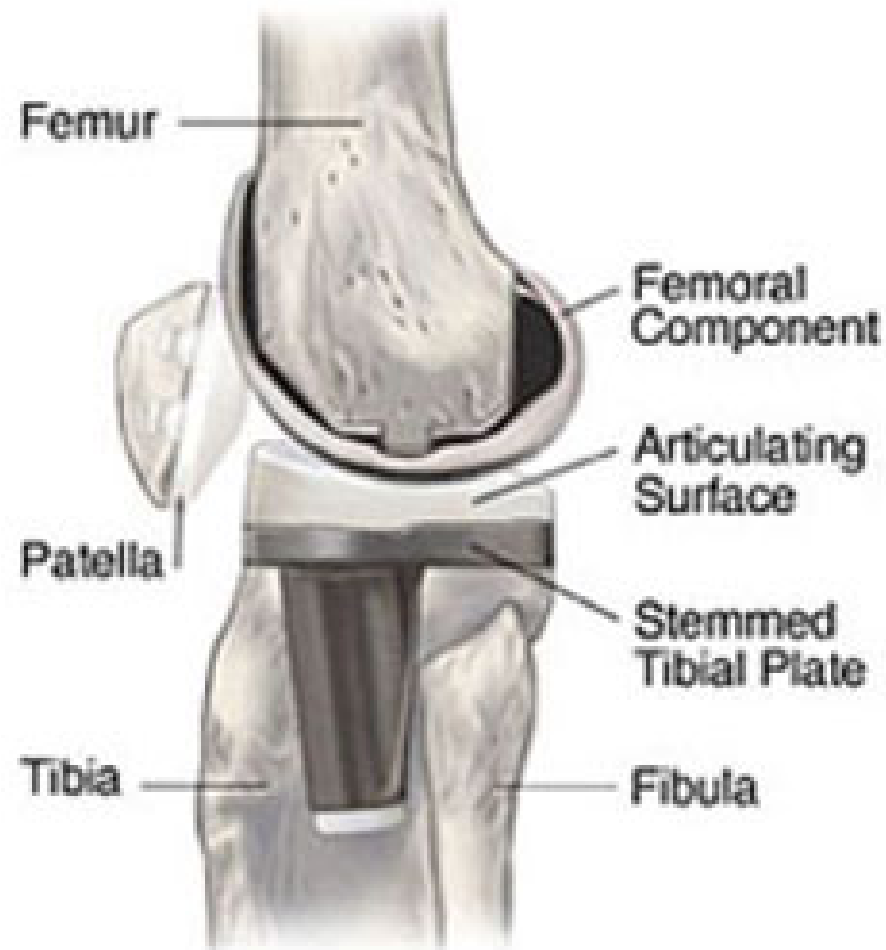
- The flexion and extension gaps should be equal and rectangular in shape.
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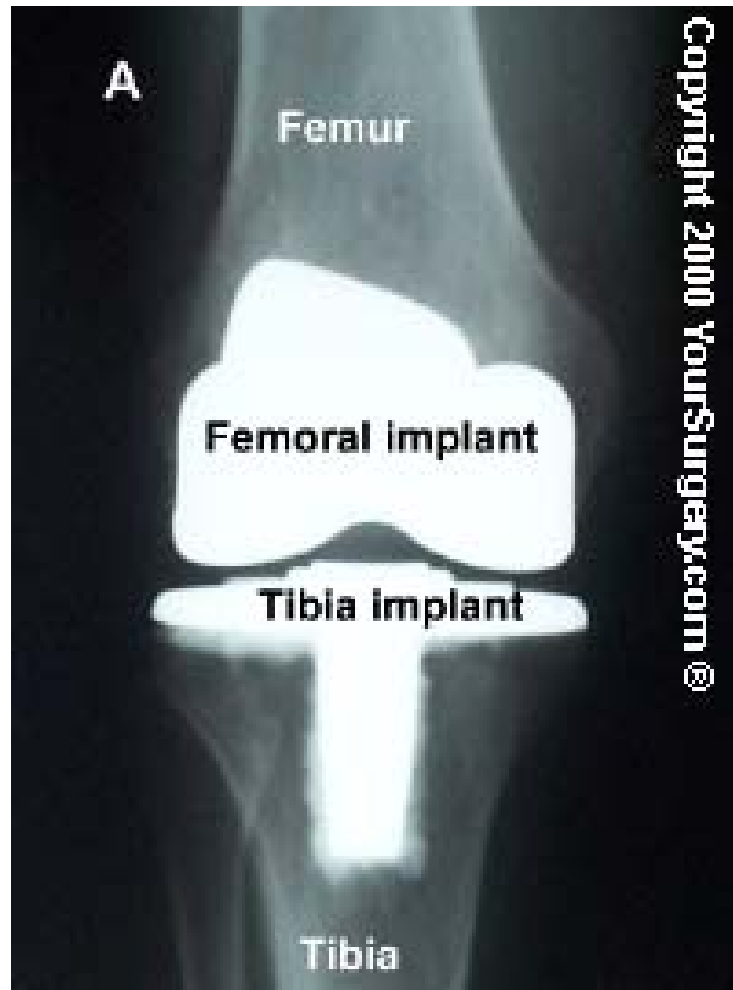
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# Completed Knee Replacement





# X-Ray of Completed TKR



# Post Operative Rehabilitation

- Rapid post-operative mobilization
- Range of motion exercises started
- CPM
- Passive extension by placing pillow under foot
- Flexion- by dangling the legs over the side of bed
- Muscle strengthening exercises
- Weight bearing is allowed on first post op day



THANK YOU