Knee viva

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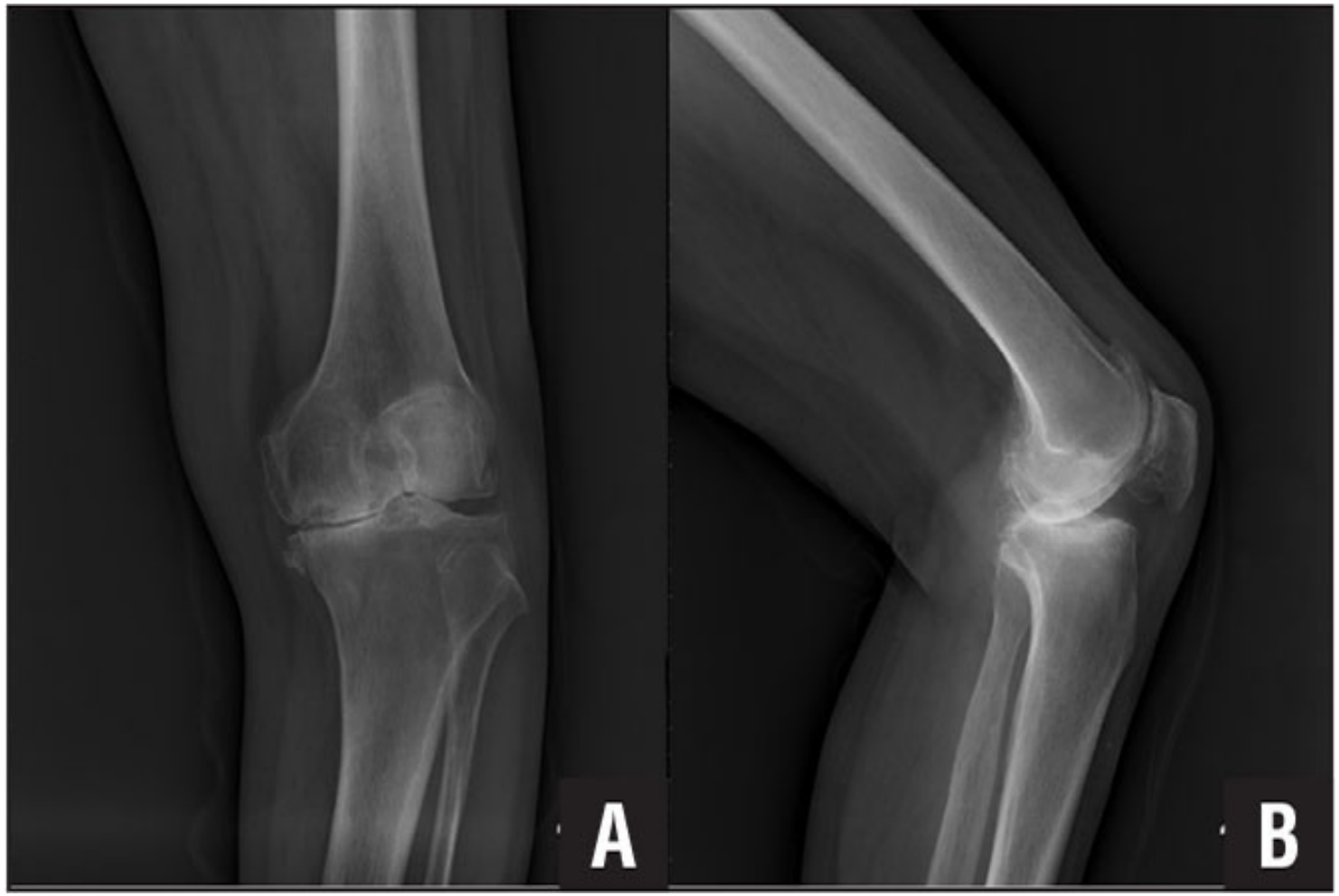
Viva 1

75-year-old male presents with worsening knee pain over the past 5 years

- What is the differential diagnosis of a painful swollen knee?
- What is the diagnosis?
- What are the risk factors?
- What is the pathogenesis of this condition?
- What are the zones of the articular cartilage?
- What are the cardinal signs of this condition?
- what are the anatomic sources of joint pain in OA?
- How are you going to treat this patient ?



What is the differential diagnosis of a painful swollen knee?

- *Mechanical pain occurs when the joint is stressed/loaded, eg. Degenerative osteoarthritis.*
- *Inflammatory: rheumatoid – AS – psoriasis.*
- *Infectious: gonococcal – Lyme.*
- *Traumatic: fractures*
- *Neuropathic: related to nerve distribution.*
- *Benign synovial disorder: PVNS – synovial chondromatosis – synovial hemangioma.*

What is the diagnosis?

- *These are A/P & lateral radiographs of left knee demonstrate features of degenerative changes involving all the three compartments with joint space narrowing- subchondral sclerosis and osteophytes formation. The leg is in overall varus alignment.*

what are the risk factors?

- non-modifiable
  - *Gender (females >males)*
  - *increased age*
  - *genetics*
  - *Race (African American males are the least likely to receive total joint replacement when compared to whites and Hispanics)*
- Modifiable
  - *articular trauma*
  - *occupation, repetitive knee bending*
  - *muscle weakness*
  - *large body mass index*
  - *metabolic syndrome (central (abdominal) obesity, dyslipidemia (high triglycerides and low-density lipoproteins), high blood pressure, and elevated fasting glucose levels).*

what is the pathogenesis of this condition?

- *Osteoarthritis is a chronic disorder of the synovial joints in which there is progressive softening and disintegration of the articular cartilage accompanied by new cartilage and bone formation and remodelling.*
- *In early stage of OA, there is ↑ water content and chondroitin sulphate which leads to disruption of the integrity of the collagen network and ↓ proteoglycan level that leads to ↓ stiffness of the matrix & the young's modulus of elasticity → cartilage tissue becomes more susceptible to further damage → chondrocytes respond to tissue damage by releasing mediators to increase proliferation.*
- *As osteoarthritis progresses, however, the proliferative response decreases and the level of proteoglycans eventually drops very low, causing the cartilage to soften and lose elasticity and thereby compromising joint surface integrity*

What are the zones of the articular cartilage?

Superficial zone	• *Type II collagen parallel to the joint* • *Highest concentration of collagen & water and lowest in proteoglycans* • *Flat chondrocytes*
Intermediate zones	• *Type II collagen is organized random* • *Round chondrocytes*
Deep layer	• *Type II collagen is perpendicular to the joint* • *Highest content of proteoglycans* • *Round chondrocytes arranged in columns*

what are the cardinal signs of this condition?

- *Narrowing of joint space, due to progressive cartilage destruction.*
- *Subcondral sclerosis under the area of cartilage loss.*
- *Subchondral cysts due to synovial intrusion into bone. In areas of very high stress, stress fractures occur and because of continued pressure , the fracture cannot heal and cyst form.*
- *Osteophytes formation. As the articular cartilage begins to degenerate, the ability of cartilage to distribute stress begins to fail and the stress on the bone increases. The bone responds to increased stress by laying down new bone (Wolff's low)*
- *Late features include joint displacement and destruction*

what are the anatomic sources of joint pain in OA?

- *cartilage is aneural, and, therefore, no pain is originated from this tissue.*
- *The pain of osteoarthritis primarily originates from the periosteum surrounding the bone.*
- *As the articular cartilage degenerate and the bones of the joint begin to rub one on another, the highly innervated periosteum becomes damaged and results in the joint pain seen in osteoarthritis.*

how are you going to treat this patient?

- ***Treatment planning**:*
- *I would like to establish from the history:*

➢ *The main complaint of the patient.*

➢ *Disability & ADLs*

➢ *What has been done for him*

➢ *Patient's medical condition*

➢ *Any source of infection (dental-dermatological-urological-URTI)*

➢ *Patient's expectation (patients satisfaction rates were reported 80% after TKA)*

how are you going to treat this patient?

- ***Treatment planning**:*
- *I would like to establish from the physical examination:*

➢ *Weight (BMI)*

➢ *Skin condition & previous surgical incision.*

➢ *Alignment of lower limbs*

➢ *Pre-op ROM.*

➢ *Stability*

➢ *P.F tracking.*

➢ *Neurovascular status*

how are you going to treat this patient?

- *the management of OA of the knee can be divided into non-surgical and surgical options. Conservative measures include:*

➢ *Weight loss, a minimum of 5% of body weight. (strong recommendation)*

➢ *Low impact aerobic fitness exercises (walking-cycling). (strong recommendation)*

➢ *NSAIDs & paracetamol. (strong recommendation)*

➢ *Muscle strengthening (Quad) and physiotherapy. (moderate recommendation)*

➢ *patellar taping for short-term relief of pain and improvement in function. (moderate recommendation)*

➢ *intra-articular corticosteroids for short-term pain relief for patients with symptomatic OA of the knee. (moderate recommendation)*

how are you going to treat this patient?

- *surgical options:*

➢ *HTO*

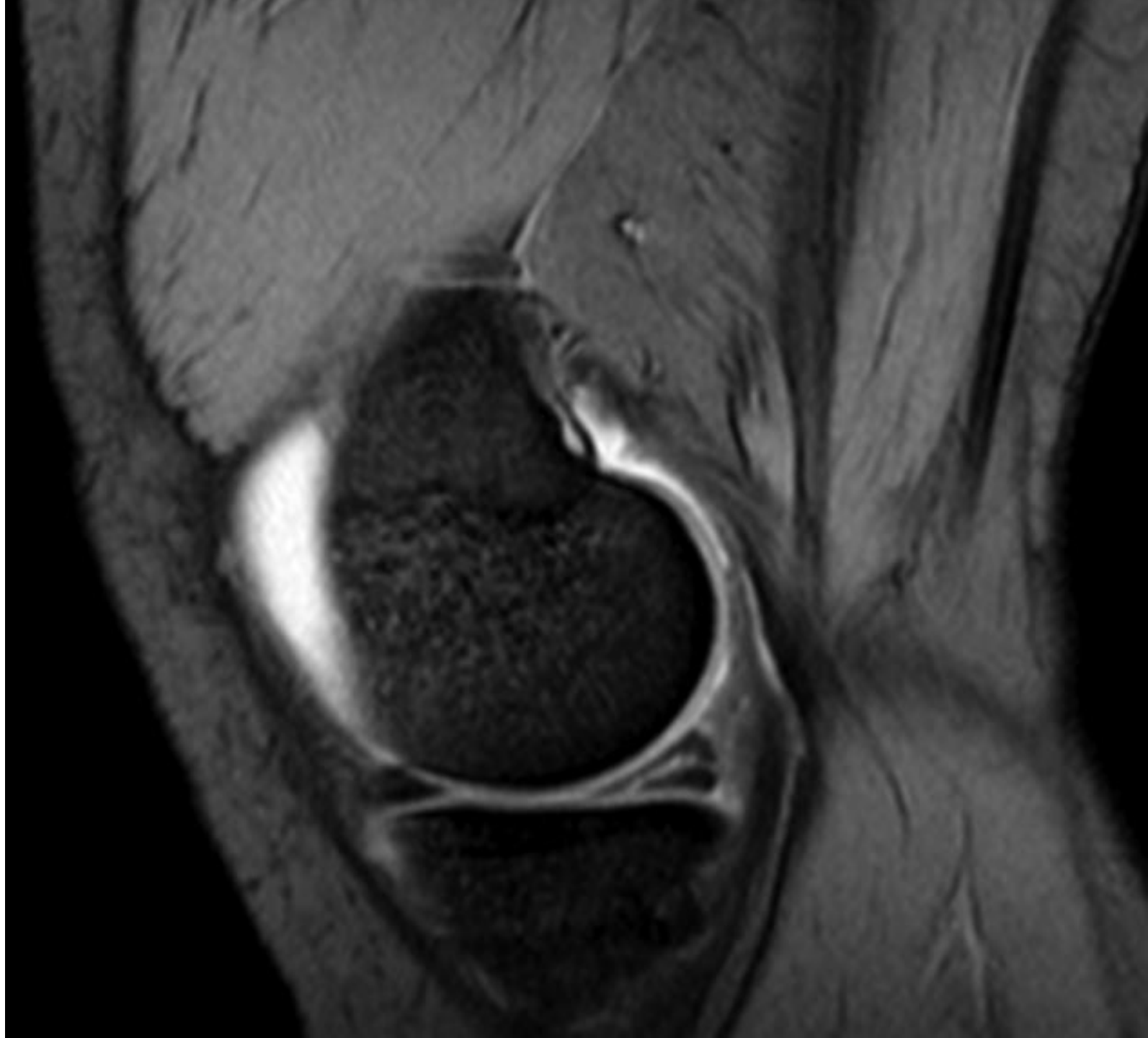
➢ *UKA*

➢ *TKA*

- *With such severe changes of osteoarthritis, the only realistic option, assuming failure and exhaustion of all non-operative measures, would be a knee arthroplasty. TKA is the treatment of choice*

Viva 2

- what is the diagnosis?
- Tell me about the anatomy and the function of the injured structure?
- Describe the differences between the medial & lateral meniscus?
- How does the type of meniscal tear affect its mechanical properties?
- What are the factors affecting the healing of the meniscus?
- What are the types of meniscal repair techniques?
- What is the effect of meniscectomy on knee joint?



What can you see?

- *This is a T2-weighted sagittal cut of a knee, showing appearance of a line of the posterior horn tear of the medial meniscus.*

Tell me about the anatomy and the function of the injured structure?

- *The menisci are fibrocartilaginous structures interposed between the tibia & femoral condyles, triangular in cross section, the peripheral borders are attached to the joint capsule while the inner border is free edge. The posterior horns of both menisci are attached to the posterior intercondylar eminence. The anterior horns of both menisci are connected by intermeniscal ligaments.*

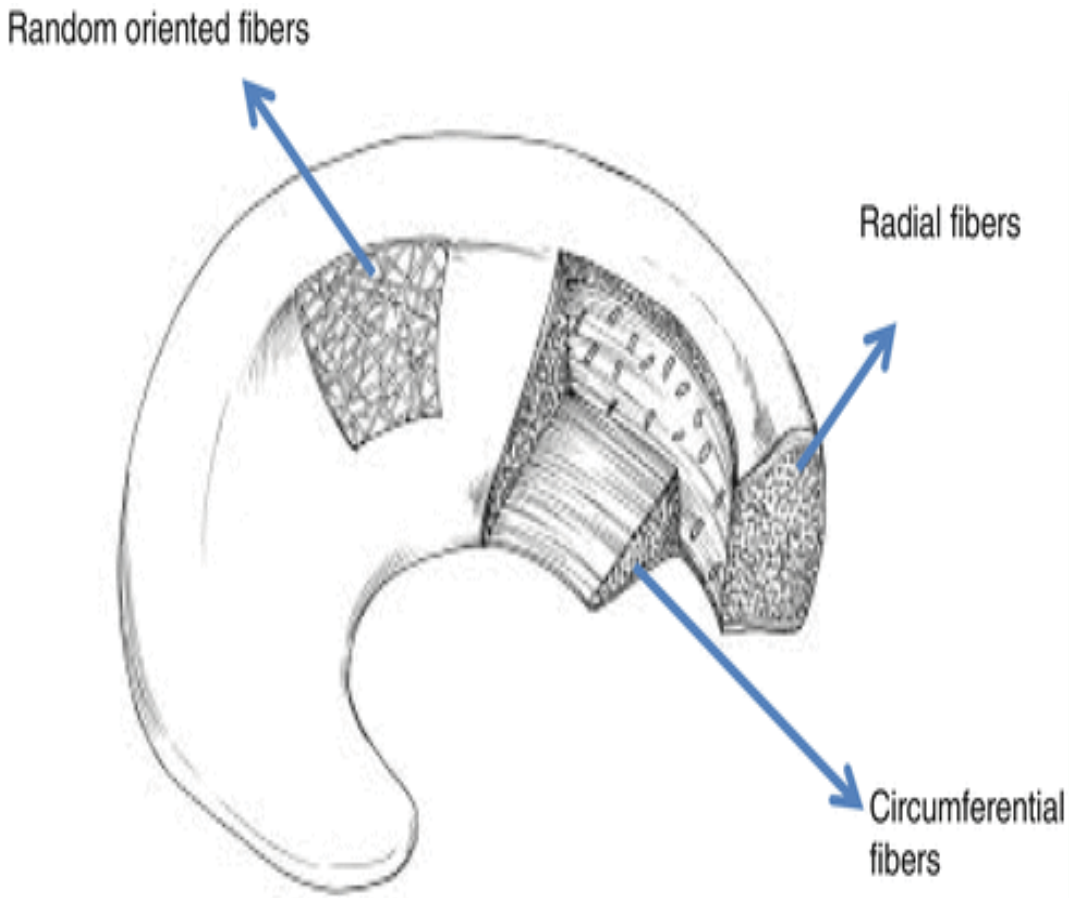
- *Histologically, the extracellular matrix is composed mainly of water (70%) and primarily type 1 collagen fibres (60%), proteoglycans, elastin and glycoproteins. The main cellular component is the fibrochondrocytes that synthesize and maintain the extracellular matrix.*

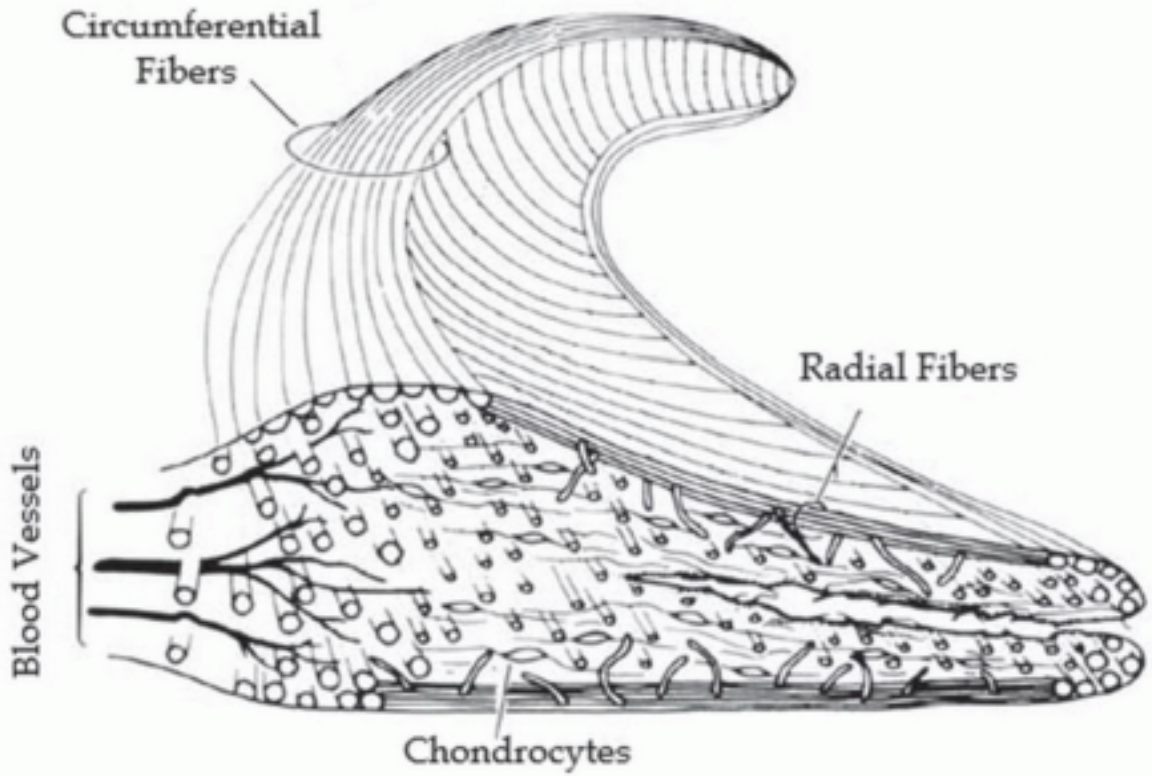
Tell me about the anatomy and the function of the injured structure?

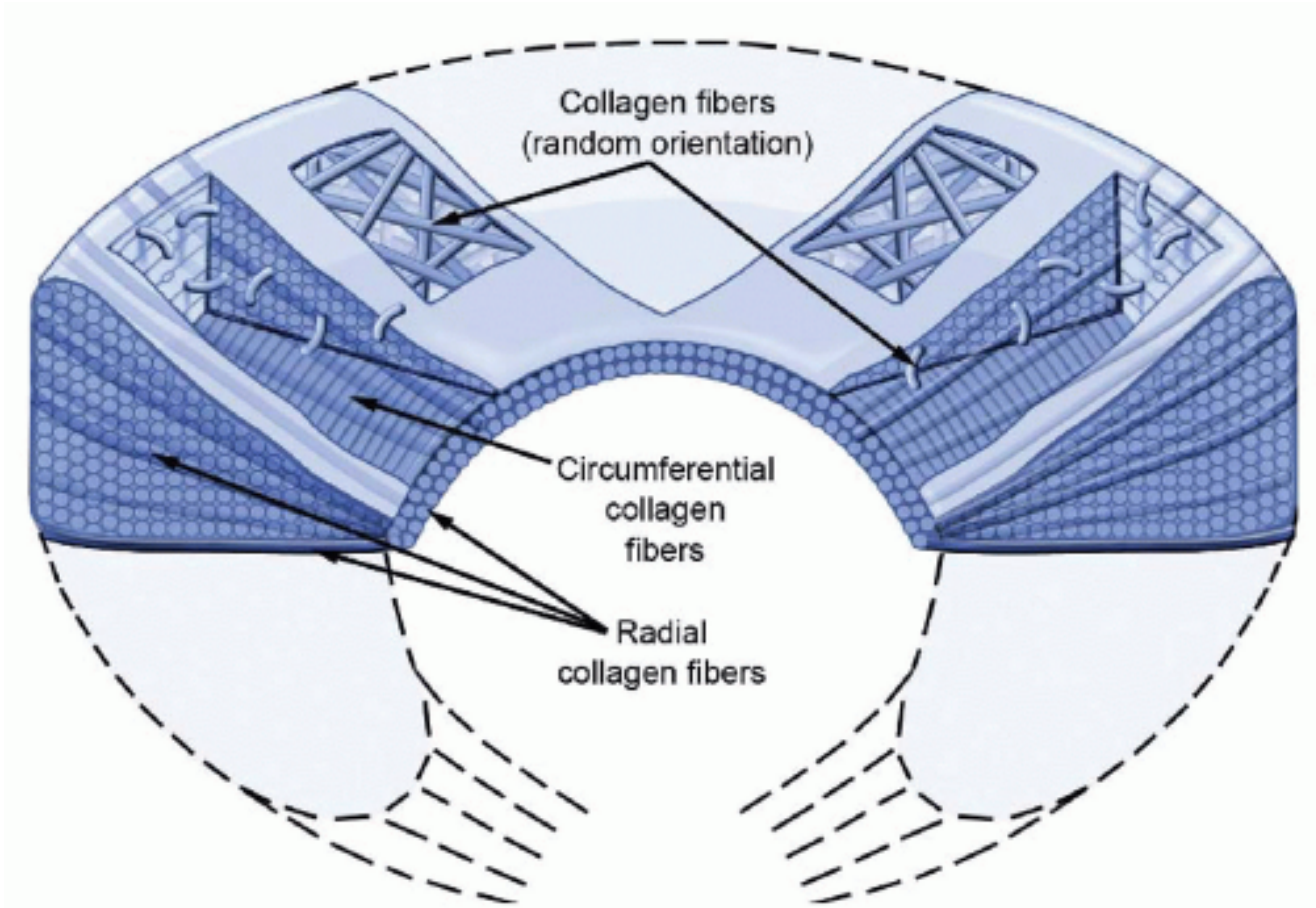
➢ *The orientation of the collagen fibres:*

