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Total Knee Arthroplasty through a Lateral Subvastus Approach

Disclosures

- No outside funding was received to conduct this study.

- Dr. Steve Nguyen owner/surgeon of Steve Nguyen, M.D.,P.A. (Optimotion Orthopaedics) and Investor in OI

2nd week postop:

- This is a more consistent result with a lateral subvastus TKA then any technological advancement

Background

The few studies that demonstrate a lateral subvastus approach to total knee arthroplasty (TKA) boast marked advantages, however, it is a technically difficult procedure with some known risks.[1,2,3]

Risks:

- Wound closures due to thin fascia on lateral side of knee
- Medial collateral ligament damage

Benefits:[1,3,4,5,6,7]

- Less Pain
- Rapid and stable gains in ROM

Background

- To Date no known studies show improved patient satisfaction which has hovered around 75-80%
  - Not navigated
  - Not robotic
  - Not PSI
- Contrast to THA which has over 90% patient satisfaction

History of Lateral Approach:

- Keblish, P. The Lateral Approach to the Valgus Knee. *Clinical Orthopaedics and Related Research*. 1991;271
  - 53 cases of valgus knee
  - 94% patient satisfaction
  - Lateral release improves patella tracking
  - Does not violate the medial blood supply to the knee
  - Use of non constrained knee (CR) ideal
  - Recommended approach of choice for valgus knees.

History of Lateral Approach

- Mont MA, Bonutti PM, Chauhan SK, et al. Lateral approach to total knee arthroplasty: Minimal soft tissue invasion. *Minimally Invasive Total Joint Arthroplasty*. 2004:151-156
  - Less anterior knee pain
  - Less quads damage

- 1: Seyler TM, Bonutti PM, Ulrich SD, Fatscher T, Marker DR, Mont MA. Minimally invasive lateral approach to total knee arthroplasty. J Arthroplasty. 2007 Oct;22(7 Suppl 3):21-6
  - 35 patients
  - 93 % patient satisfaction
  - Less anterior knee pain
  - Early quad function return
  - "instruments and implants that have not been customized for this approach led to a considerable rate of early complications"

Personal Experience

- Ortho Trauma fellowship 2001
- Trauma residency coordinator 2002-2005 Orlando Health
- Private trauma group 2005-2008
- 2009-present private practice

Experience with lateral subvastus TKA

- 1st Lateral approach TKA 2010
- 10000 + Cases Later
- Formed a total knee implant company in 2016
  - 1st case Implanted in 2020
  - 5000+ implants later….
  - No recalls
  - No implant failures to date

Primary Goal of OI

- Design instruments to facilitate a lateral approach
  - Reduce learning time
    - Before OI
      - 200 cases learning curve
      - Higher incidence of MCL injury
    - After OI instrumentation
      - 5 case learning curve and approximately 2 cadaveric labs

Bilateral TKA one week and 4 weeks later

2nd goal of OI

- ✓ Design the optimal implant and articulating surface

Advanced PF design concepts

- Stem capable AM tibial tray-extends pf indications to osteoporotic patients
- PF femur/tibia/patella
- Inset and onlay PF patella

Articulating design highlights CR knees

- Medial or Lateral Pivot capabilities
- Vit E poly
- HCCR
- PS knee releasing this later this year

Lateral Approach to TKA: Benefits

Indisputable	•Improved Patella tracking •The approach is a Lateral Release •Avoids Damaging the Medial Saphenous Nerve in the front of the knee •Ie Less anterior knee pain
Evidence is tracking to show (but more controlled studies needed)	•Superior patient satisfaction •Rapid ROM •Less quadriceps damage •Less Infection
Life changing growth for early adopters.	•Your patient will just do better. •Physicians who have adopted the approach average 50-100% growth in their knee business in the first year •Average case for our surgeons are 400/yr.

4 months

Lateral approach to TKA: Downside

- Difficult Technique to learn
  - Similar to the Anterior approach to hip (also popularized by a trauma surgeon)
  - Follow the steps

- Higher risk of MCL injury if you don't place the retractor in the right slot
- Difficult revision.
- Difficult for PS surgeons.

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Volume 49, March 2024, Pages 56-61. Steve Nguyen et al.

- Lateral subvastus approach to total knee arthroplasty: A novel surgical technique and retrospective review of **931** consecutive cases with a minimum of 1 year f/u
  - Largest consecutive series of patients
  - ALL total knee replacement were performed through a lateral appproach.
  - 91 % patient satisfaction at 1 year
  - Less than 1% infection rate (deep wound infection
  - KSS at 90 by 3months
  - Knee flexion average 117 degrees by 6 weeks
  - Manipulation rate of 1.9%