- *Superficial layer: random orientation*
- *Middle layer: random & radial orientation.*
- *Deep layer: mainly circumferential orientation of fibres*

➢ *Circumferential fibres provides resistance to tension forces, while radial fibres provides resistance to shearing forces*


Random oriented fibers
Radial fibers
Circumferential fibers

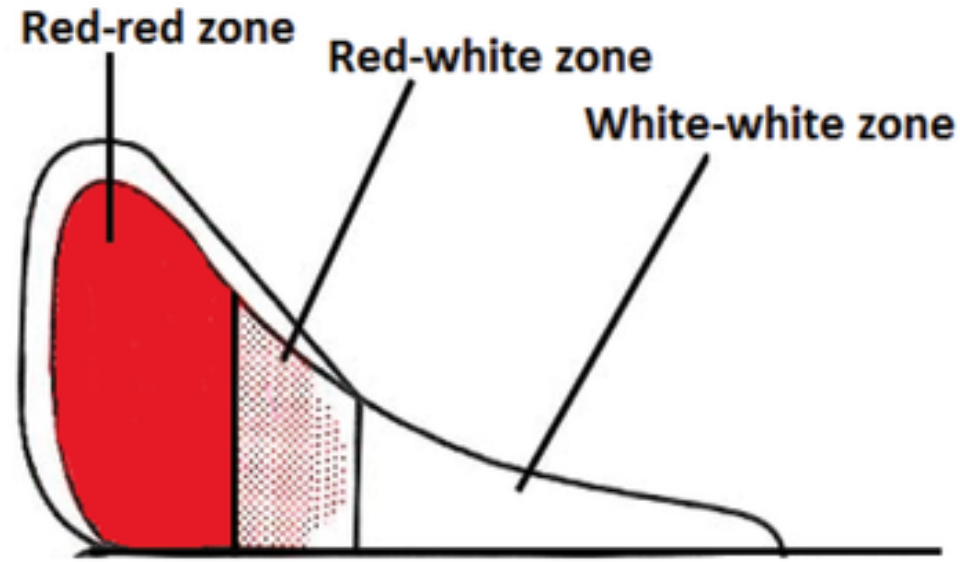

Circumferential Fibers
Radial Fibers
Blood Vessels
Chondrocytes

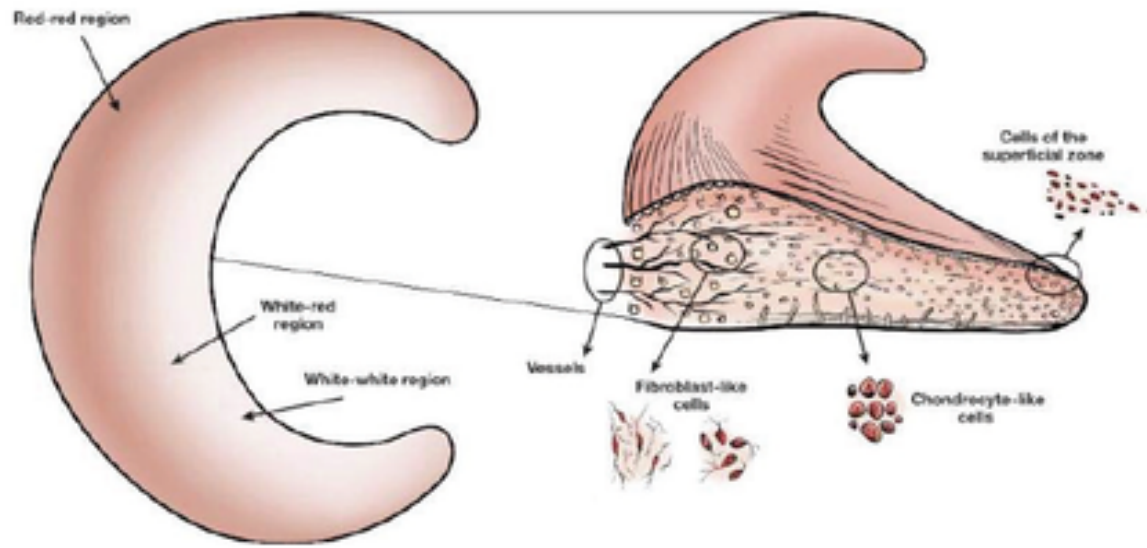

Collagen fibers
(random orientation)
Circumferential
collagen
fibers
Radial
collagen fibers

Tell me about the anatomy and the function of the injured structure?

- *50% of the meniscus(surface area) is vascularized at birth. 10-25% in adults. The blood supply to the meniscus comes from the lateral, middle and medial branches from the inferior genicular artery.*
- *It is divided into 3 zones:*
  - *Red zone: 3 mm from capsular junction*
  - *Red/white zone: 3-5 mm from the capsular junction.*
  - *White zone: > 5 mm from the capsular junction.*

Meniscus Zones (Vasculature)





Tell me about the anatomy and the function of the injured structure?

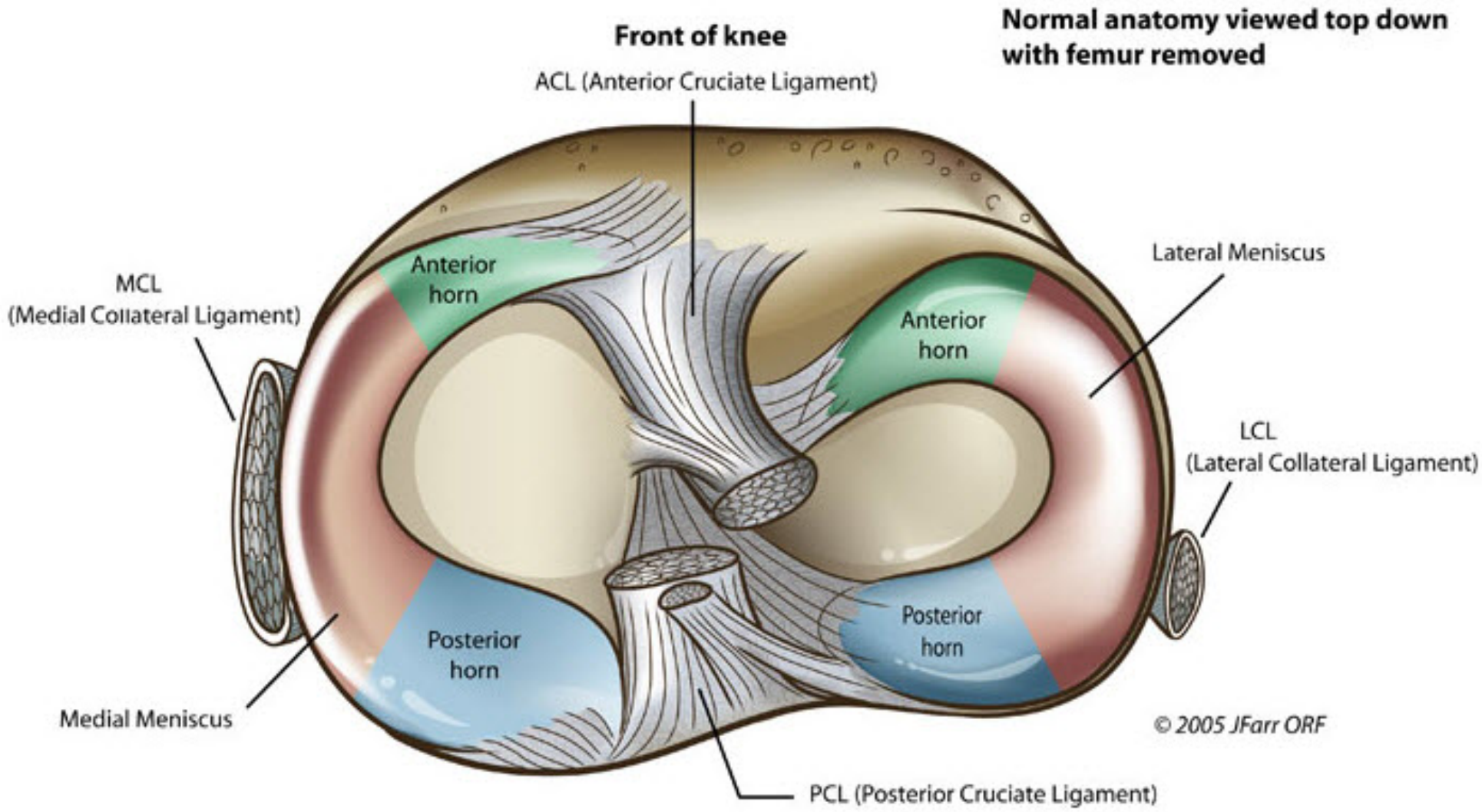
➢ *The main functions of the menisci are:*

- *load transmission with estimated 50% in extension and 85% in flexion.*
- *Shock absorbers.*
- *joint conformity and articular congruity.*
- *Secondary stabilizers (post.horn of the medial meniscus is a secondary stabilizer to anterior translation of the tibia)*
- *proprioceptive function*

Describe the differences between the medial & lateral meniscus?

- *Medial meniscus: C-shaped, covers a smaller area than lateral, covers 50% of the medial tibial plateau, the peripheral attachments are more rigid than LM which has the popliteus hiatus, and therefore more stable. Tears more common than LM (during knee flexion, the posterior excursion of the lateral meniscus is 11.2mm, which is nearly twice that of the medial meniscus)*

- *Lateral meniscus: almost circular, covers a larger area than MM, covers 70% of lateral tibial plateau, the attachment of the lateral meniscus combined with the convexity of the lateral tibial plateau is critical to knee kinematics during flexion and make LM more mobile. Provides more biomechanical support to the joint than the MM. tears more common in acute ACL injury*

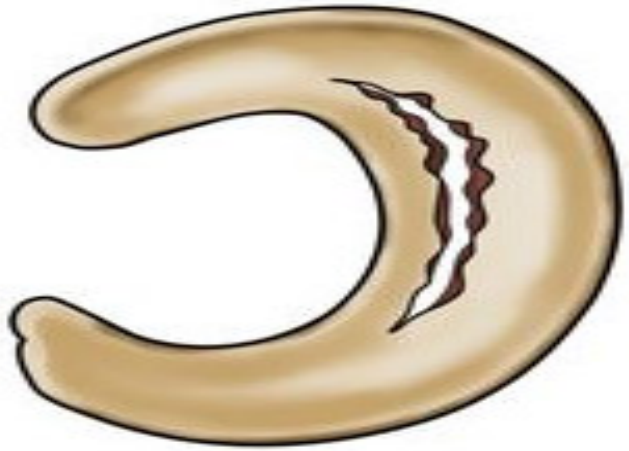

Front of knee
ACL (Anterior Cruciate Ligament)
Normal anatomy viewed top down
with femur removed
MCL
(Medial Collateral Ligament)
Anterior
horn
Lateral Meniscus
Anterior
horn
LCL
(Lateral Collateral Ligament)
Posterior
horn
Posterior
horn
Medial Meniscus
© 2005 JFarr ORF
PCL (Posterior Cruciate Ligament)

How does the type of meniscal tears affect its mechanical properties?

- *Radial tears of the MM or LM of up to 75% do not significantly change the tibiofemoral joint contact pressure(stresses).*

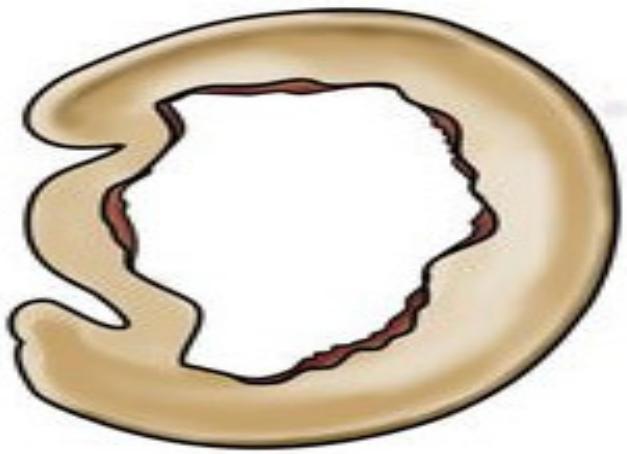
- *Vertical tears significantly increase the tibiofemoral joint contact pressure*

Different Types Of Meniscus Tear

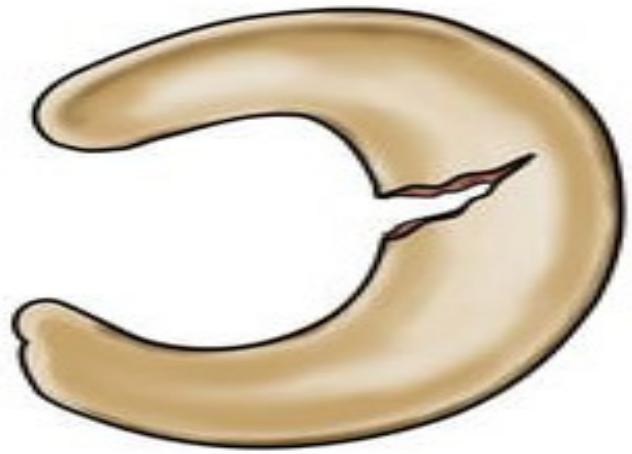


Longitudinal (Vertical) Tear

May progress to

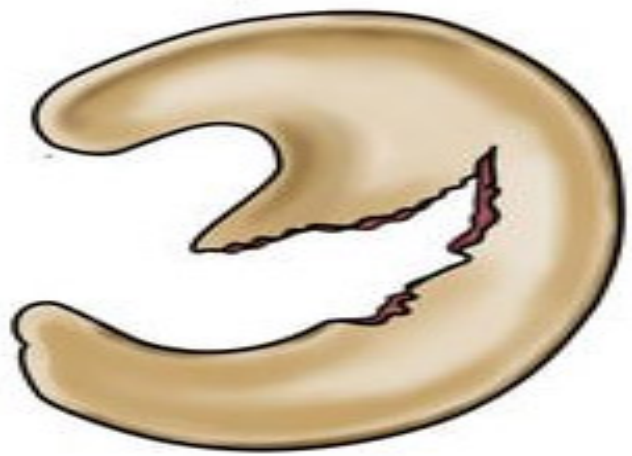


Bucket Handle Tear

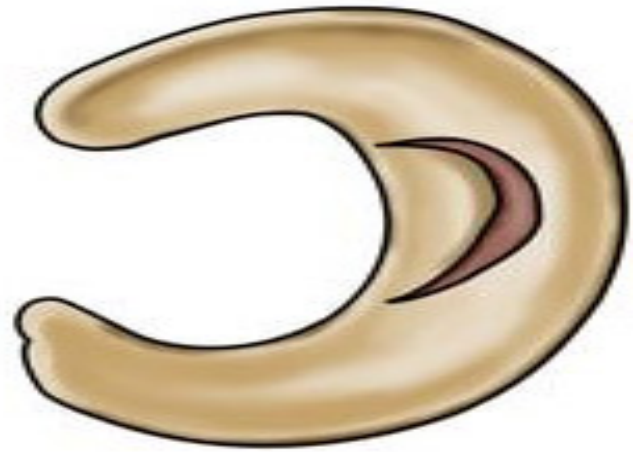


Radial Tear

May progress to

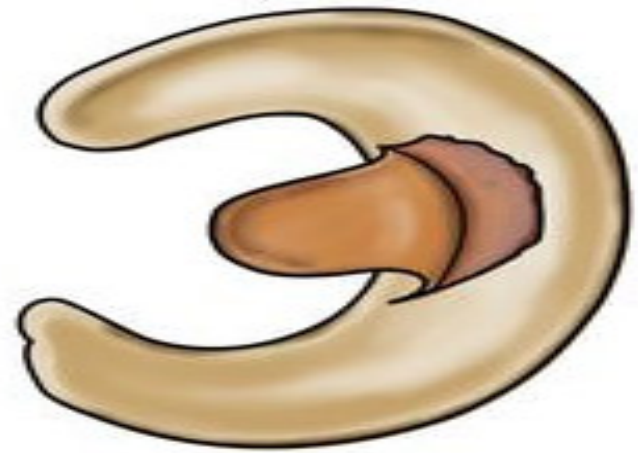


Parrot Beak Tear



Horizontal Tear

May progress to



Flap Tear

What are the factors affecting the healing of the meniscus?

➢*The capacity for healing of the meniscus is determined by the :*

- *The vascularity of the region. Tears in red-red zone are more likely to heal than red-white or white-white zone.*
- *The age. Because the zones change with age, healing capacity is greater in children than adolescents.*
- *Type of the tear. Radial tears are less likely to heal than those running circumferentially.*
- *Interval to treatment. Better results if carried out < 8wks.*
- *Repair combined with ACL reconstruction. Traditional literature report higher healing rates with concurrent ACL reconstruction, current literature shows no difference in healing for* ***2nd generation all-inside repairs*** *with/without concomitant ACL reconstruction*

❖*Complex, degenerative and central/radial tear are best excised partially.*

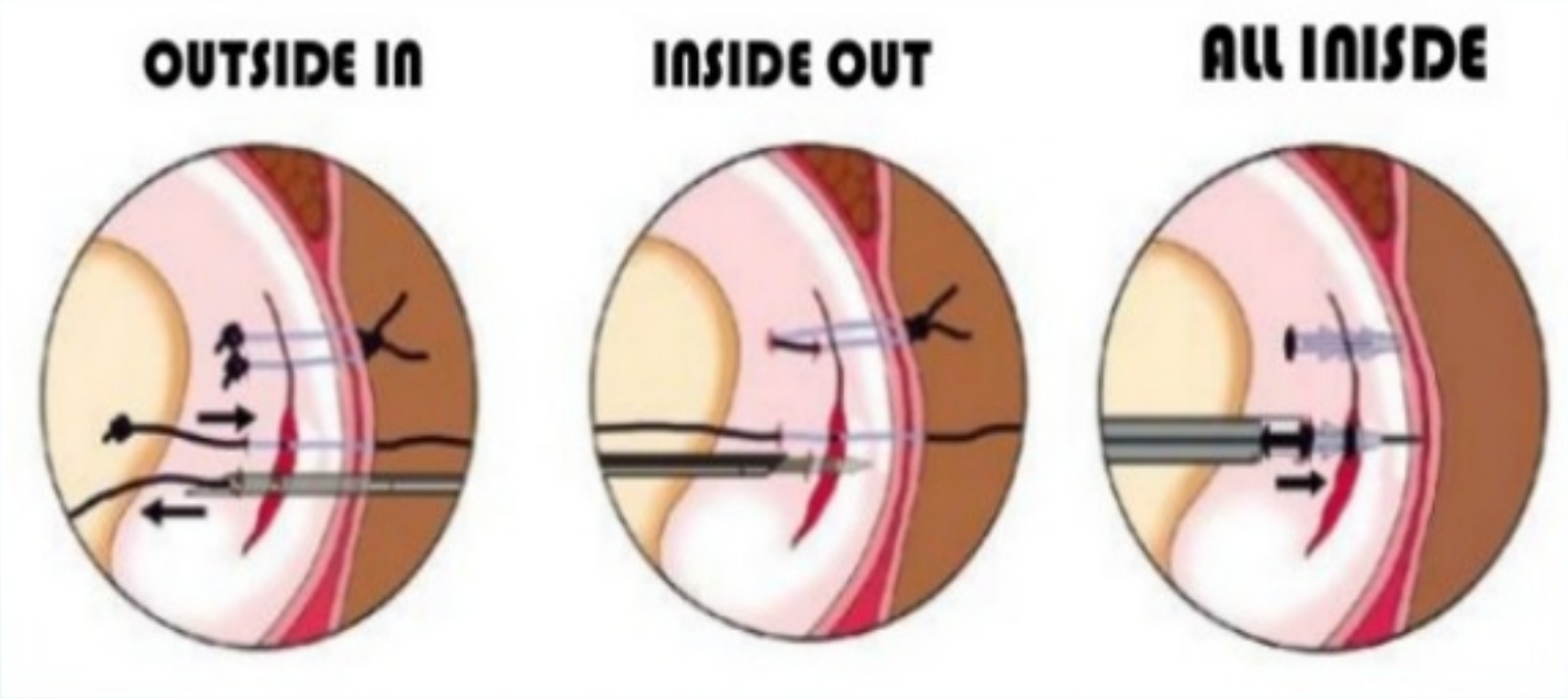
What are the types of meniscal repair techniques?

➢ *The four main meniscal repair methods are :*

- *Open technique: uncommon, except in trauma and knee dislocation*
- *All inside: becoming very popular with the developments of new devices, has many complications (device breakage-chondral injury)*
- *Outside in: useful in anterior horn tears.*
- *Inside out: considered gold standard.*

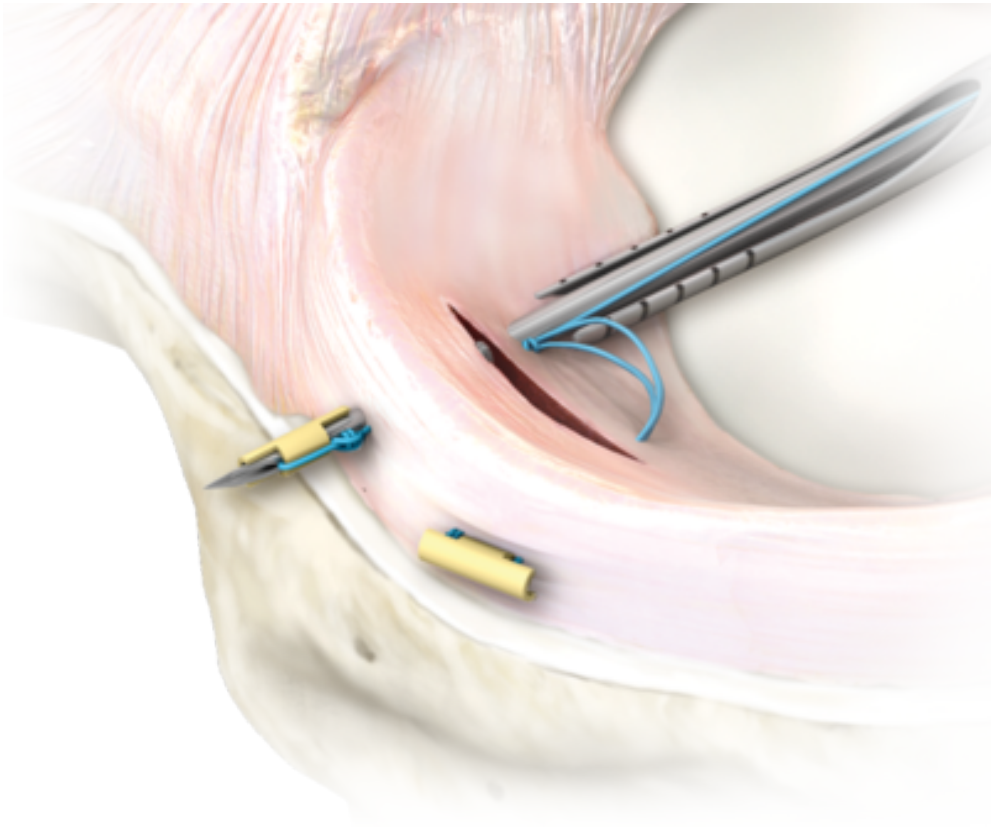
❖vertical mattress sutures are strongest because they capture circumferential fibbers .

TECHNIQUE



Hybrid repairs is combination

All inside

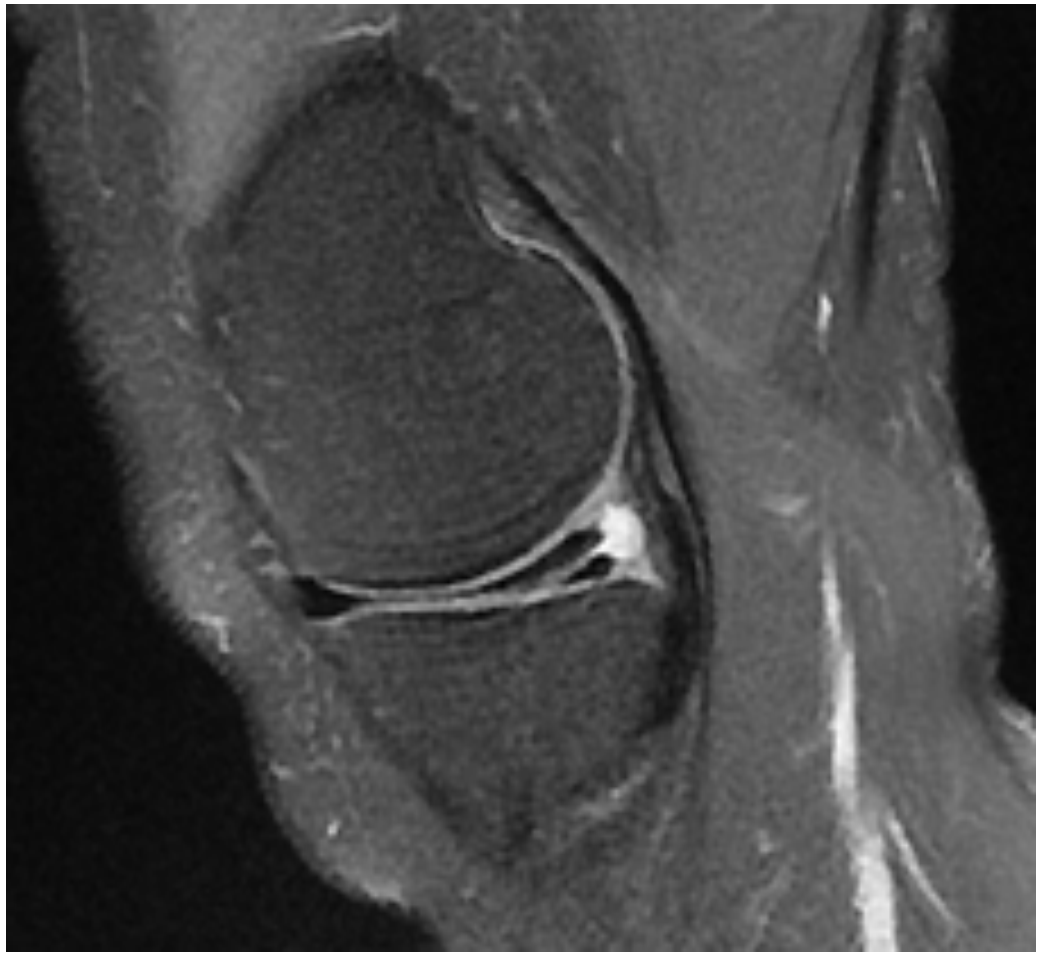


What is the effect of meniscectomy on knee joint?

- *lateral meniscus carries 70% load in the lateral compartment whereas the medial meniscus carries 50% , therefore lateral meniscectomy is associated with more subsequent arthritic changes than medial meniscectomy*
- *Partial meniscectomy increases the contact stresses(loads) by 65%, >200% following total meniscectomy.*
- *Posterior root tears and total meniscectomy have biomechanical similarities and both can cause significant change in contact pressure*

Viva 3

- What is the diagnosis?
- What is the pathophysiology of this condition?
- What are the different types?
- What are the clinical features?
- What are the treatment options?



What is the diagnosis?

- *This is T2-weight MRI sagittal cut of the knee showed meniscal syct.*
- *A condition characterized by a local collection of synovial fluid (gelatinous fluid) within or adjacent to the meniscus*

What is the pathophysiology of this condition?

- *The exact cause is unknown, associated with meniscal tear, which functions as a one way valve. synovial fluid extrudes and then concentrates to form gel-like material.*

What are the different types?

- Perimeniscal cysts
  - *small lesions of fluid within the meniscus*
  - *medial cysts are slightly more common than lateral.*
  - *medial cysts = posterior horn.*
  - *lateral cysts = anterior horn or mid-portion*
  - *radial or vertical tears, usually = perimeniscal cysts*

- Parameniscal cysts (e.g., baker cysts)
  - *extruded fluid outside the meniscus (most common)*
  - *usually located between semimembranosus and medial head of gastrocnemius*
  - *horizontal and complex tears, usually = parameniscal cysts*

What are the clinical features?

- *Asymptomatic*
- *Pain. Localized to medial /lateral joint line or the back of the knee.*
- *Mechanical symptoms*
- *Intermittent knee swelling*
- *Palpable masses (popliteal)*
- *Lateral cysts are firm, medial cysts are larger and softer*
- *Crepitus*
- *Pisani's sign (cyst size deceases with knee flexion)*

What are the treatment options?

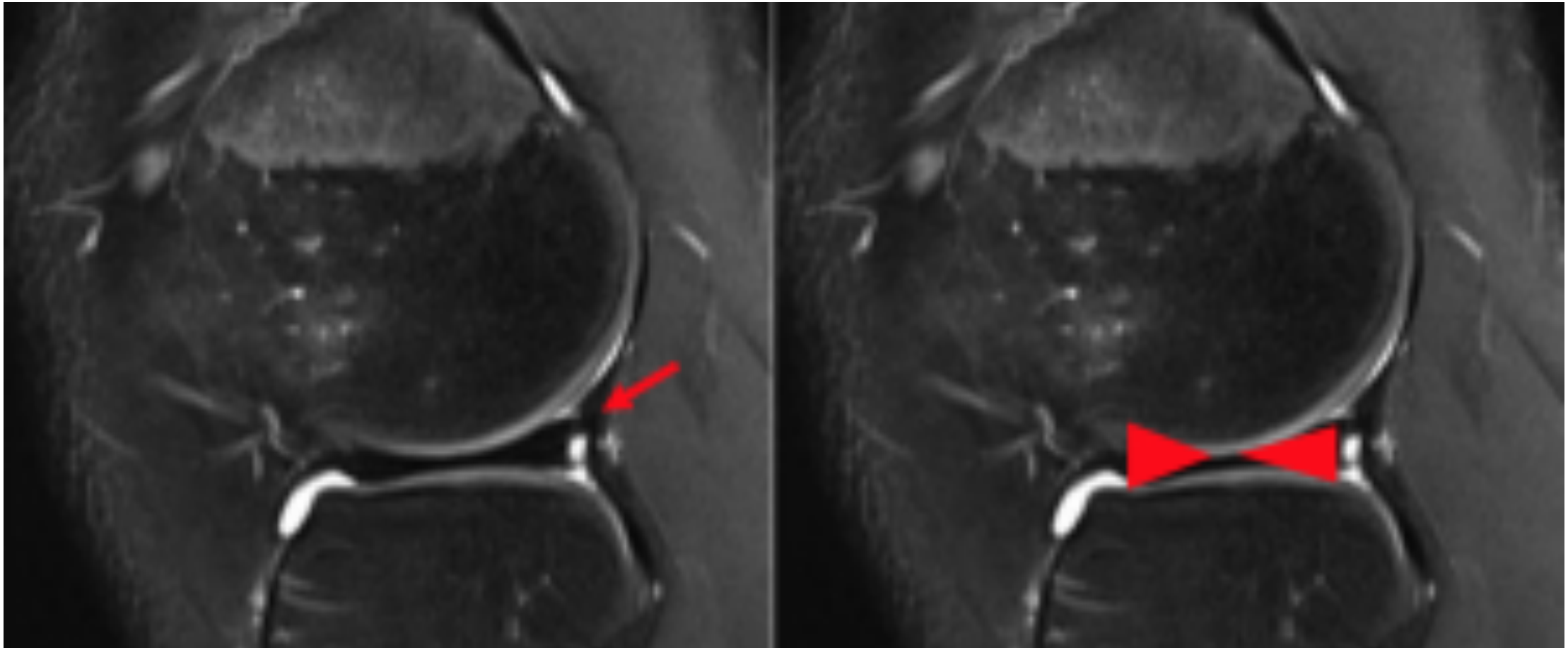
- ***Depends on the symptoms, size, location, relation to meniscal tear.***
- ***NSAIDs, rest, physiotherapy***
  - *Indicated as 1st line of treatment*
- ***Aspiration & steroid injection***
  - *Indicated in isolated baker's cysts in young patient*
- **Arthroscopic debridement, cyst decompression and meniscal resection**
  - *Indicated in perimeniscal cyst associated with tear not amenable for repair.*
- **cyst excision using open posterior approach**
- *Indicated in parameniscal cyst*

Viva 4

- What is the diagnosis?
- How can you classify this condition?
- What are the radiographic features of this condition?
- What are the treatment options?

What is the diagnosis?

- *These are T1-weight images sagittal cut MRI with meniscal continuity (bow-tie sign). Features suggestive of discoid meniscus.*
- *It is an abnormal development of the meniscus leads to a hypertrophic and discoid shaped meniscus*
- *Also referred to as "popping knee syndrome“*
- *Occurs due to failure of resorption of the central portion of the meniscus during development.*
- *The lateral meniscus is most commonly affected and it is bilateral in 25% of affected people*

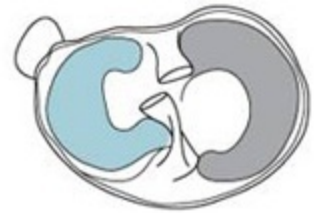


How can you classify this condition?

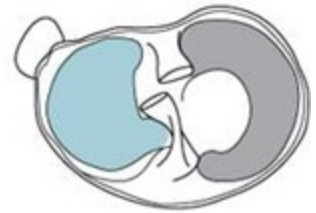
❖***Watanabe classification of discoid lateral meniscus 1974 (based on arthroscopic appearance)***

- *Type I: normal peripheral attachment, with complete covering of the lateral tibial plateau. (Complete)*
- *Type II: normal peripheral attachment, with incomplete covering of the lateral tibial plateau. (Incomplete)*
- *Type III: characterised by lack of posterior meniscotibial attachment (coronary ligament) . It is stabilized only by the meniscofemoral ligament of Wrisberg (Wrisberg variant)*

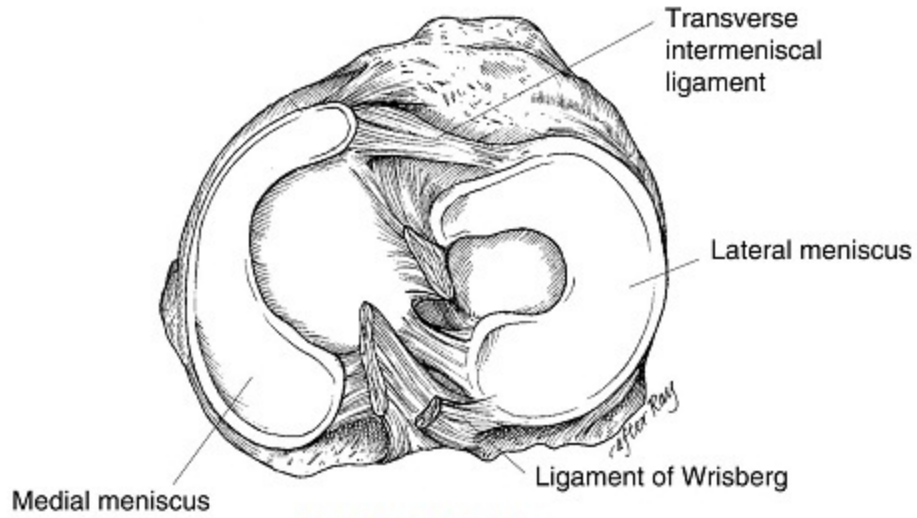
Normal



1. Incomplete



2. Complete



3. Wrisberg

(missing the posterior coronary ligament = hypermobile)

4. Ring-Shaped

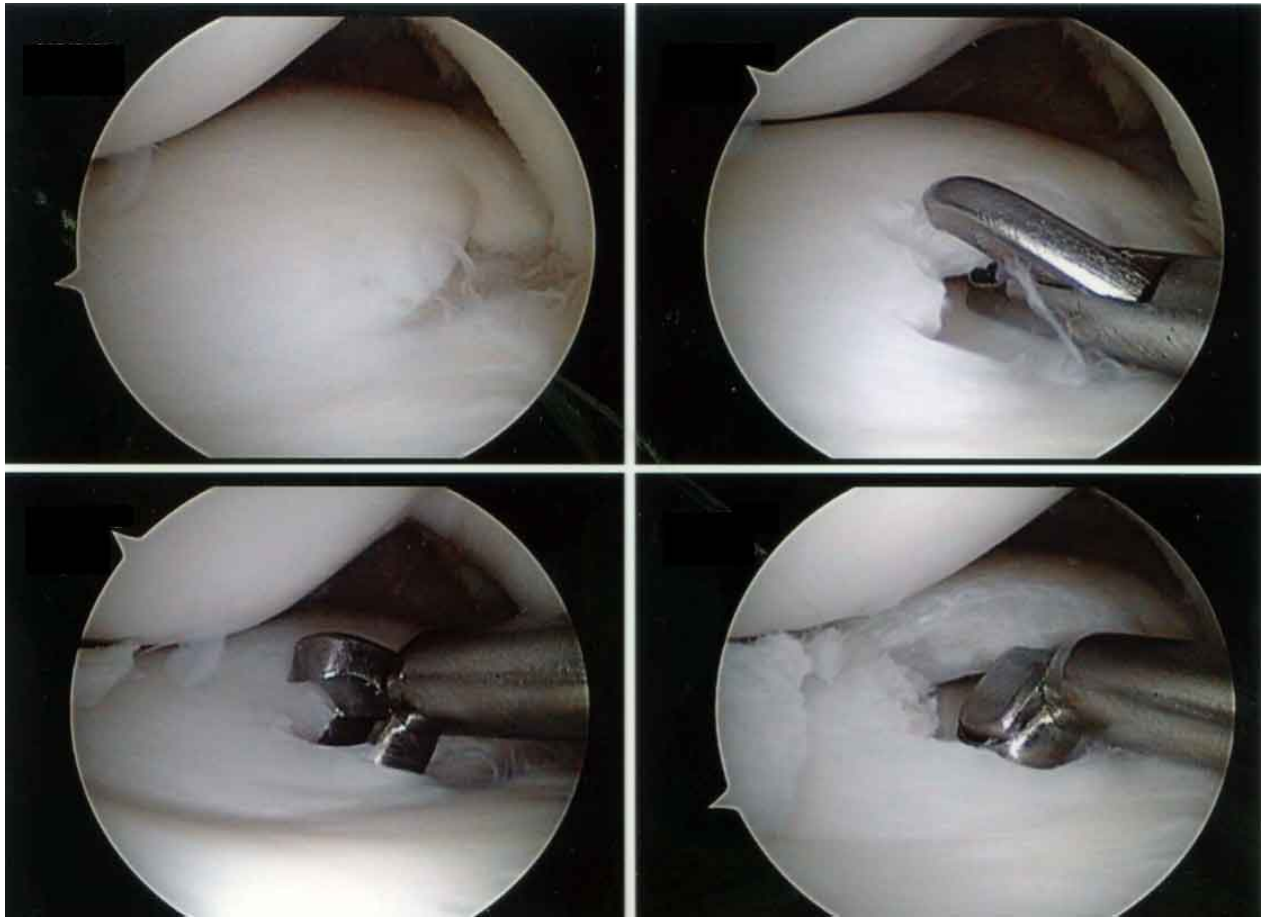
What are the radiographic features of this condition?

- *Widening of the joint space (up to 11mm)*
- *Squaring of the lateral femoral condyle*
- *Flattening of the lateral tibia plateau*
- *Hypoplastic lateral intercondylar(tibia) spine.*

What are the treatment options?

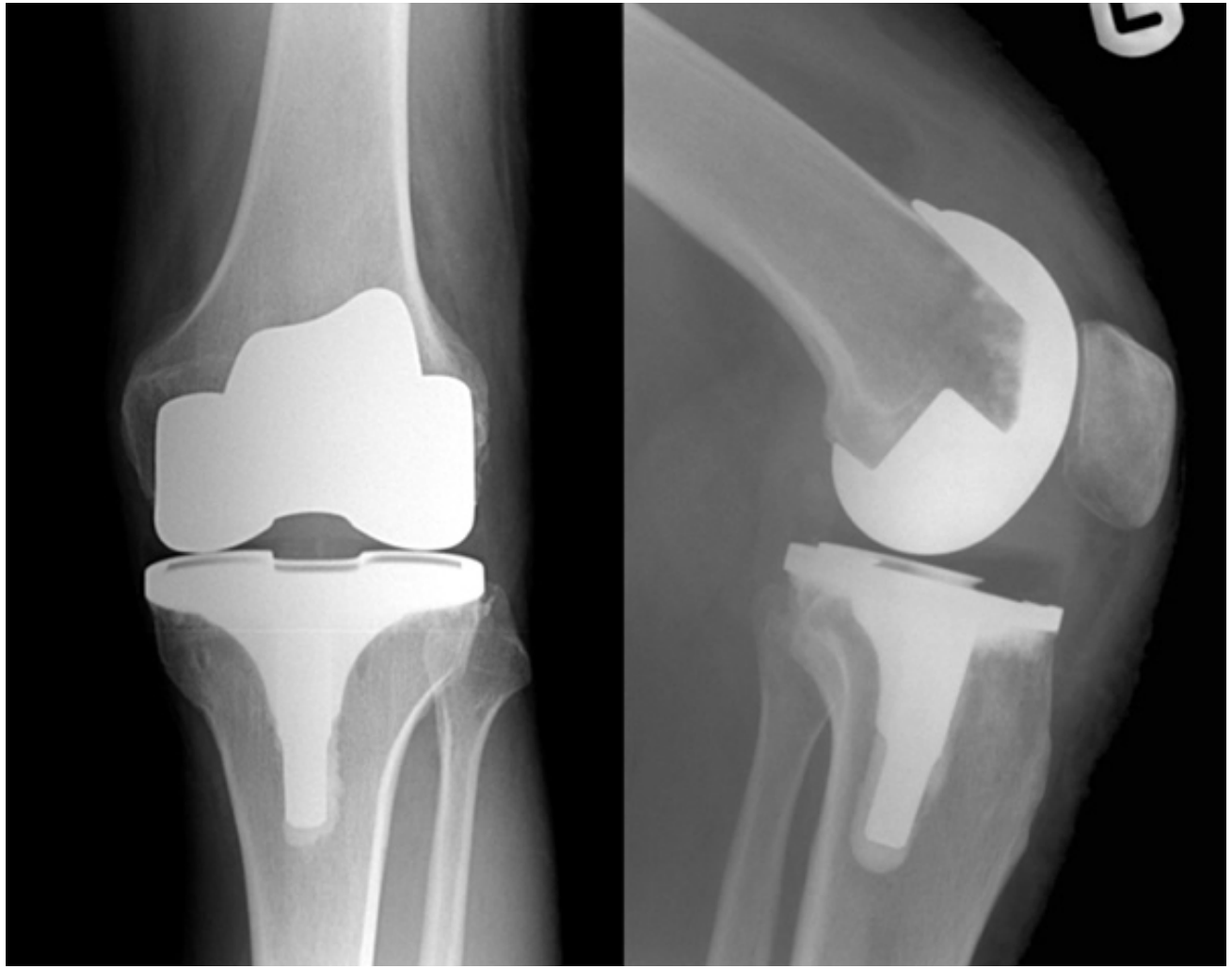
- *Asymptomatic → leave it alone*
- *Symptomatic type I – II → arthroscopic debridement and saucerization*
- *Symptomatic type III → meniscal repair and reattachment of the posterior horn*

sequential saucerization of the discoid meniscus.



Viva 5

- What are the surgical approaches for TKR? Describe in details the approach you are going to use.
- What maneuvers can be performed to facilitate eversion of the patella during the standard medial parapatellar approach?
- What are the technical goals for TKR?
- *What are the palpable landmarks used to assist the placement of the extramedullary tibial alignment jigs?*
- *What are the different designs of knee implants in TKA?*
- *Resurfacing vs nonresurfacing of the patella in TKA?*



What are the surgical approaches for TKR? Describe in details the approach you are going to use.

- ***Surgical approach may be dictated by*** *:*

➢*surgeon preference*

➢*prior incisions. (if multiple incision, choose more lateral, blood supply comes from medial side)*

➢*degree of the deformity*

➢*patella baja*

➢*patient obesity*

What are the surgical approaches for TKR? Describe in details the approach you are going to use.

- ***Medial para-patellar approach**:*

➢ *Straight midline skin incision. (5 cm proximal to patella → tibial tubercle).*

➢ *dissection between the vastus medialis and quadriceps tendon.*

➢ *Dislocate the patella and flip laterally.*

➢ *Pros: familiar-excellent exposure.*

➢ *Cons: difficult to access lateral retinaculum-development of lateral patellar subluxation.*

What are the surgical approaches for TKR? Describe in details the approach you are going to use.

- ***lateral para-patellar approach**:*

➢ *Pros: useful for addressing lateral contractures-useful for fixed valgus deformities-preserves blood supply to patella-prevents lateral patellar subluxation.*

➢ *Cons: difficult eversion of patella makes exposure challenging.*

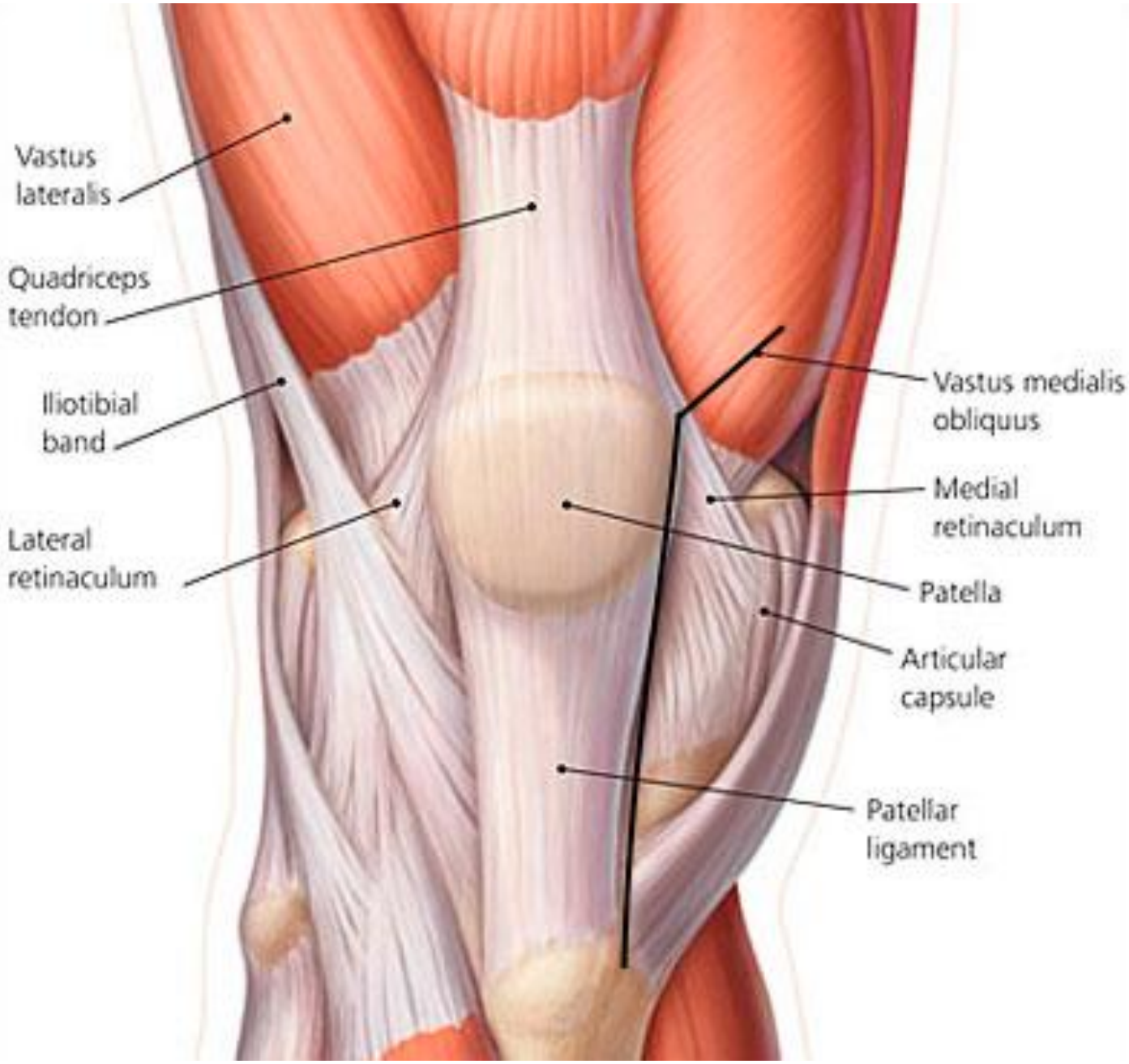
What are the surgical approaches for TKR? Describe in details the approach you are going to use.

- ***midvastus approach**:*

➢ *Similar approach to medial parapatellar that spares VMO insertion and may lead to quicker recovery, proximal portion of the arthrotomy extends into the muscle belly of the vastus medialis.*

➢ *Pros: potentially allows accelerated rehab due to avoiding disruption of extensor mechanism- patellar tracking may be improved compared to medial parapatellar approach*

➢ *Cons: less extensile- exposure can be difficult.*


Vastus lateralis
Quadriceps tendon
Iliotibial band
Lateral retinaculum
Vastus medialis obliquus
Medial retinaculum
Patella
Articular capsule
Patellar ligament

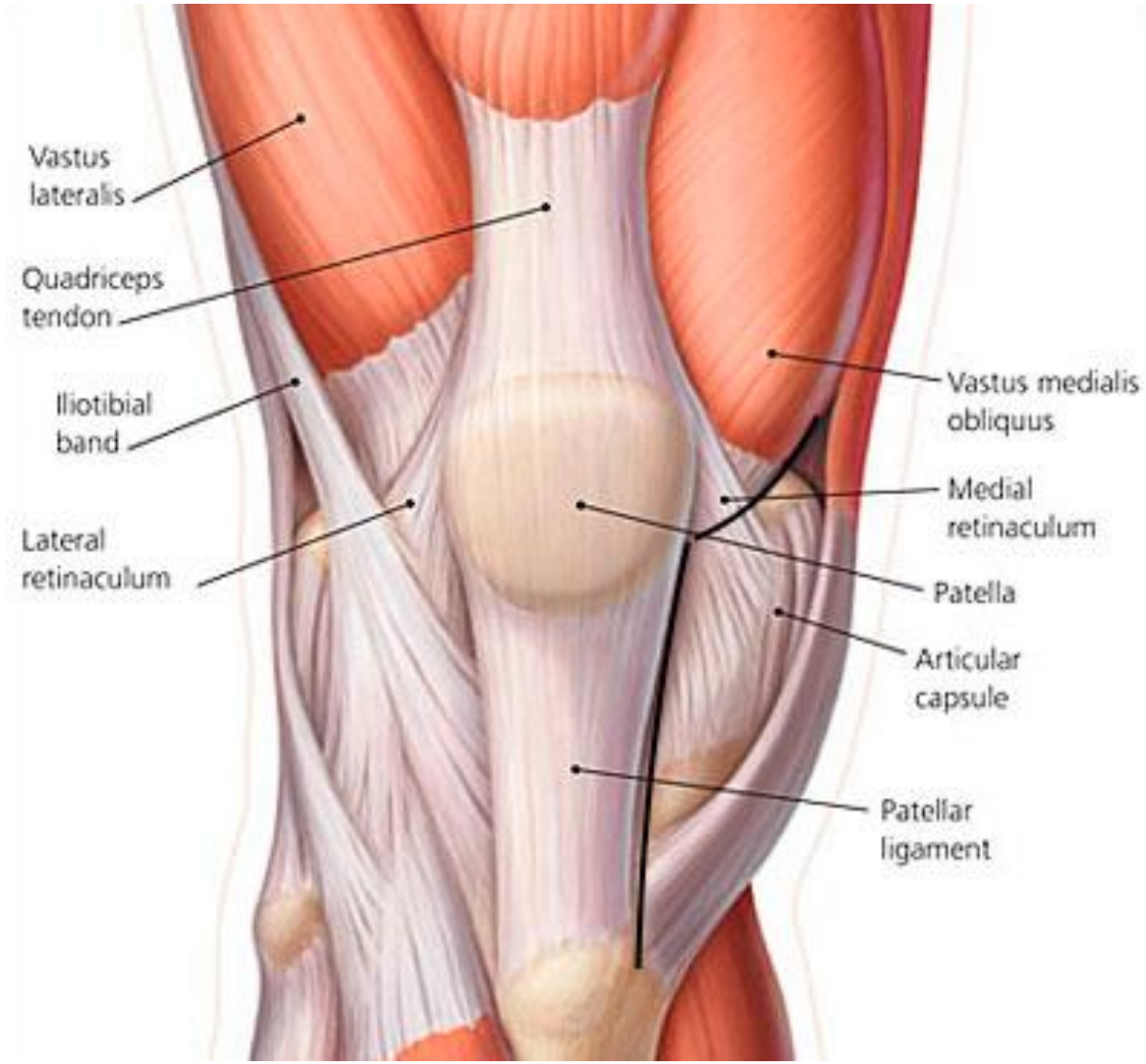
What are the surgical approaches for TKR? Describe in details the approach you are going to use.

- ***subvastus approach**:*

➢ *muscle belly of the vastus medialis is lifted off the intermuscular septum.*

➢ *Pros: preserving the blood supply to the patella-preserving the anatomy of the quadriceps tendon (maintains stability of knee)*

➢ *Cons: patella can be difficult to evert and is subluxated laterally instead.*


Vastus lateralis
Quadriceps tendon
Iliotibial band
Lateral retinaculum
Vastus medialis obliquus
Medial retinaculum
Patella
Articular capsule
Patellar ligament

What are the surgical approaches for TKR? Describe in details the approach you are going to use.

- ***vastus medialis splitting approach**:*

➢ *The vastus medialis splitting approach begins with a division of the vastus medialis along its fibers at the proximal two-thirds and distal one-third junction. The muscle division ends at the superior medial pole of the patella, and the capsular arthrotomy is then carried distally along the medial aspect of the patella. It was initially reported that this approach yielded a decrease in the number of lateral retinacular releases. However, when the study was repeated in a randomized fashion, no difference in lateral retinacular release rates was noted between the medial parapatellar arthrotomy and the vastus medialis splitting approach.*

What are the surgical approaches for TKR? Describe in details the approach you are going to use.

- ***Medial para-patellar approach**:*

➢***Position & set up:*** *Place the patient in a supine position on the operating table, using lateral support and foot boost, exsanguinate the leg by applying a compressive bandage; then, inflate a tourniquet.*

➢***Landmarks:*** *patella – patellar tendon – tibial tubercle – anterior tibial margin.*

➢***Incision:*** *Make a longitudinal straight midline incision with knee in flexion, extending 5 cm proximal to the superior pole of the patella to below the level of the tibial tubercle, raising thick flap on each side.*

➢***Internervous plane:*** *None.*

What are the surgical approaches for TKR? Describe in details the approach you are going to use.

- ***Medial para-patellar approach**:*

➢ ***Superficial Surgical Dissection:** Divide the subcutaneous tissues in the line of the skin incision, ensuring hemostasis. Develop a medial skin flap to expose the quadriceps tendon, the medial border of the patella, and the medial border of the patellar tendon. Enter the joint by cutting through the joint capsule. Begin on the medial side of the patella, taking care to leave a cuff of capsular tissue medial to the patella. Divide the quadriceps tendon in the medial 1/3 to enter the suprapatellar pouch.*

➢ ***Deep Surgical Dissection:** remove the anterior fat pad and osteophytes around the patella. Dislocate the patella laterally and rotate it 180°; then, flex the knee to 90°. If the patella does not dislocate easily, it can be given added mobility by extending the incision superiorly over the interval between the rectus femoris and vastus medialis muscles*

What are the surgical approaches for TKR? Describe in details the approach you are going to use.

- ***Medial para-patellar approach**:*

➢ ***Structures at risk:** The infrapatellar branch of the saphenous nerve often is cut during this approach*

What maneuvers can be performed to facilitate eversion of the patella during the standard medial parapatellar approach?

- 1. *Extending the incision proximally into the quadriceps tendon*
- *2. Releasing adhesions in the lateral retinaculum and patellofemoral ligament*
- *3. Removing the peripheral osteophytes about the patella*
- *4. Performing a lateral retinacular release*
- *5. Careful and sequential proximal medial tibial release and external rotation of the tibia.*

What are the technical goals of TKA?

- ***Technical goals**:*

➢ *Restoration of mechanical alignment(axis)*

➢ *Restoration of joint line*

➢ *Coronal plane balancing*

➢ *Sagittal plane balancing*

➢ *Restoration and preservation of Q angle*

What are the technical goals of TKA?

- ***Technical goals**:*

➢*Restoration of mechanical alignment*

- *This ensures that the body weight passes through the centre of the hip, knee and ankle. An unbalanced knee replacement leads to excessive medial or lateral loading (valgus or varus) and increases the possibility of early failure.*
- *The bony cuts of both femur & tibia are perpendicular to the mechanical axis.*
- *the femoral mechanical axis runs from the head of the femur to the intercondylar notch of the distal femur, and the tibial mechanical axis extends from the centre of the proximal tibia(mid point between the intercondyler spines) to the centre of the ankle.*
- *The mechanical, and anatomic axes of the tibia commonly correspond exactly with one another.*
- *the anatomic axis of the femur has an approximate 5°–7° of inclination from the mechanical axis*

What are the technical goals of TKA?

- ***Technical goals**:*

➢*Restoration of joint line*

- *If bone defects are small (<1cm) >> fill with cement.*
- *If bone defects are large >> use bone graft or metallic augmentation.*
- *Elevating the joint line >> patella baja- mid-flexion instability- inability to obtain full extension.*
- *Lowering the joint line >> patella alta- flexion instability- lack of full extension.*

What are the technical goals of TKA?

- ***Technical goals**:*

➢*Coronal plane balancing*

- *In reality, adequate removal of osteophytes results in correct medial and lateral collateral ligament balancing in vast majority of cases, however, in cases where a non-correctable varus or valgus deformity persists, staged soft tissue release are required.*

General Rules>>

- concave side:

tight ligaments need release.

- convex side:

stretched ligaments need tightening.

must test balancing in both flexion and extension!

What are the technical goals of TKA?

- ***Technical goals**:*

➢*Coronal plane balancing*

The Varus Knee

Osteophytes & meniscus

Deep MCL

Posteromedial corner(Semimembranousus and capsule)

Superficial MCL !!

What are the technical goals of TKA?

- ***Technical goals**:*

➢*Coronal plane balancing*

- *Perform differential release: posterior portion of MCL is tight in extension while the anterior portion is tight in flexion*
- *The PCL is often included for significant varus deformities, in which a cruciate substituting implant should be used.*

What are the technical goals of TKA?

- ***Technical goals**:*

➢*Coronal plane balancing*

The Valgus Knee

Osteophytes

Lateral capsule

Iliotibial band (tight in extension)

Popliteus (tight in flexion)

LCL

What are the technical goals of TKA?

- ***Technical goals**:*

➢*Sagittal plane balancing*

Goal: to obtain a gap that is equal in extension and flexion

General rules:

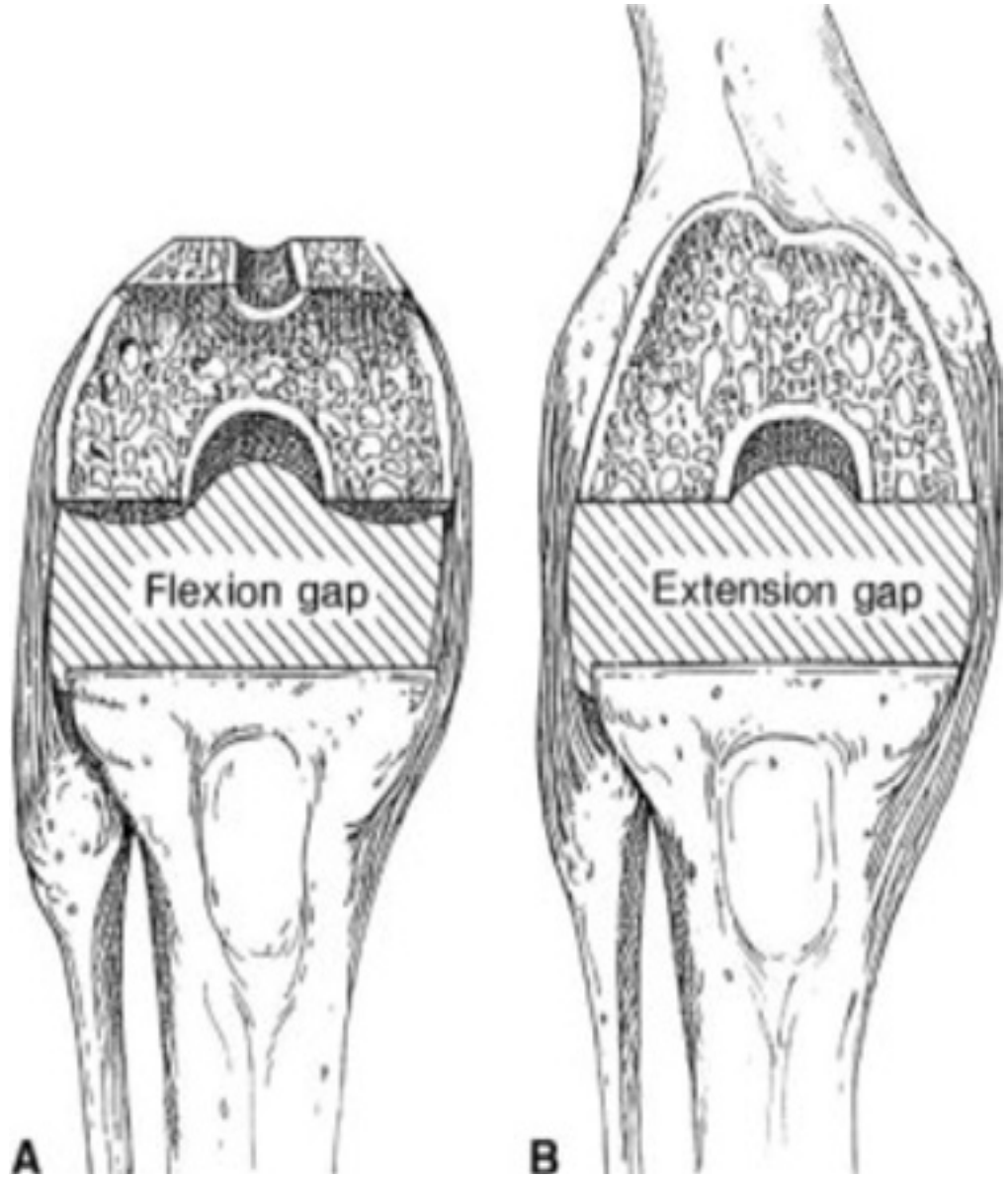
- *Adjust femur if asymmetric :*

➢ *distal femur cut affects extension gap*

➢ *posterior femur cut affects flexion gap*

- *Adjust tibia if symmetric (same in both flexion and extension):*

➢ *tibia cut affects both flexion and extension gaps*


Flexion gap
Extension gap
A
B

What are the technical goals of TKA?

- ***Technical goals**:*

➢*Sagittal plane balancing*

Goal: to obtain gap that is equal in extension and flexion

General rules:

- *Changes in the thickness of the tibial insert will affect both the flexion gap and the extension gap equally.*
- *Changes in the size of the femoral component will affect the flexion gap only.*
- *Moving the femoral component anterior or posterior increases or decreases the flexion gap respectively.*
- *gap which is appropriate in extension and loose in flexion can lead to posterior knee dislocation.*
- *Tight in flexion and tight in extension can lead to tibial tray lift off*

What are the technical goals of TKA?

- ***Technical goals**:*

➢*Restoration and preservation of Q angle*

- *Angle between axis of extensor mechanism and axis of patellar tendon*.
- increase in the Q angle will lead to increase lateral subluxation forces on the patella relative to the trochlear groove, possible pain, mechanical symptoms, accelerated wear, and even dislocation.

What are the technical goals of TKA?

- ***Technical goals**:*

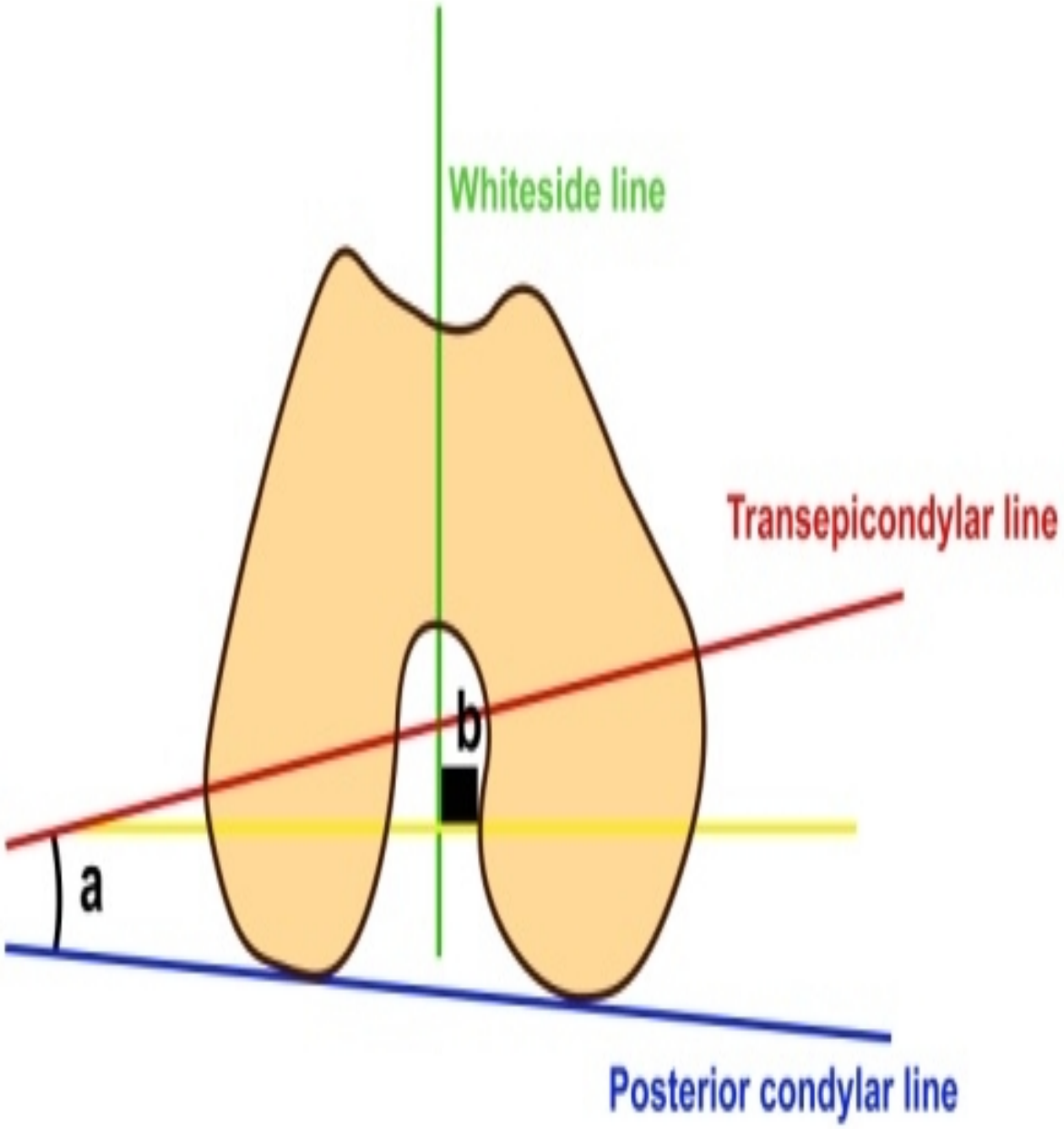
➢ *Restoration and preservation of Q angle*

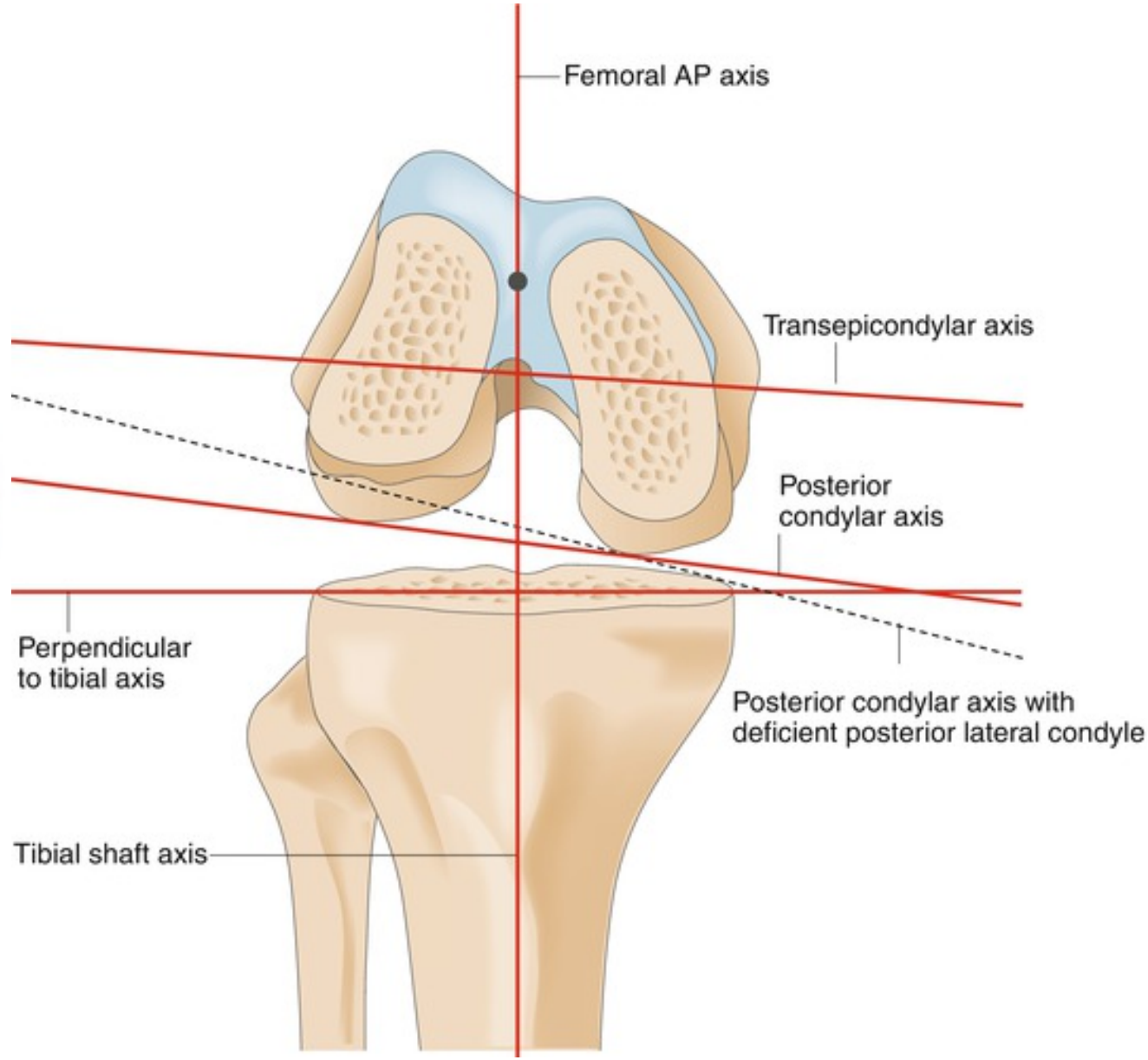
- *Established techniques to determine proper femoral component rotation:*

➢ *Cutting perpendicular to Whiteside's line (a line from the centre of the trochlear groove to the centre of the intercondylar notch)*

➢ *Cutting parallel with the trans-epicondylar axis.*

➢ *Cutting at 3 degree external rotation to the posterior condylar axis (its 3° internally rotated relative to the transepicondylar axis)*


Whiteside line
Transepicondylar line
b
a
Posterior condylar line


Femoral AP axis
Transepicondylar axis
Posterior
condylar axis
Perpendicular
to tibial axis
Posterior condylar axis with
deficient posterior lateral condyle
Tibial shaft axis

What are the palpable landmarks used to assist the placement of the extramedullary tibial alignment jigs?

- *The palpable landmarks used to place the extramedullary tibial alignment jigs are the tibial tubercle, tibial spines, and medial and lateral malleolus.*
- *The jig should be positioned over the tibial tubercle and aligned parallel with the tibial spines, while intersecting the intermalleolar distance.*
- *In this position, the jig should line up with the second ray of the foot.*

What are the different designs of knee implants in TKA?

- *Constraint ladder: Cruciate retaining (CR) → PCL substituting (PS) → Constrained non-hinged → Constrained hinged.*

❖***Cruciate retaining (CR):***

- *Depends on the intact PCL to provide stability in flexion.*
- *X-ray doesn't show box in the central portion of the femoral component.*
- *Indications:*

➢ *Minimal bone loss*

➢ *Minimal soft tissue laxity*

➢ *Intact PCL*

➢ *Mild deformity. Varus<10°. Valgus <15°*

What are the different designs of knee implants in TKA?

❖***Cruciate retaining (CR):***

- *Advantages:*

➢ *Preserves the anatomy and normal knee kinematics*

➢ *Preserves proprioceptive fibres (intact PCL)*

➢ *Preserves bone stock on the femoral side (less distal femoral cut)*

➢ *Provides less constraint, so lower shear forces at the tibial component – host interface.*

➢ *Avoids tibial post-cam impingement that occur in P.S knee*

What are the different designs of knee implants in TKA?

❖***Cruciate retaining (CR):***

- *Disadvantages:*

➢ *Technically more difficult to balance the knee*

➢ *Tight PCL that may cause accelerated PE wear*

➢ *Loose PCL may lead to flexion instability & subluxation.*

➢ *Less conforming surfaces to allow roll-back*

What are the different designs of knee implants in TKA?

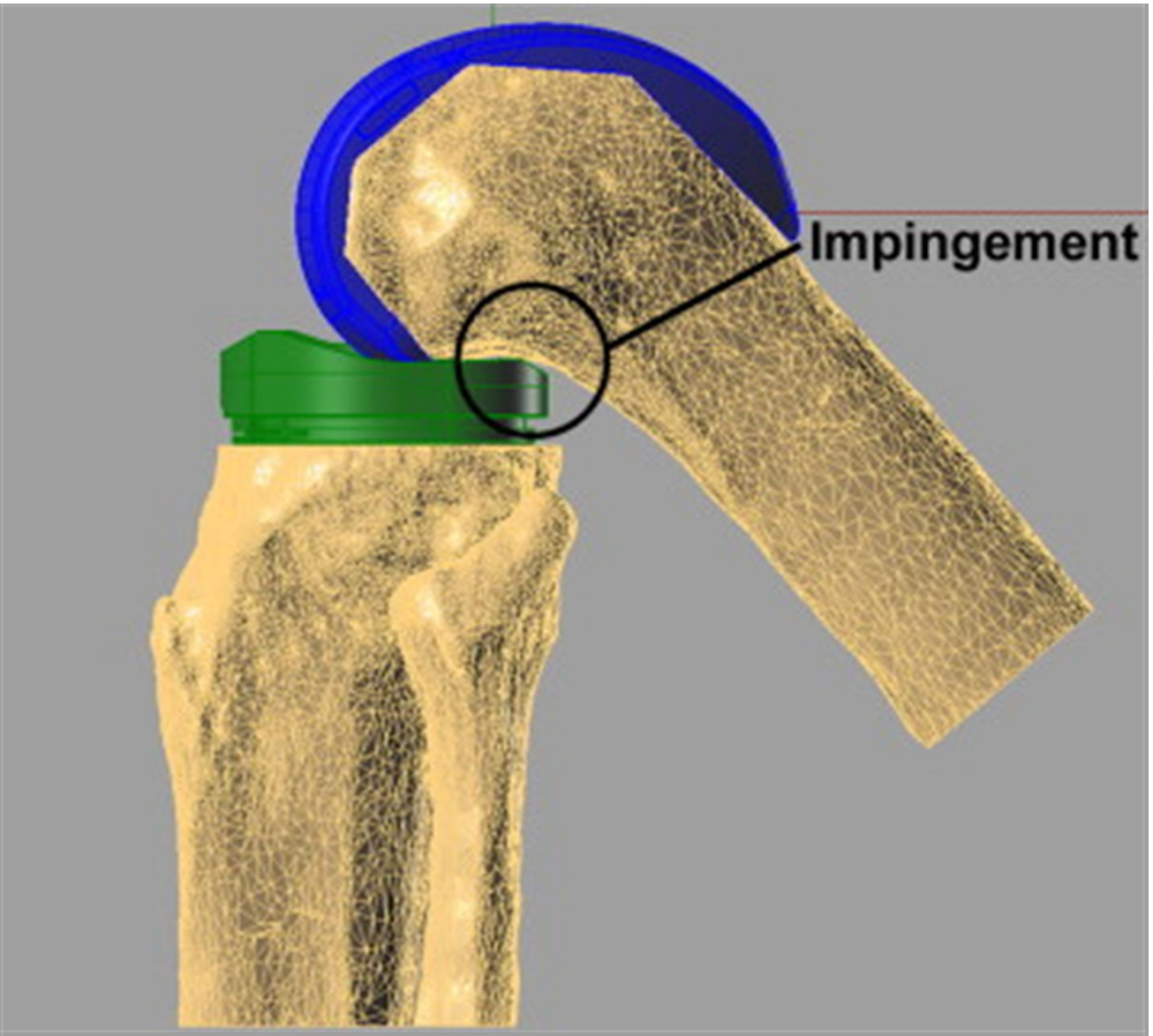
❖***PCL substituting/sacrificing***

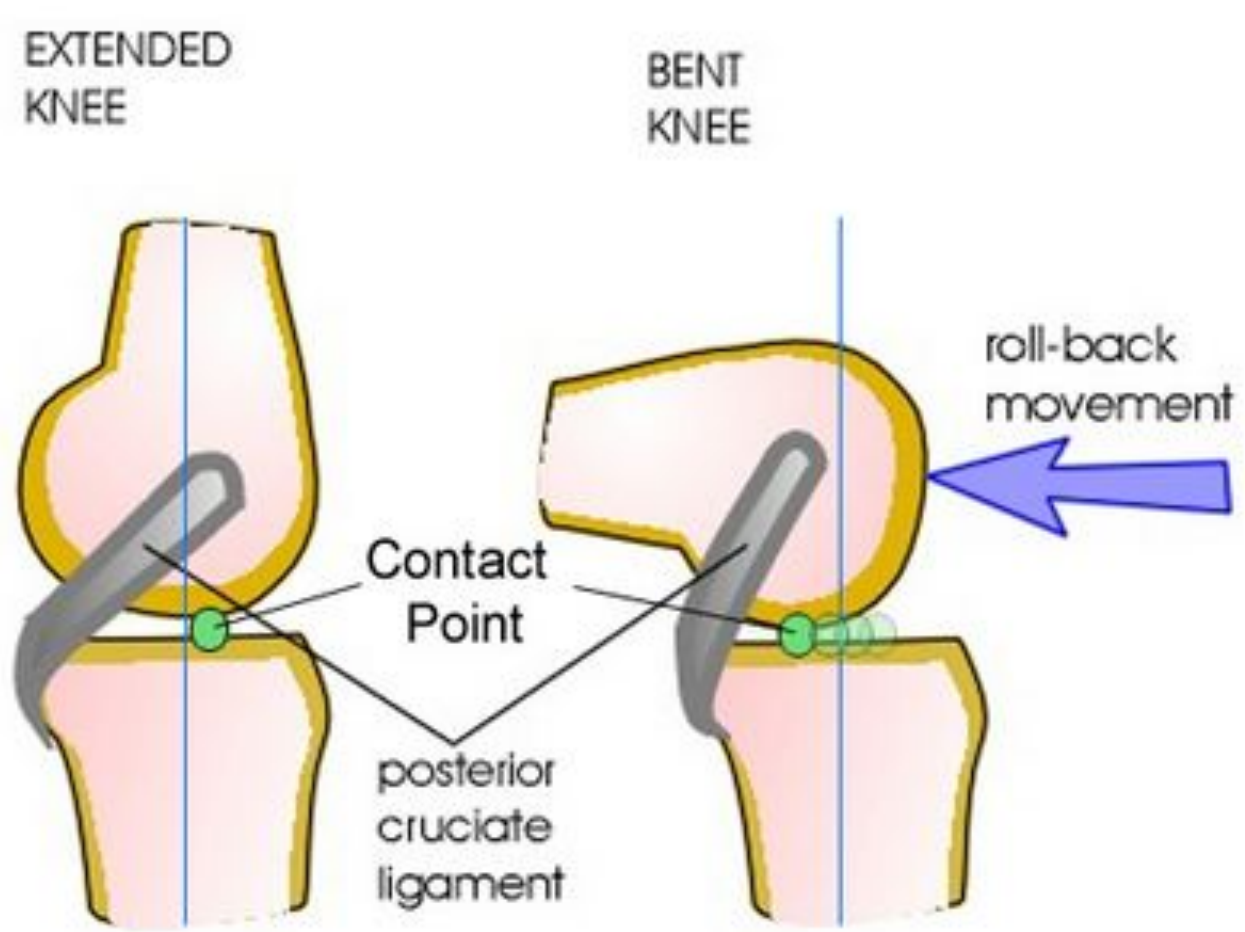
- *Femoral component contains a cam that engage the tibial PE post during flexion which prevents the cam from anterior translation and allows for mechanical roll-back*
- *Femoral roll-back: it is the posterior shift in the femoral – tibial component contact point in the sagittal plane as the knee flexes. improves quadriceps function and range of knee flexion by preventing posterior impingement during deep flexion*
- *Indications:*

➢ *Deficient or absent PCL*

➢ *Inflammatory arthritis, may lead to late PCL rupture*

➢ *Previous patellectomy*


Impingement


EXTENDED KNEE
BENT KNEE
roll-back movement
Contact Point
posterior cruciate ligament

What are the different designs of knee implants in TKA?

❖***PCL substituting/sacrificing***

- *Advantages:*

➢ *Easier to balance the knee*

➢ *Better Conforming surfaces allowing roll-back*

➢ *The cam – post mechanism improves anterior – posterior stability*

➢ *Higher degrees of flexion*

➢ *Better ROM*

What are the different designs of knee implants in TKA?

❖***PCL substituting/sacrificing***

- *Disadvantages:*

➢ *Increased constraint which associated with high stresses at the fixation interface leading to increased loosening*

➢ *Increased tibial post wear*

➢ *Tibial post dislocation. If the flexion gap is loose, femur can jump over the tibial post and dislocates.*

➢ *Patella clunk syndrome. Scar tissues get caught in the box causing snap when the knee moves in to extension*

What are the different designs of knee implants in TKA?

❖***Constrained(limitation) non-hinged***

- *It has large tibial post and deep femoral box to provide varus/valgus stability and rotational stability.*
- *Indications:*

➢ *Deficient collaterals*

➢ *Flexion gap laxity*

➢ *Moderate bone loss*

- *Provides more stability, but higher risk of loosening (due to increased constraint)*

What are the different designs of knee implants in TKA?

❖***Constrained hinged***

- *Constrained prosthesis with linked femoral & tibial components*
- *Indications:*

➢ *Global instability*

➢ *Resection of tumors*

➢ *Massive bone loss*

What are the different designs of knee implants in TKA?

❖***Mobile bearing tibial components***

- *A prosthesis where the PE insert can rotate on the tibial baseplate*
- *Indicated in the younger active patients*
- *It is believed that , due to increased contact area, it leads to decreased contact stress which lowers the PE wear.*
- *Clinical trials have shown that the mobile bearing design does not provide any functional or radiological advantage over fixed bearing prosthesis.*
- *Disadvantages: can lead to bearing spin-out (dislocation) in case of loose flexion gap.*

Resurfacing vs nonresurfacing of the patella in TKA?

- *It has been shown that resurfacing:*
  - *Reduces anterior knee pain*
  - *Improved knee strength in flexion (strain descent)*
- *Recent long term results showed no difference in outcomes between resurfaced and nonresurfaced knees.*
- *Against resurfacing: long term problems with patellar fracture.*
- *Indications for selective patellar replacement:*
  - *Patellofemoral osteoarthritis*
  - *Rheumatoid arthritis (inflammatory)*
  - *Preoperative patellofemoral pain*
  - *Obese patients.*

TKA technique

- *Approach has been described*
- *Remove femoral osteophytes and ACL and mark the Whiteside line.*
- *Insert the intramedullary guide for femoral alignment just medial to the midline and anterior to PCL attachment. Fix the distal cutting device with the desired valgus with respect to IM rod. Oscillating saw used for distal femur cutting. Protect the collateral ligaments and tibial surface from oscillating saw.*
- *Mark the transepicondylar axis. Align the cutting guide parallel to transepicondylar axis for anterior femoral cut. Adjust the height to prevent notching of the anterior cortex. Make the anterior cut – posterior cut – chamfer cut*
- *Then place the notch cutting block*
- *Remove the remnant from PCL and posterior horns.*
- *Place the tibial extramedullary guide, tibial cut is made perpendicular to its anatomical axis.*

TKA technique

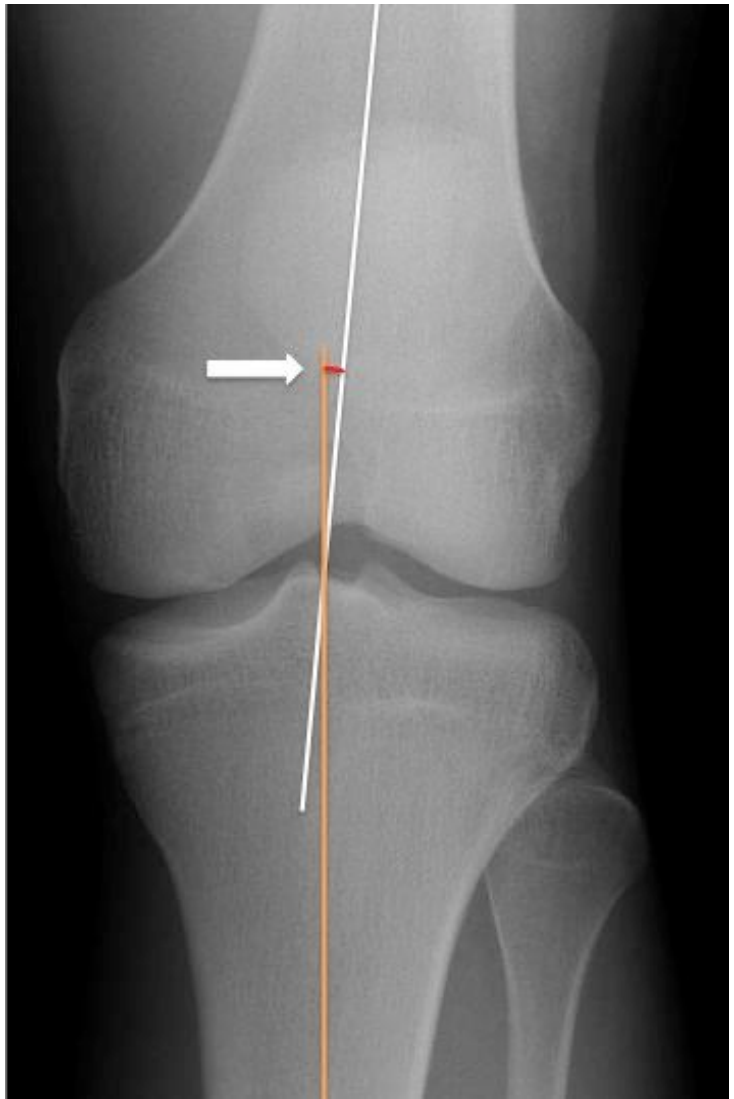
- *Impact the trial and assess*
- *Thoroughly lavage the knee joint, remove any debris and prepare for cementing.*

Viva 6

- Describe the radiograph
- What is the importance of the possible medial joint line opening seen in the radiograph?
- What conditions are associated with this pattern of joint disease?
- What are the perioperative considerations for total knee arthroplasty in valgus knee?
- What are the problems and the intraoperative technical considerations associated with knee valgus deformity?
- what form of knee replacement would be appropriate?
- Describe the method of lateral ligament complex release and balancing the knee for valgus knees?

Describe the radiograph

- *This A/P weightbearing radiograph of right knee showing lateral compartment osteoarthritis noted by the loss of joint space, osteophytes formation and subchondral sclerosis. It shows also valgus deformity of the left knee.*
- Tibiofemoral angel is defined as the angle between the anatomical axis of femur & the anatomical axis of tibia.
- *The normal tibiofemoral angle is 5 – 6 degrees.*
- *The valgus knee can be defined as a tibiofemoral angle greater than 10 degrees.*



What is the importance of the possible medial joint line opening seen in the radiograph?

- *this could represent deficiency of the MCL. In this situation one should have the option of a constrained prosthesis available when it comes to surgery.*

What conditions are associated with this pattern of joint disease?

- *The valgus deformity of the knee with arthritis is commonly seen in:*

➢*women*

➢*inflammatory joint conditions such as rheumatoid arthritis.*

➢*overcorrection of high tibial osteotomy (HTO)*

➢*post-traumatic arthritis following lateral meniscectomy*

➢*osteonecrosis.*

What are the perioperative considerations for total knee arthroplasty in valgus knee?

- *The preoperative assessment should include a thorough history and examination to establish if there are any predisposing factors such as rheumatoid arthritis and the success of non-surgical management. The competency of the knee collateral ligaments and degree of deformity correction should be assessed in order to plan on type of implants.*

What are the problems and the technical considerations associated with knee valgus deformity?

- *The medial structures are stretched while lateral and posterior structures are contracted.*
- *the release of lateral and posterior structures may result in increased extension gap requiring a thicker insert which may elevate the joint line.*
- *Excessive PCL release usually requires cruciate sacrificing implants in order to balance the knee*
- *Lateral femoral condyle hypoplasia, therefore the tibia is externally rotated relative to the femur.*
- *the standard 3° posterior condylar referencing can result in internal rotation of the component. AP axis (Whiteside line) is used to prevent malrotation in the form of internal rotation*

What are the problems and the technical considerations associated with knee valgus deformity?

- *Patellar maltraking*
- *With correction of significant valgus deformity, one has to watch for peroneal nerve palsy in the postoperative period.*

what form of knee replacement would be appropriate?

- *depends on the extent of the soft-tissue release and the competence of the ligaments following the release.*
- *In the valgus knee the competence of the medial collateral ligament (MCL) is a factor that should be assessed pre-operatively, as well as whether or not the FFD and valgus are correctable.*
- *If the MCL and the lateral collateral ligament (LCL) are competent after the soft-tissue releases and bone cuts have been made, an unconstrained TKR prosthesis may be used.*
- *If the PCL is attenuated and/or if the joint line is significantly altered, a posterior stabilised design is recommended (PCL substituting option should always be available at the time of surgery)*

what form of knee replacement would be appropriate?

- *If the MCL is attenuated then a more constrained prosthesis will be required.*
- *If the LCL has to be released then, again, a more constrained prosthesis will be required.*

Describe the method of lateral ligament complex release and balancing the knee for valgus knees?

- *Sequential release of lateral structures (more on the femoral side). This is called inside out technique*
- *Lateral release should begin with removal of the lateral osteophytes off the femur and tibia and release of the lateral capsule off the tibia → If the knee is tight laterally in extension the iliotibial band can be released either sub-periosteally off Gerdy's tubercle, or by Z-lengthening or "pie-crusting" → The next structure to be released is popliteus tendon, which is released sub-periosteally off the lateral condyle of the femur. In a large > 15° valgus deformity these releases will usually be necessary. → If the knee still remains tight laterally the next step would be to release the LCL sub-periosteally off the* ***lateral condyle of the femur****. At this stage a constrained knee prosthesis should be considered and one should be aware of the possibility of stretching the peroneal nerve when correcting large valgus deformities.*

Viva 7


- *What can you see?*
- *What is unic-ompartmental knee arthroplasty and how is it different from total knee arthroplasty?*
- *what are the Prerequisites for UKA?*
- *what are the contraindications for UKA?*
- *UKA vs TKA*

What can you see?

- *AP and lateral radiographs showing a left medial UKA. The components look well fixed and aligned. There are no obvious periprosthetic fractures. The lateral compartment and PFJ look relatively normal.*

What is unic-ompartmental knee arthroplasty and how is it different from total knee arthroplasty?

- Unicompartmental knee arthroplasty involves replacement of a single compartment of the knee, either medial or lateral, or patellofemoral whereas total knee arthroplasty involves replacement of all three compartments of the knee: the medial and lateral compartments and the patellofemoral compartment.
- Both the anterior and posterior cruciate ligaments are preserved in unicompartmental knee arthroplasty.
- Medial compartment is more common, lateral compartment arthroplasties have equivalent results to medial.

what are the Prerequisites for UKA?

- Unicompartmental diseases (non-inflammatory).
- Intact ligaments (ACL & PCL).
- No signs of medial-lateral subluxation or instability.
- Correctable Varus deformity < 10, valgus deformity < 5.
- FFD < 15.
- ROM > 90.
- Elderly >60.
- Thin (non-obese).
- Low activity demand.

what are the contraindications for UKA?

- Tricompartmental osteoarthritis.
- Inflammatory arthritis.
- Previous menisectomy in the opposite compartment
- Anterior cruciate ligament (ACL) deficiency
- Fixed varus deformity that cannot be corrected on clinical examination
- Knee flexion contracture >15°
- Range of motion <90° of flexion

UKA vs TKA

❖**Advantages**

➢Smaller incision.

➢Less time/blood loss/dissection/morbidity.

➢Preservation of normal knee kinematics

➢More Range of movement.

➢Easier surgery/cheaper.

➢Early rehabilitation/return to work

➢Avoids patellar related complications (maltraking-fracture-dislocation)

➢Maximizes the longevity of TKA

UKA vs TKA

❖**Disadvantages**

- 90% 10 year survival – less than TKR.
- Feasible only if one compartment involved.
- Needs good range of movement with varus or valgus malalignment less than 10 degrees.
- 10 % revision rate compared to 3% for total knee. *The most common cause of revision is disease progression*.

Viva 8

- What are the prerequisites for the procedures shown on the radiograph?
- What are the types of this procedure?
- Discuss the pre operative planning and the different techniques of this procedure
- Discuss methods of fixation.

What are the prerequisites for the procedures shown on the radiograph?

- *the radiograph showed medial opening wedge valgus producing high tibial osteotomy. Prerequisites:*

➢ *Age <60 years, active, healthy patients*

➢ *Non-obese patients. BMI<35*

➢ *Unicompartmental disease.*

➢ *No inflammatory arthritis.*

➢ *Flexion contracture < 15 degrees*

➢ *> 90 degrees flexion*

➢ *Procedure needs < 15 degrees correction*

➢ *Coronal knee stability*

➢ *No history of total meniscectomy of the other compartment. (in the history it is important to ask if the patient ahd previous surgery)*

➢ *Non-smoker (use CWHTO in smokers)*

What are the types of this procedure?

- *predominately done for varus deformities. Valgus producing osteotomy, success rate 50 – 85 %*
- *less common for valgus deformities. Varus producing osteotomy, success rate 87%. Distal femoral osteotomy better if lateral femoral condyle hypoplasia present*

Discuss the pre operative planning and the different techniques of this procedure?

- *Basic concept*

➢ *Centre of the hip = centre of femoral head.*

➢ *Centre of the knee = midpoint of line connecting the two spines.*

➢ *Centre of the ankle = midpoint of talar width and height.*

➢ *Mechanical axis of lower limb = weight bearing line = straight line from the centre of the hip to centre of the ankle.*

➢ *Mechanical axis of the femur and tibia.*

Discuss the pre operative planning and the different techniques of this procedure?

- *Aim (goals)*

➢ *Unload the compartment.*

➢ *Reduce pain.*

➢ *Delay TKR.*

Discuss the pre operative planning and the different techniques of this procedure?

- *Planning*

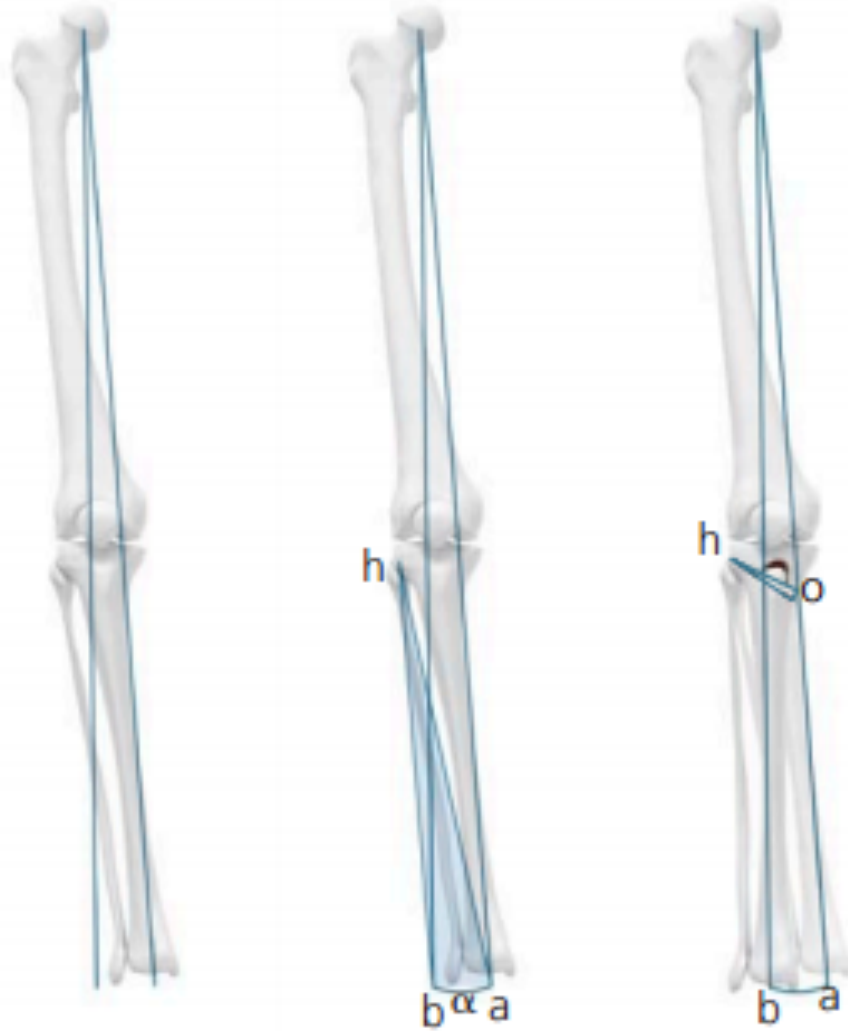
➢ *Appropriate radiography: weight bearing A/P, lateral and skyline views – Standing long leg radiographs in neutral position*

➢ *Measure the mechanical axis*

➢ *Draw the new mechanical axis*

➢ *Measure the degree of deformity and plan the size of wedge needed.*

➢ *Determine Fujisawa point (62% of tibial plateau width from medial side)*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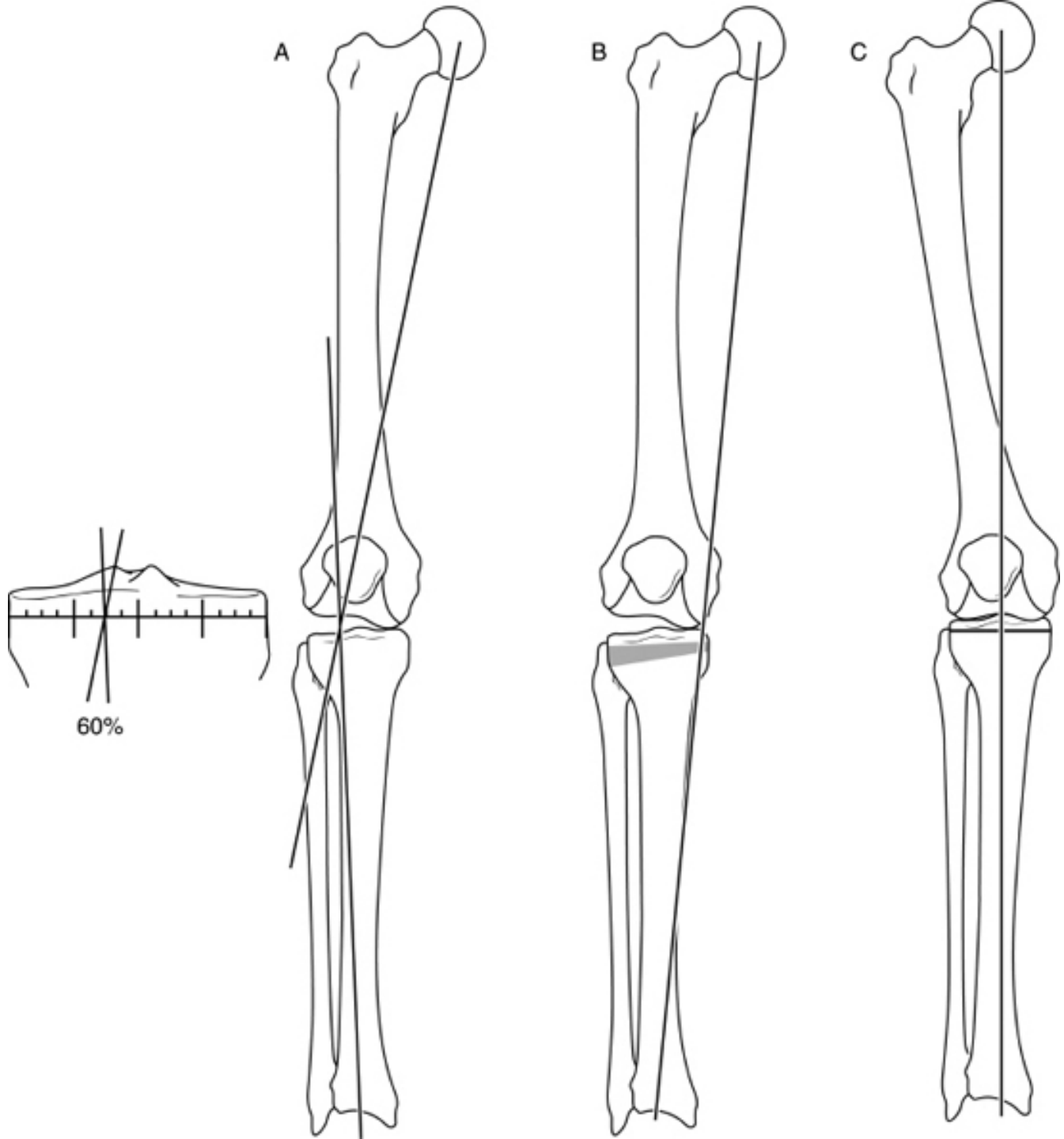
A
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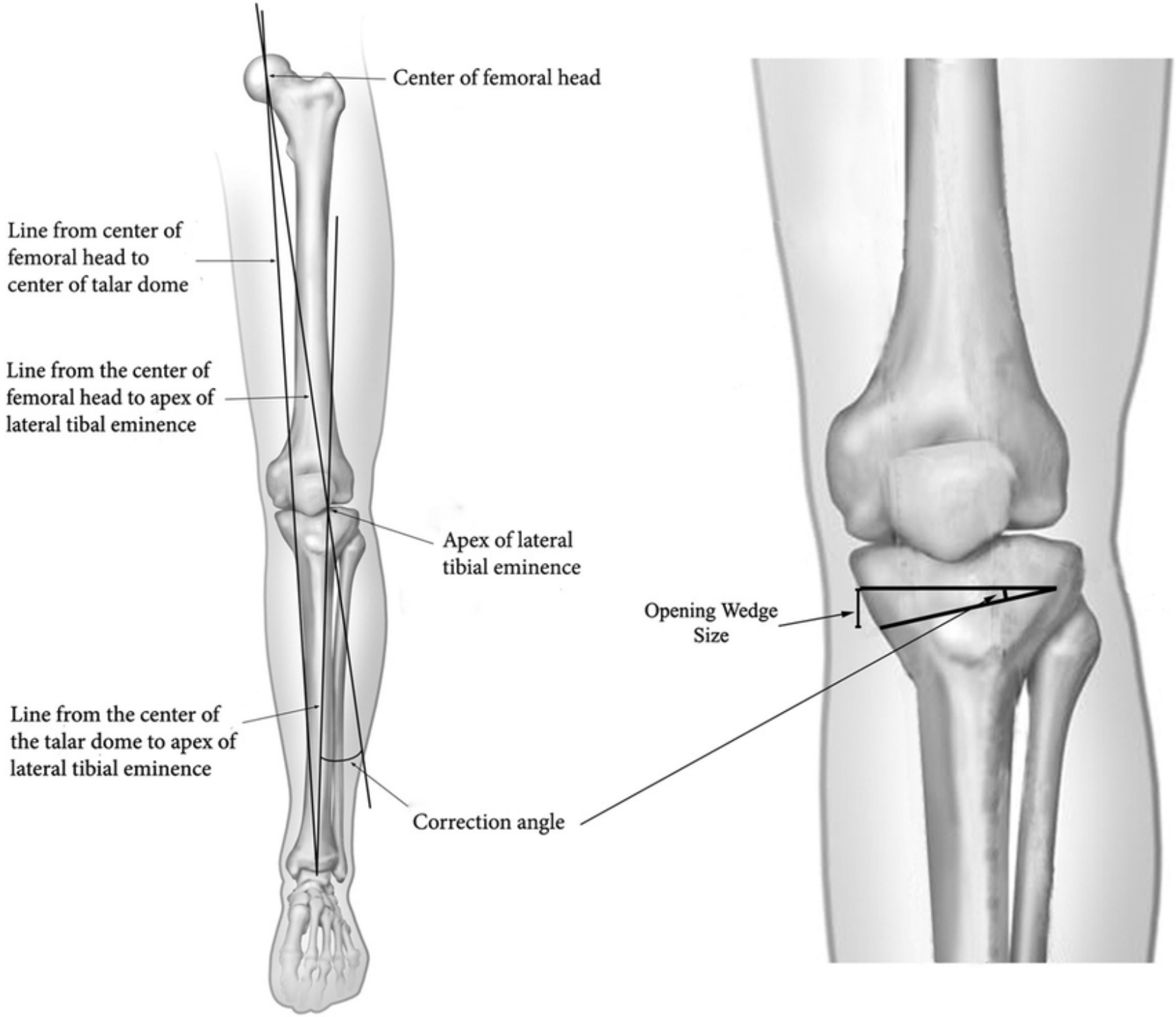
C
60%


Center of femoral head
Line from center of femoral head to center of talar dome
Line from the center of femoral head to apex of lateral tibal eminence
Apex of lateral tibial eminence
Line from the center of the talar dome to apex of lateral tibial eminence
Correction angle
Opening Wedge Size

Discuss the pre operative planning and the different techniques of this procedure?

- *Techniques*

❖*lateral closing wedge technique*

- *most common technique*

➢ *Anterolateral approach starting 1cm below the joint line and continues towards the lateral edge of the tibial tubercle and anterior tibial crest*

➢ *anterior tibialis muscle is elevated using a periosteal elevator to expose the bone.*

➢ *Osteotomy starts above the level of tibial tubercle and 15mm from the joint line*

➢ *Osteotomy is directed medially parallel to the joint line.*

➢ *Medial cortex and periosteum is preserved to act as a hinge while closing the osteotomy*

➢ *wedge of bone removed (A 10mm wedge excision leads to 10 degrees correction in 57mm wide tibia)*

➢ *Protect peroneal nerve*

➢ *ORIF of wedge using a plate or staples*

Discuss the pre operative planning and the different techniques of this procedure?

- *Techniques*

❖*lateral closing wedge technique*

- *Advantages*

➢ *greater potential of correction*

➢ *Provides more stability allows for faster rehab and weightbearing*

➢ *No required bone graft*

Discuss the pre operative planning and the different techniques of this procedure?

- *Techniques*

❖*lateral closing wedge technique*

- *Complications*

➢ *Lower the posterior tibial slope*

➢ *Patella baja (common with open wedge)*

➢ *Proximal tibio-fibular joint disruption. Fibular osteotomy at the same time of tibial osteotomy prevents this complication.*

➢ *Vascular injury: anterior tibial artery – posterior tibial artery*

➢ *Peroneal nerve palsy*

➢ *Compartment syndrome*

➢ *more difficult conversion to TKA*

Discuss the pre operative planning and the different techniques of this procedure?

- *Techniques*

❖*Medial opening wedge technique*

- *Technique*

➢ *An incision is made in the midway between posteromedial border of the tibia and medial aspect of the tibial tuberosity.*

➢ *Sartorius fascia is cut and retracted medially*

➢ *Two K-wires are placed 4 cm below the medial joint line just above the Pes anserinus toward the safe zone of the lateral cortex (safe zone at the level of the tip of fibular head)*

➢ osteotomy is done below and parallel to the k-wires using an oscillating saw leaving the lateral 10 mm intact

➢ *ORIF of wedge*

Discuss the pre operative planning and the different techniques of this procedure?

- *Techniques*

❖*Medial opening wedge technique*

- *Advantages*

➢ *Preserve bone stock (subsequent TKR is technically easier)*

➢ *avoids proximal tibiofibular joint*

➢ *avoids peroneal nerve in anterior compartment*

➢ *Use of single cut*

➢ *Easier to convert to total knee replacement*

Discuss the pre operative planning and the different techniques of this procedure?

- *Techniques*

❖*Medial opening wedge technique*

- *Disadvantages*

➢ *Requires bone graft*

➢ *Increased incidence of non-union and delayed union.*

➢ *Loss of fixation and recurrence of varus deformity*

➢ *Raising the joint line and patella baja*

➢ *Increasing the posterior tibial slop which increase anterior tibial translation.*

➢ *Slow rehabilitation*

➢ *MCL becomes tight*

Discuss the pre operative planning and the different techniques of this procedure?

- *Techniques*

❖*CWHTO vs OWHTO*

- *No differences were found for any clinical outcome including pain, functional score or complications. Smith et al a meta-analysis 2011*
- *All techniques have short – midterm good results.*

Discuss the pre operative planning and the different techniques of this procedure?

- *Techniques*

❖*Distal femur osteotomy*

- *Indicated in*

➢ *Valgus knee with severe deformity > 12 degrees needs distal femur varus producing osteotomy to prevent joint line obliquity*

➢ *Lateral femoral condyle hypoplasia*

Discuss methods of fixation.

❖*Spacer plates (i.e. the Puddu plate)*

- *Pros*

➢ *small, low profile implants that require small incision*

➢ *less soft tissue damage.*

- *cons*

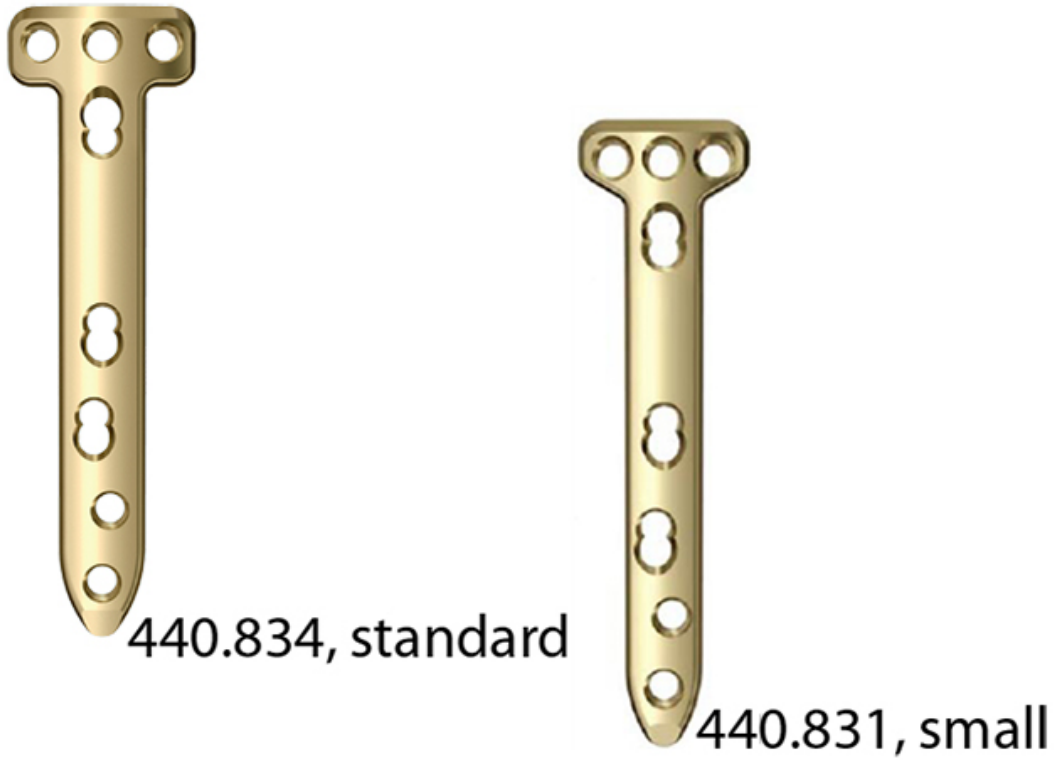
➢ *less rigid with the possibility of delayed union, nonunion, and failure of fixation leading to increased posterior tibial slope*

➢ *necessitates longer period of non-weight bearing for at least 6 weeks after surgery*

Discuss methods of fixation.

❖*Plate fixators (i.e. The TomoFix plate)*

- *are based on the locking compression plate (LCP) concept offering the advantage of a rigid fixation, possibility of early weight bearing after two weeks, and early start of motion. Eight locking bolts are the minimum required number of screws for a rigid fixation with four proximal and four distal to the osteotomy site.*



Viva 9

- What are the possible causes of the complication shown on radiograph?
- What are the surgical technical options to correct this complication in TKA?

What are the possible causes of the complication shown on radiograph?

- *Radiograph of the knee showed HTO with patella baja*
- *Causes:*

➢ *Rising of the joint line relative to the tibial tubercle (commonly occur in OWHTO)*

➢ *Scarring or infra-patellar contraction syndrome (occurs in both OWHTO & CWHTO)*

What are the surgical technical options to correct this complication in TKA?

- *Trim anterior tibial and patellar PE at the impingement sites*
- *Lowering the joint line by cutting more off the proximal tibia and using distal femoral augmentation*

Viva 10

The failed TKA

- Describe the radiograph
- What are the commonest causes of pain following TKA?
- How would you investigate a patient with pain following TKA?
- What are the causes for TKA revision?
- What are the causes of catastrophic PE failure?
- Are you aware of any classification system for bone loss around knee arthroplasty?
- What are the main goals of revision TKA?
- What are the implant choices for revision TKA?
- What are the options of management of the extensive bone loss?
- What are the operative steps in revision knee surgery?

Describe the radiograph

- *This an A/P radiograph of both knees, demonstrate bilateral total knee arthroplasty. In the right knee, there is varus tilt of the tibial component, with long stem knee replacement in the left side*

What are the commonest causes of pain following TKA?

- *Laskin categorized pain after TKA into seven types:*

➢*start-up pain*

➢*pain on weight bearing*

➢*Pain with full flexion*

➢*Pain with full extension*

➢*pain with stair climbing or descent*

➢*rest pain*

➢*continuous postoperative pain .*

What are the commonest causes of pain following TKA?

- ***Start-up pain***

➢*Start-up pain occurs with initial weight bearing and improves after several steps.*

➢*Following cemented arthroplasty, start-up pain usually reduced in 4 to 6 weeks.*

➢*Following cementless arthroplasty, start-up pain can continue for 3 to 4 months because micromotion is present until in-growth occurs.*

➢*Continued start-up pain is suggestive of loosening of tibial component.*

What are the commonest causes of pain following TKA?

- ***Pain on weight bearing***

➢ *Pain on weight bearing, which usually occurs from a mechanical cause, and improved when the patient sits*

What are the commonest causes of pain following TKA?

- ***Pain with full flexion***

➢ *Pain with full flexion can be caused by impingement between a posterior femoral osteophyte and the tibial component, or due to overstuffing of the flexion gape.*

What are the commonest causes of pain following TKA?

- ***Pain with full extension***

➢ *Early postoperative pain in full extension occurs with a knee effusion or hemarthrosis and usually resolves within several weeks of surgery.*

➢ *Chronic pain in full extension is commonly caused by an overstuffed extension gape.*

What are the commonest causes of pain following TKA?

- ***Pain with stair climbing or descent***

➢ *Pain associated with stair climbing or descent can be due to dysfunction of the extensor mechanism.*

➢ *Patellar maltracking or subluxation is a common cause of these symptoms.*

What are the commonest causes of pain following TKA?

- *Rest pain and Continuous postoperative pain that never improves are associated with infection or CRPS.*

What are the commonest causes of pain following TKA?

- ***The predominant causes of pain:***

➢*Infection — may not be commonest but is the most important to exclude*

➢*Patellofemoral problems*

➢*Component malposition (overhang, malalignment, poor cementing)*

➢*Loosening*

➢*Complex regional pain syndrome (CRPS)*

➢*Instability*

➢*Dual pathology (hip arthritis or spine cause)*

How would you investigate a patient with pain following TKA?

- ***Careful history:***

➢*The date and indication for arthroplasty*

➢*The nature of the pain is carefully analysed, including its character, location, radiation ,and aggravating and relieving factors*

➢*The intra-operative and immediate post-operative care, including wound healing, length of stay, and any reported complications. The rehabilitation and physical therapy course is also noted*

➢*The temporal course of the postoperative symptoms is noted. (Patients with either loosening or a haematogenous infection usually have an asymptomatic period with good knee function before becoming symptomatic. Conversely, patients with improper balancing and instability or with complex regional pain syndrome(CRPS) or dual pain typically do not report an asymptomatic interval)*

How would you investigate a patient with pain following TKA?

- ***Careful history:***

➢*any co-morbidities. Systemic illnesses, such as inflammatory arthropathy and neuropathy, can affect joint function. Diabetes can affect the outcome of TKA.*

➢*Any previous operations or procedures in the same knee.*

➢*Any dental, colonoscopic, urologic procedures.*

How would you investigate a patient with pain following TKA?

- ***Examination:***

➢*effusion/hemarthrosis*

➢*Alignment*

➢*soft tissues*

➢*CRPS*

➢*ROM*

➢*PF tracking, patella clunk*

➢*balance, flex/extension mismatch*

➢*tender areas, hips and spine.*

How would you investigate a patient with pain following TKA?

- ***Investigations:***

➢*X-ray: component sizing, tibial overhang, patellofemoral joint overstuffing, patella subluxation, loosening/infection, fractures, heterotopic ossification*

➢*Blood tests: CRP, ESR*

➢*CT scan: may help assess rotation of components*

➢*Aspiration/biopsy: if there is infection.*

What are the causes for TKA revision?

- *Patellofemoral maltracking (malposition of components). (most common cause)*
- *infection*
- *Abnormal joint line problems (elevated joint line-lowered joint line)*
- *Loosening (tibial component more common)*
- *Osteolytic wear. (backside wear due to motion between tibial insert and metal tray)*
- *Catastrophic wear. Defined as Macroscopic premature failure of PE due to excessive loading or mechanical loosening*
- Ligamentous instability
- Periprosthetic fractures
- Patellar clunk syndrome

What are the causes of catastrophic PE wear?

- *Patient factors*
  - ➢Obesity leading to increased loading over the PE accelerating the wear and leads to fatigue failure

What are the causes of catastrophic PE wear?

- *Implant factor*

➢PE thickness

- The minimum recommended thickness is 8 mm
- Solution: Avoid use a PE insert of less than 8mm by making a more tibial cut

➢Articular surface design

- flat designs of tibial PE leading to decreased contact surface area which leads to increased contact stress leading to increased wearing

What are the causes of catastrophic PE wear?

- Kinematics
  - excessive femoral roll back lead to increased PE wearing

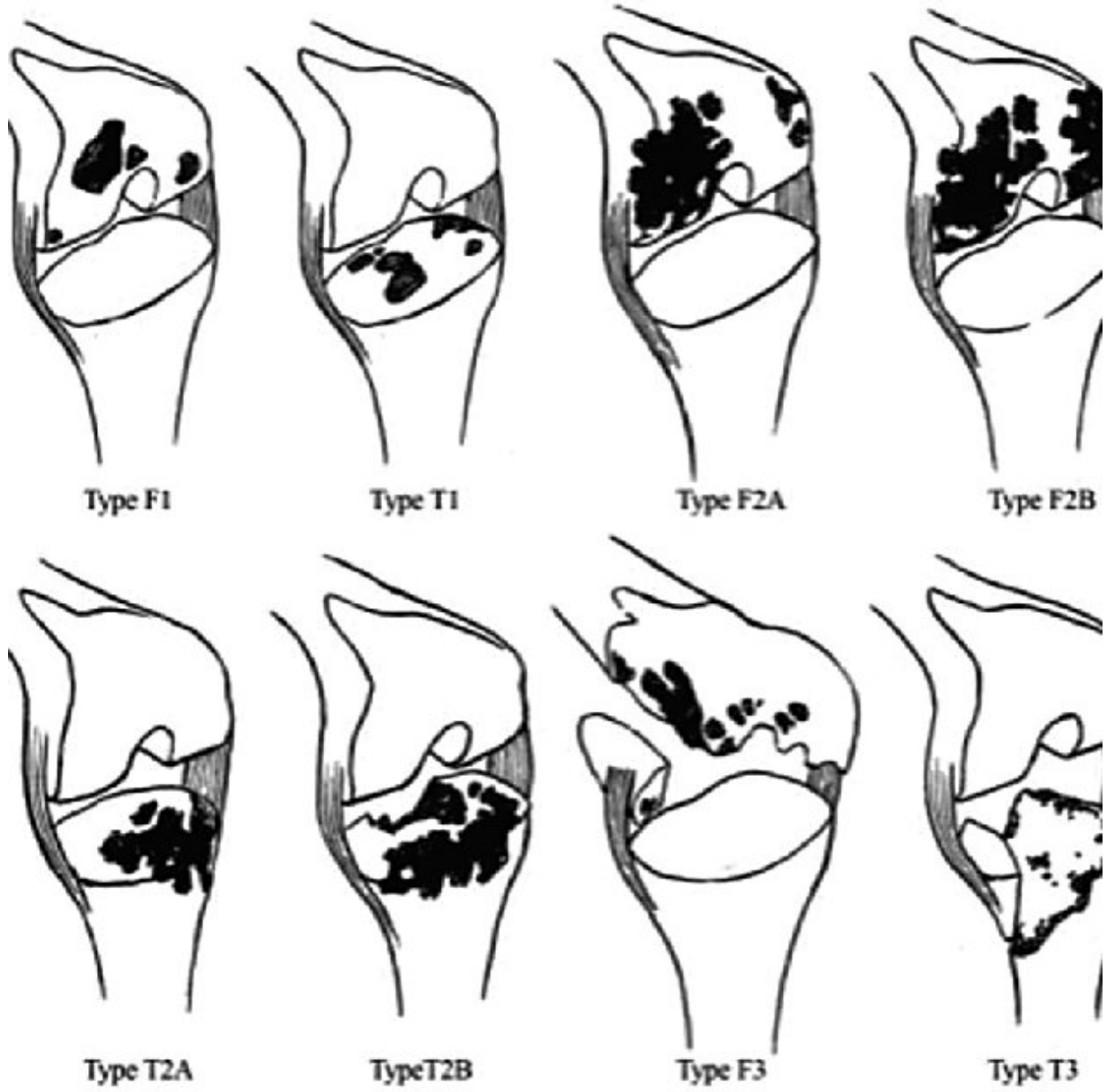
- PE machining
  - cutting tools can disrupt chemical bonds of PE leading to subsurface delamination and fatigue cracking
  - Solution: use direct compression molding of PE

What are the causes of catastrophic PE wear?

- PE sterilization
- In oxygen rich environment the PE become oxidized leading to early failure due to:
  - subsurface delamination
  - pitting
  - fatigue cracking
- Shelf time
  - More than 5 years is not recommended as increase risk of oxidization

Are you aware of any classification system for bone loss around knee arthroplasty?

Anderson Orthopaedic Research Institute (AORI) Classification		
Type	Description	Treatment
Type 1	Minor bone defects with intact metaphyseal bone that do not compromise stability	Cement fill or impaction allograft
Type 2A	Metaphyseal bone damage that involves 1 femoral condyle or tibial plateau	Cement fill, augments, small bone graft
Type 2B	Metaphyseal bone damage that involves both femoral condyles or tibial plateaus	Cement fill, augments, small bone graft
Type 3	Massive bone loss comprising a large portion of condyle/plateau, and can involve the collateral ligaments/patellar tendon	Bulk allografts, custom implants, megaprosthesis, porous tantalum, metaphyseal sleeves, rotating hinge


Type F1
Type T1
Type F2A
Type F2B
Type T2A
TypeT2B
Type F3
Type T3

What are the main goals of revision TKA?

- *Extraction of knee components with minimal bone and soft tissue destruction*
- *Restoration of cavitary and segmental defects*
- *Restoration of the joint line*
- *Balanced knee ligaments*
- *Stable knee components.*

What are the implant choices for revision TKA?

- *The constraint ladder within knee implant design includes:*

➢ *Unconstrained prosthesis (PCL retaining)*

↓

➢ *Unconstrained prosthesis (PCL substituting)*

↓

➢ *Constrained, non-hinged prosthesis*

↓

➢ *Constrained, hinged prosthesis.*

What are the options of management of the extensive bone loss?

- *The use of cement, either alone or combined with screws and mesh.*
- *The use of bone grafting with structural or morsellized graft.*
- *The use of modular augmentation of the components with wedges or blocks of metal*
- *The utilization of custom-made, tumour or hinge implants*

What are the operative steps in revision knee surgery?

❖ ***Exposure***

- *Longer skin incision, this allows identification of the normal tissue planes and allows the scar tissue to be mobilized and subsequent wound closure.*
- *Extended medial para-patellar approach, allows better visualization.*
- *Synovectomy*
- *PCL sacrifice can help in exposure*
- *Tibia tubercle osteotomy in the very stiff knee with patella Baja.*
- *Rectus snip or quadriceps turn down.*

What are the operative steps in revision knee surgery?

❖***Extraction of the components***

- *Preservation of bone stock should be considered a high priority during component removal*
- *proceed with tibial side first by establishing tibial joint line (tibial joint line should be 1.5 to 2 cm above head of fibula, use x-ray of contralateral knee to determine exact distance)*
- *After establishing tibia joint line proceed with femoral side to match the tibia*
- *Smaller defects can be filled with cement or bone graft.*
- *Gross bone loss may require megaprosthesis.*

What are the operative steps in revision knee surgery?

- ***Balance flexion-extension gap***
- ***Balance medial-lateral gap***
- ***Address the patellofemoral tracking***

Viva 11

- What are the indications/ contraindications of this procedure?
- What is the optimal position?
- What are the different techniques?
- What are the possible complications following this procedure?

What are the indications/contraindications of this procedure?

- *The radiograph showed intramedullary arthrodesis of the knee*
- *Indications:*

➢ *Salvage for failed TKA (the most common)*

➢ *Loss of extensor mechanism*

➢ *Neuropathic arthropathy*

➢ *Painful ankylosis following trauma or infection*

➢ *Poos soft tissue coverage*

➢ *Uncontrollable infection*

What are the indications/contraindications of this procedure?

- *The radiograph showed intramedullary arthrodesis of the knee*
- *Contraindications:*
- *Absolute*
  - *Infection*
- *Relative*
  - *bilateral knee arthrodesis*
  - *contralateral leg amputation*
  - *significant bone loss*
  - *ipsilateral hip or ankle DJD*

What is the optimal position?

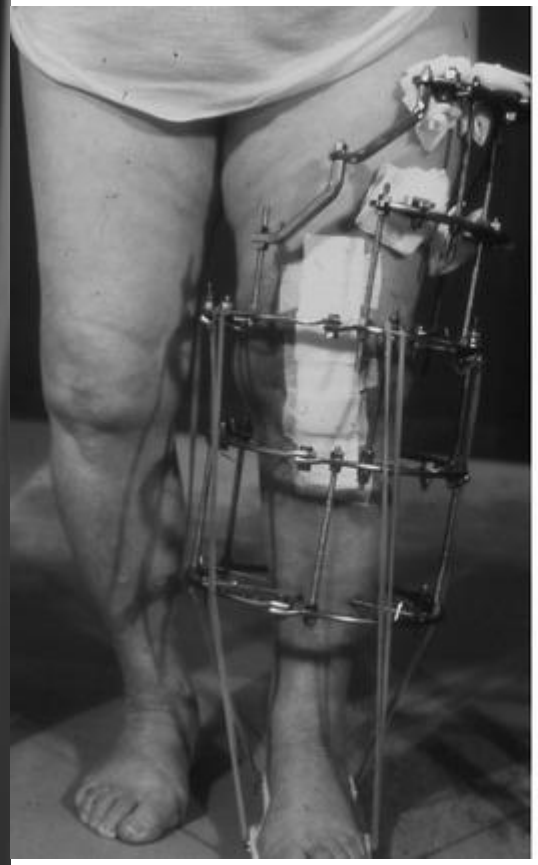
- *5 – 8 degrees valgus*
- *10 degrees external rotation*
- *10 – 15 degrees flexion*
- *The above degrees is easier to achieve with external fixator rather than IMN*

What are the different techniques?

- *IMN*
  - *can be one long antegrade device or a two part device connected at the knee, through piriform fossa*
  - *More reliable in achieving union than external fixation*
  - *Technically difficult*
  - *The nail has to be inserted after removal of implants and treatment of infection*
- *External fixation*
  - *Conventional or circular frame*
  - *Allows for arthrodesis in the presence of infection*
  - *Can be applied at the same time of implants removal*

What are the different techniques?

- *Plate fixation*
  - *Main drawback is recurrent or new infection*

What are the possible complications following this procedure?

- *Nonunion*
- *Malunion*
- *Recurrent infection*
- *Low back pain*
- *Ipsilateral hip degenerative changes*
- *Contralateral knee degenerative changes*
- *Fracture*
  - *supracondylar femur or proximal tibial metaphysis fractures*
    - *these occur from increased stress in these regions after arthrodesis*

Viva 12

- What is the etiology and the most common location of this condition?
- Are you aware of any classification system for this condition?
- How would you evaluate a patient with this condition?
- What are the treatment options?

What is the etiology and the most common location of this condition?

- *Results from acute trauma or chronic repetitive overload*

- *commonly found in anterior aspect of lateral femoral condyle and posterolateral tibial plateau*

Are you aware of any classification system for this condition?

Outerbridge Arthroscopic Grading System	
Grade 0	Normal cartilage
Grade I	Softening and swelling
Grade II	Superficial fissures
Grade III	Deep fissures, without exposed bone
Grade IV	Exposed subchondral bone

How would you evaluate a patient with this condition?

- History
  - *Not all defects are symptomatic*
  - *Activity related pain*
  - *H/O trauma*
  - *Mechanical symptoms*

How would you evaluate a patient with this condition?

Physical exam

- *look for background factors that predispose to the formation of articular defects*

➢ *joint laxity*

➢ *malalignment*

➢ *compartment overload*

➢ *Assess gait*

➢ *Assess ROM*

➢ *Ligamentous integrity*

How would you evaluate a patient with this condition?

Imaging

- *Radiograph*

➢ *A/P – lateral – merchant*

➢ *Long leg film to assess alignment*

➢ *MRI: Most sensitive for evaluating focal defects*

What are the treatment options?

❖**rest, NSAIDs, physiotherapy, weight loss**

➢ *The 1st line of treatment when symptoms are mild*

- *There are many options of surgical treatment*
- treatment is individualized, there is no one best technique for all defects
- decision-making algorithm is based on several factors
  - patient factors
    - age
    - skeletal maturity
    - low vs. high demand activities
    - ability to tolerate extended rehabilitation
  - defect factors
    - size of defect
    - location
    - contained vs. uncontained
    - presence or absence of subchondral bone involvement

What are the treatment options?

- *basic algorithm*
  - *correct malaligment, ligament instability, meniscal deficiency. Concomitant realigment procedures of the patellofemoral joint (such as lateral release, medial tubercle transfer, or anteromedial tubercle transfer) and the tibiofemoral joint (high tibial osteotomy) are indicated in the presence of mechanical malalignment.*
  - *measure size*
    - *< 4 cm2 = microfracture or osteochondral autograft transfer.*
    - *> 4 cm2 = osteochondral allograft transplantation or autologous chondrocyte implantation*

What are the treatment options?

❖**Debridement**

- *removal of loose chondral fragments may relieve mechanical symptoms*
- *problem is exposed subchondral bone or layers of injured cartilage*
- *unknown natural history of progression after treatment*

What are the treatment options?

❖Marrow stimulation (microfracture)

- *is a marrow stimulation technique where stem cells from the medullary canal are given an access to the base of the lesion by making small perforations in the subchondral bone*
- *defect is prepared with stable vertical walls and the calcified cartilage layer is removed*
- *awls are used to make multiple perforations through the subchondral bone 3 - 4 mm*
- *protected weight bearing and continuous passive motion (CPM) are used while mesenchymal stem cells mature into mainly fibrocartilage which composed mainly from collagen type I & III*

What are the treatment options?

❖Marrow stimulation (microfracture)

- *Fibrocartilage is biologically and biomechanically inferior to native hyaline cartilage.*
- *However, this repair process will create a congruent joint surface and prevent further deterioration of the adjacent cartilaginous tissue.*
- *best results for acute, contained cartilage lesions less than 2 cm x 2cm*

What are the treatment options?

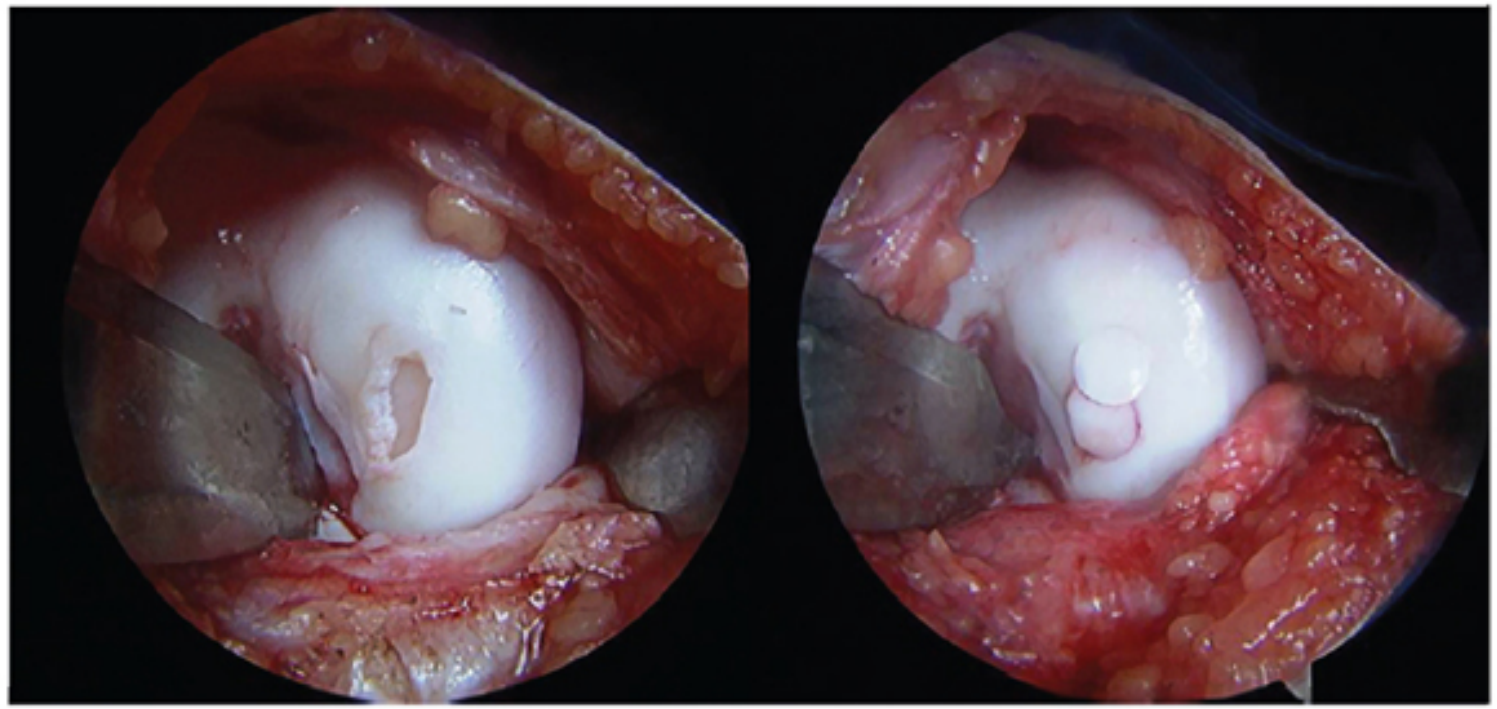
❖**Osteochondral autograft transfer (OAT) / Mosaicplasty**

- *goal is to replace a cartilage defect in a high weight bearing area with normal autologous cartilage and bone plug(s) from a lower weight bearing area (e.g. intercondylar notch)*
- *The chondrocytes in the graft remain viable, the transferred cartilage heals, and biopsy reveals articular cartilage composed primarily of type II collagen.*
- *Technique: a recipient socket is drilled at the site of the defect - a single or multiple small cylinders (8mm long – 4 to 12mm diameter) of normal articular cartilage with underlying bone are harvested from lesser weight bearing areas (periphery of trochlea or notch) - plugs are then press-fit into the defect*

What are the treatment options?

❖**Osteochondral autograft transfer (OAT) / Mosaicplasty**

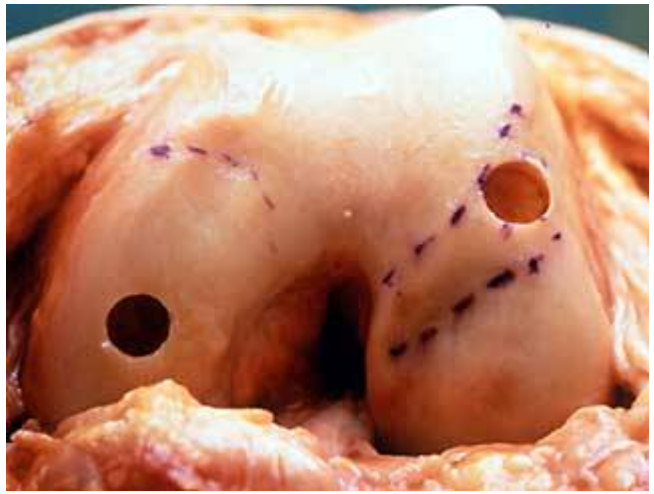
- *Pros: include autologous tissue, cost-effectiveness, single-stage, may be performed arthroscopically*
- *Cons: matching the size and radius of curvature of cartilage defect is difficult – weightbearing should delayed to 3 months.*



What are the treatment options?

❖Osteochondral allograft transplantation

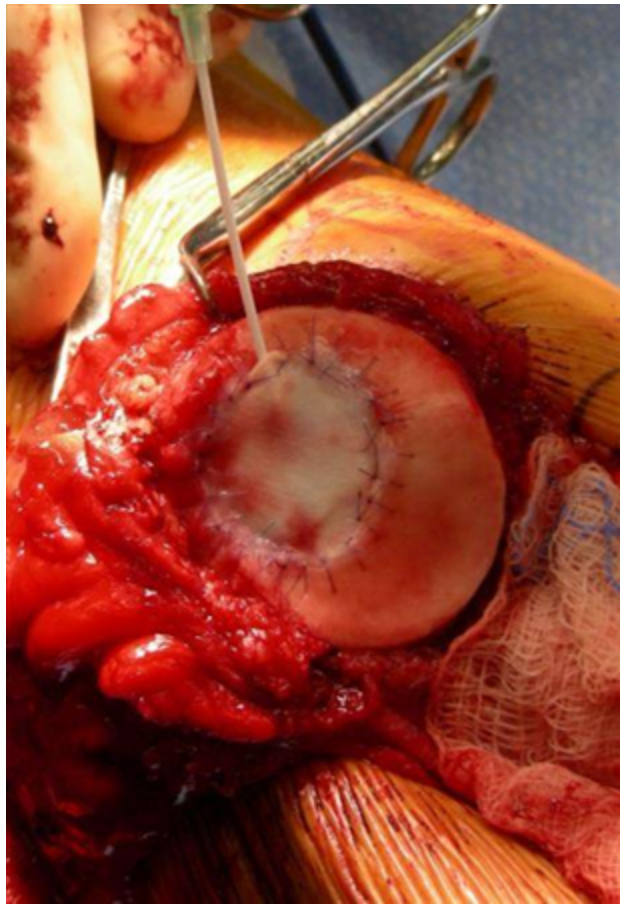
- *goal is to replace cartilage defect with fresh osteochondral allograft containing living chondrocytes with underlying bone*
- *Technique: match the size and radius of curvature of articular cartilage with donor tissue - a recipient socket is drilled at the site of the defect - an osteochondral dowel of the appropriate size is cored out of the donor - the dowel is press-fit into place*
- *Pros: ability to address larger defects, can correct significant bone loss, useful in revision of other techniques*
- *Cons: limited availability and high cost of donor tissue - live allograft tissue carries potential risk of infection*



What are the treatment options?

❖Autologous chondrocyte implantation (ACI)

- *Technique: arthroscopic harvest of cartilage from a lesser weight bearing area, in the lab, chondrocytes are released from matrix and are expanded in culture, defect is prepared, and chondrocytes are then injected under a periosteal patch sewn over the defect during a second surgery*
- *Still under evaluation and has promising early rsults*



Viva 13

- What can you see?
- Describe the anatomy of the injured structure?
- What is the mechanism of injury?
- How do they present? What are the clinical features?
- How would you treat this patient?

What can you see?

- This is A/P radiograph of a skeletally mature patient, showing Segond fracture which is an avulsion of the lateral tibial, indicates ACL injury.
- Studies have determined that a Segond fracture is actually an avulsion of the anterolateral ligament.
- Claes and Bellemans (2013) found that the ALL originates at the lateral femoral epicondyle, and inserts at the anterolateral aspect of the proximal tibia.
- Segond fracture associations: ACL (93%), medial meniscus (30%), lateral meniscus (23%).

Describe the anatomy of the injured structure?

- ACL is composed of 90% type 1 collagen, 10% type 3 collagen
- Average length is 33mm, width 11mm.
- Intra-articular, intra-synovial, intra-capsular.
- The femoral attachment is a semi-circular area on the postero-medial aspect of lateral femoral condyle, while the tibial attachment is a broad, irregular area at the intercondylar eminence.
- It has two bundles AM & PL.
- AM: originates on the anterior and proximal aspect of LFC and inserts on the anteromedial aspect of the ACL footprint on the proximal tibia. It is more isometric, tight in flexion, provides antero-posterior stability

Describe the anatomy of the injured structure?

- PL: originates posterior and lateral to AM origin, and inserts on the posterolateral aspect of the footprint of ACL attachment on the proximal tibia. Tight in extension. Provides rotational stability
- The middle geniculate artery is the primary blood supply.
- The posterior articular branch of the posterior tibial nerve provides innervation.
- ACL strength 2200 N

What is the mechanism of injury?

- Contact or non-contact injury. (*Noncontact injuries occur with the knee in slight flexion, valgus, and internal rotation as a deceleration injury, and contact injuries typically involve a lateral side impact producing a valgus force to the knee*).
- Acute ACL associated with lateral meniscal injury (more common)50%. (*Medial meniscus tears are more common in chronic ACL injuries*)
- ACL-MCL injuries are much more common than ACL-LCL injuries because of the mechanism of injury (Valgus versus Varus)

- Female athletes have a 2-4 fold higher risk of ACL injury than males. Causes:
  - Neuromuscular forces factor: the most common factor. Female athletes after menarche have higher Quad strength than hamstring, putting them at high risk of ACL injury.
  - Landing biomechanical factor: land in more extension with valgus moment
  - Anatomical: smaller notch, smaller ligament (Cross section), valgus alignment.
  - Genetic: A genotype within the COL5A1 gene is associated with reduced risk for ACL ruptures in women.

How do they present? What are the clinical features?

- 70% hear or feel a pop at time of injury.
- immediate swelling (70%) / hemarthrosis. caused by bleeding from branches of the middle geniculate artery.
- Quadriceps avoidance gait.
- Lachman test, the most sensitive test. Grading A= firm endpoint, B= no endpoint

➢Grade 1: 1-5 mm translation

➢Grade 2 A/B: 6-10mm translation

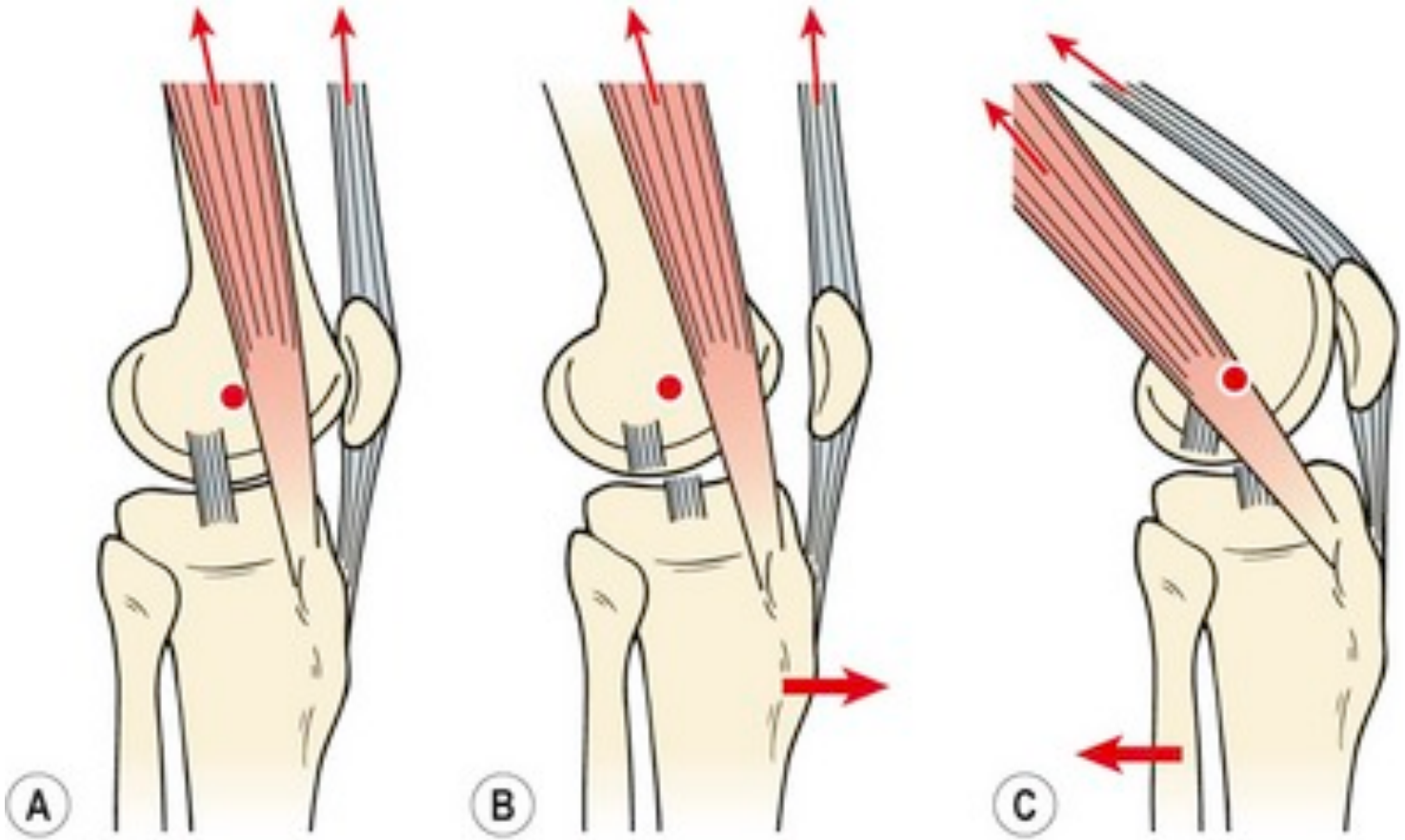
➢Grade 3 A/B: > 10mm translation

- end point is said to be hard when the ACL abruptly halts the forward motion of the tibia on the femur;
- end point is soft when there is no ACL & restraints are more by elastic secondary stabilizers
- Following ACL reconstruction laxity should not exceed 3 mm compared to the opposite site

How do they present? What are the clinical features?

- Pivot-shift test: pathognomonic for ACL injury, the test begins with the knee in full extension, which is then flexed while applying a valgus moment, as the iliotibial band passes posterior to the axis of knee rotation at 20-30° of knee flexion, the lateral tibia plateau which is subluxated **anteriorly** on the femur reduces with clunk.
- relies on an intact medial complex (MCL) and an intact iliotibial band
- Anterior drawer test

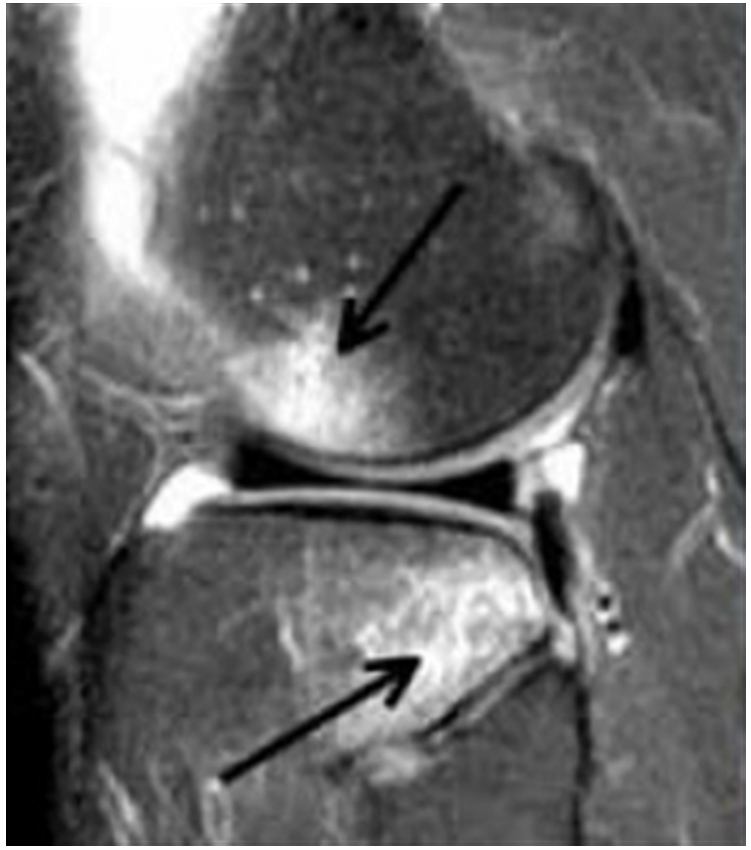
Pivot shift test mechanism



- MRI:

1. Bruising occurs in the middle 1/3 of LFC, posterior 1/3 of the lateral tibial plateau. (During the ACL subluxation event, the posterolateral tibia plateau sublaxate anteriorly, making contact with the mid portion of the lateral femoral condyle and resulting in this characteristic bone bruise pattern.
   - Also known as a kissing lesion sign.
2. Disruption of ACL fibres.
3. Empty lateral wall in coronal view. (empty hole sign)


SE/cs
TR:1000
NEEPA
FOV:14x14
4.0thk/1.0sp
256x192/2 NEX



presence or absence of fat in aspirated fluid is key distinction for osteochondral fracture associated with ACL tear

How would you treat this patient?

Non-Surgical

- Appropriate for patients with partial ACL injuries-low demand patients.
- Most patients can function well and without instability and perform activities of daily living (ADLs) after a complete ACL injury.
- Includes: physiotherapy(Hamstrings(more important) and Quadriceps strengthening exercises-proprioceptive training)-activity modification(avoid cutting and pivoting sports).

Surgical

- **Indications:**

➢ACL tear with instability that interfere with ADLs.

➢Patients who work in occupations that may involve physical compact (police officers- firefighters)

➢Children, as activity restriction is not possible.

- **Contraindications:**

➢Lack of Quadriceps function

➢Comorbidities

➢Advanced osteoarthritis is a relative contraindication.

Surgical

Immediate vs Delayed

- Immediate ACL reconstruction in the setting of a knee with limited motion carries an increased risk for postsurgical stiffness (arthrofibrosis). Delayed surgery after the patient regains range of motion is preferred.
- Patients should not have surgery until they have regained full ROM

Graft choices

Autologous Bone-Patellar tendon-Bone

- Pros:
  - ➢considered the "gold standard"
  - ➢bone to bone healing
  - ➢faster incorporation (*has been found to have the shortest duration of incorporation at approximately 6 weeks*).
- Cons:
  - ➢highest incidence of anterior knee pain.
  - ➢patella fracture (usually postop during rehab), patellar tendon rupture. Uncommon

Graft choices

Quadruple hamstring autograft

Pros:

- smaller incision
- less anterior knee pain.
- Has the highest tensile force, maximum load to failure is approximately 4000 Newton's

Cons:

- decreased peak flexion strength at 3 years compared to Bone-PT-Bone
- concern about hamstring weakness in female athletes leading to increased risk of re-rupture. Harvesting autologous hamstrings usually only results in a 10% (approximately) reduction in hamstring strength.

Graft choices

Quadriceps tendon autograft

- taken with patella bone plug
- much less common

Graft choices

Allograft

- pros & cons

➢useful in revisions.

➢longer incorporation time.

➢risk of disease transmission.

➢increased risk of re-rupture in young athletes.

➢Irradiating allograft is required to eliminate the risk of disease transmission, however, it can decrease the mechanical properties.

➢Fresh frozen grafts preserve their strength.

Graft choices

There are no consensus functional outcomes that are superior for one autograft option over the other at this time.

Surgical technique

- Double-bundle reconstruction attempts to duplicate native ACL anatomy.
- Biomechanical studies have shown that double-bundle reconstruction more closely reproduces normal knee kinematics; however, this technique does not offer a clear advantage in terms of clinical outcomes and associated with higher surgical costs because of the need for additional fixation.
- The use of one or two incisions do not appear to affect the outcome.

Surgical technique

The most important surgical factor is a well performed technique , not specific type of technique

Surgical technique

Graft size

- When using a BTB graft, the graft diameter can be determined by the surgeon.
- However, when using hamstring tendons the graft diameter is predetermined by the natural diameter of the tendons of each individual and the surgeon has no influence on that.
- Grafts greater than 7 mm in diameter are usually preferred and current recommendation is graft size of more than 8 mm

Surgical technique

Graft length

- It is estimated that a length of 9 cm for a looped graft (18 cm for un-looped) is needed, to give about 3 cm of intra-articular graft, 4.5 cm in the tibia and 2.5 cm in the femur

Surgical technique

Current standards for anatomical ACL reconstruction

Femoral tunnel placement

- **Coronal plane**: tunnel should be placed on lateral wall (9-10 o'clock position in Rt knee. 2 o'clock in Left knee) to create more horizontal graft and to reconstruct both AM and PL bundle function, Femoral tunnel posterior to lateral intercondylar ridge (Resident's ridge)
- **Sagittal plane**: keep 1-2 mm rim of bone between tunnel and posterior cortex of femur.

Surgical technique

Current standards for anatomical ACL reconstruction

Tibial tunnel placement

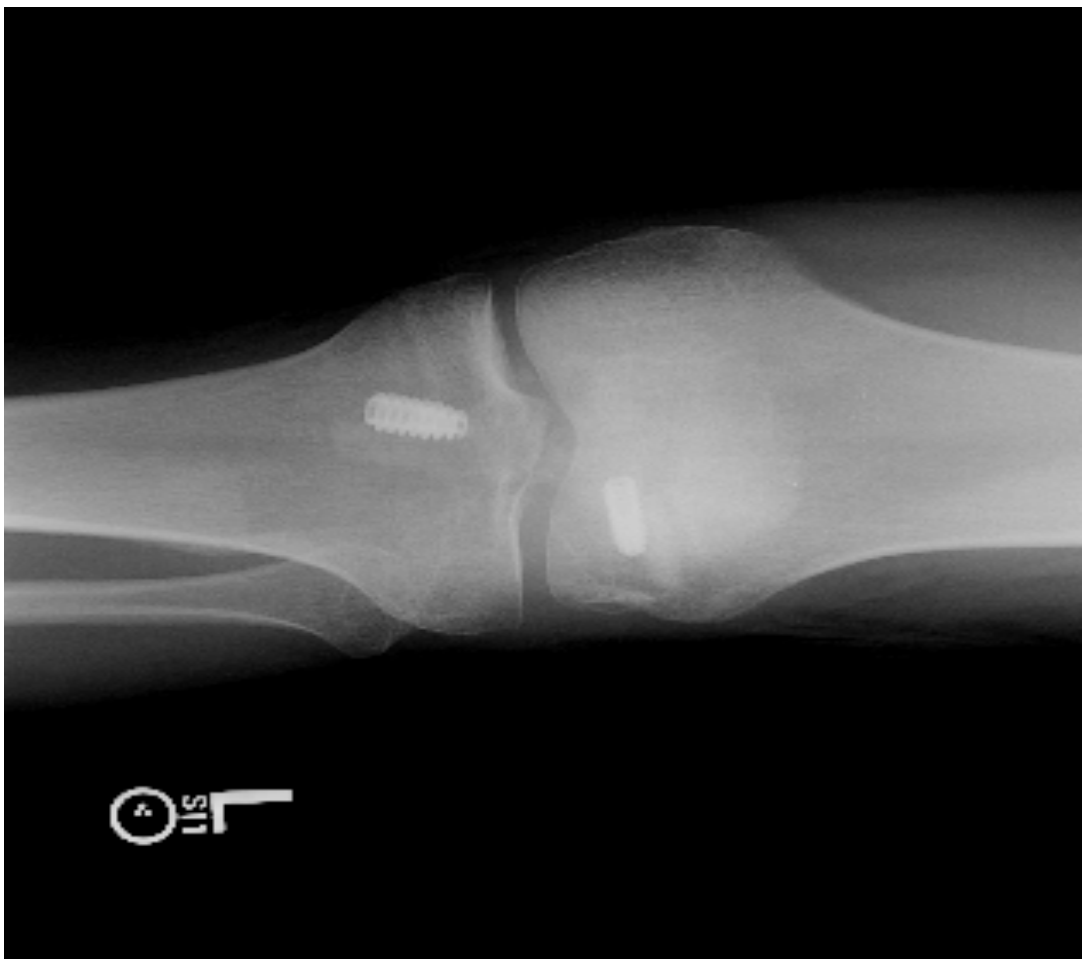
- **Coronal plane**: tunnel trajectory of < 75° from horizontal (obtained by moving tibial starting point halfway between tibial tubercle and posterior medial edge of tibia).
- **Sagittal** plane: centre of tunnel entrance into joint should be 10-11mm in front of anterior border of PCL insertion. **Posterior** to Blumenssat line when knee in full extension and 9 mm posterior to the intermeniscal ligament

Surgical technique

Current standards for anatomical ACL reconstruction

Tibial tunnel placement

- Several reference points are described for the tibial tunnel. These include the anterior border of the posterior cruciate ligament (10–11mm anterior to) and the posterior border of the anterior horn of the lateral meniscus (along a line from this point to the tibial spine)




X-Table
HYPEREXTENSION

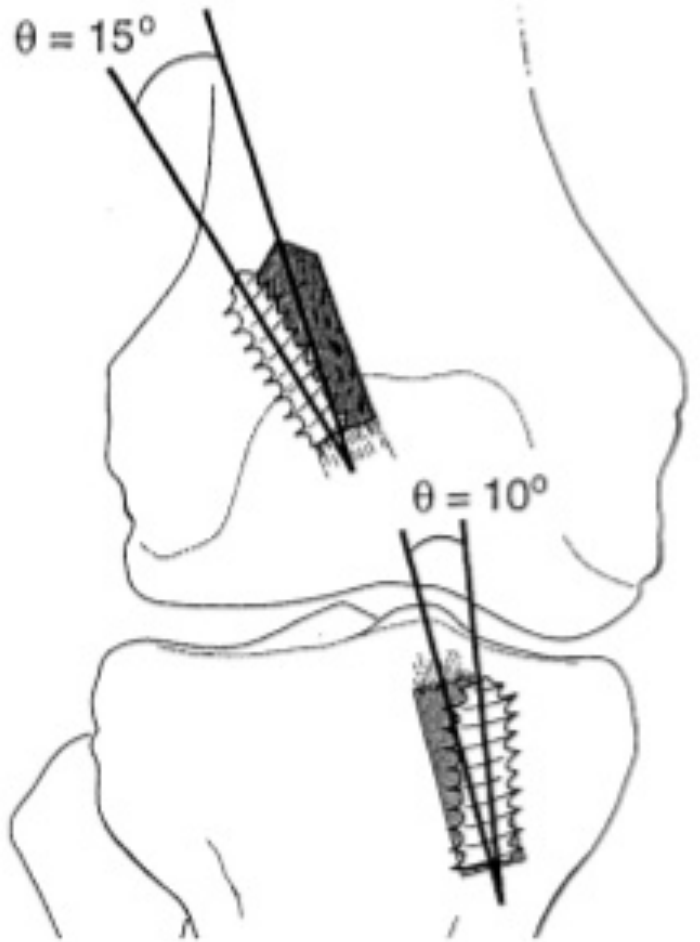
Surgical technique

- Studies have determined that a knee flexion angle of 110 degrees is optimal to avoid blowout of the back wall and injury to the lateral structures while drilling.

- Interference screws should be parallel to the tunnel to provide ideal compression of the graft against the sidewall. If the screw is mistakenly inserted at a diversion angle (>30) than the graft, loss of fixation could occur.(this is more with transtibial fixation of the femur tunnel)

Divergence

- *Difference between the angle of tunnel and screw direction*
- *More with transtibial technique of femoral tunnel preparation*
- *>20 degree compromises stability*



Schroeder FJ. Reduction of femoral interference screw divergence during endoscopic anterior

Rehabilitation

Immediate Post-op

- Cryotherapy (Ice)
- Immediate weight bearing as tolerated with crutches (shown to reduce patellofemoral pain) until they can walk normally without crutches which is generally takes about 1 month.
- Several recent meta-analyses and systematic reviews have found no clear indication for the use of a functional brace or knee immobilizer after ACL reconstruction.

Early Rehab

- The initial goals of rehabilitation focus on:

➢ Achieving full extension.

➢ Activation of the quadriceps muscles.

➢ Progressive flexion.

➢ Restoring normal gait.

Early Rehab

- Isometric exercises (foot planted) such as quad sets and straight leg raises are encouraged. (isometric quadriceps, or simultaneous quadriceps and hamstrings contraction).
- Open chain extension exercises, such as (seated leg extensions) and isokinetic quadriceps strengthening (15-30°) are generally not allowed in the first 6 weeks of rehabilitation after reconstruction of the ACL because they put increased stress on the graft

- exercises are isometric hamstrings contraction (at 15°, 30°, 60°, and 90°), isometric quadriceps contraction (at 60° and 90°), simultaneous contraction of the quadriceps and hamstrings muscles (at 30°, 60°, and 90° of knee flexion), and active flexion-extension motion of the leg without weights between 35° and 90° of flexion (or the same activity with 45 N of weight between 45° and 90° of flexion)

Rehabilitation

- Randomized clinical trials comparing an early accelerated versus non-accelerated rehabilitation have demonstrated no significant differences in long-term results. These studies did not address timing of return to play with an early accelerated rehabilitation program

- Return to play remains a controversial topic where there is no high-level evidence to decide the ideal time frame.