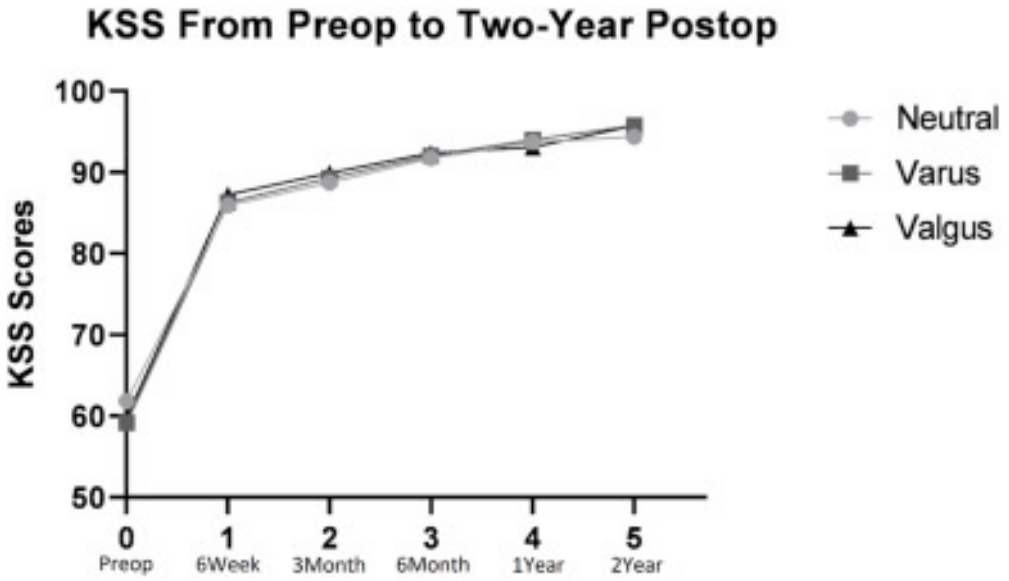
Methods

- IRB Approval was obtained for a retrospective chart review on 1072 TKA's performed through the lateral subvastus approach between July 2020 and November 2021.

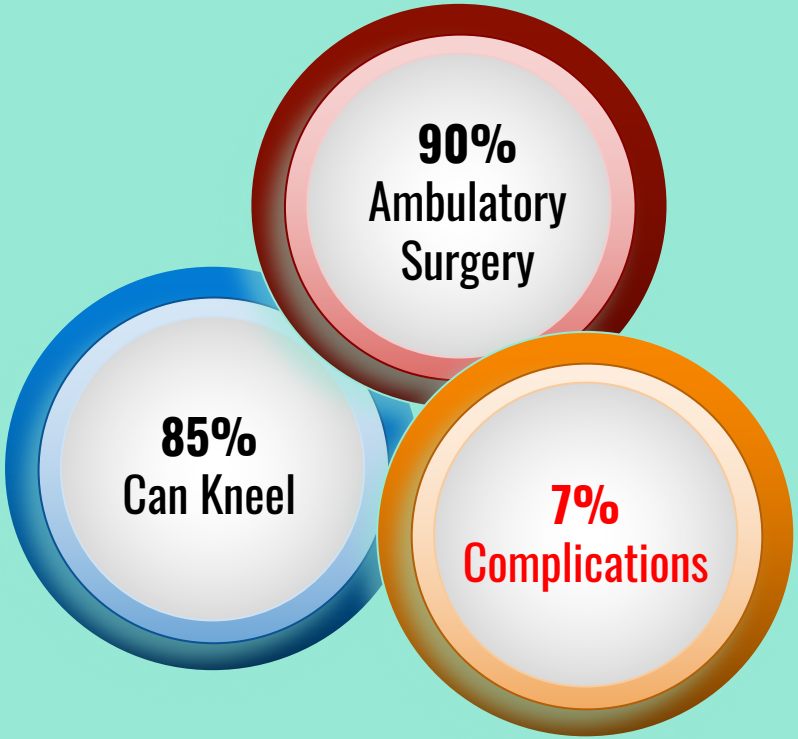
- Surgery conducted by 3 orthopaedists in the same group.

- Data analyzed included: Length of stay (LOS), surgical facility, range of motion (ROM), 90-day complications, and patient-reported kneeling ability.

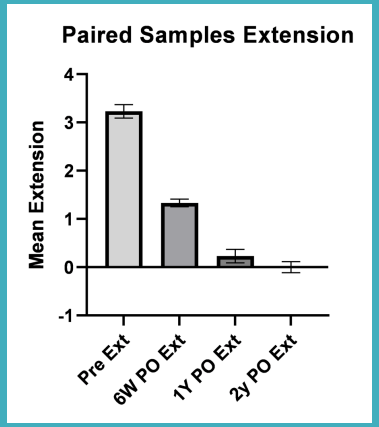
KSS society improvement most rapid over 1st 6 weeks

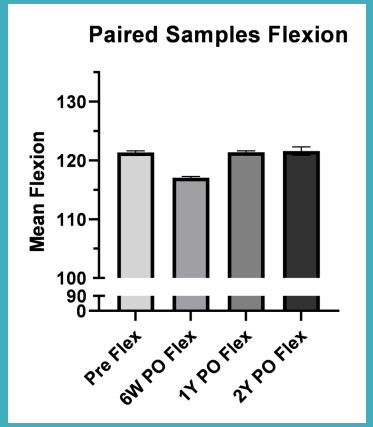


Results



Range of motion improved at 6 weeks PO with continued improvement throughout two-years.





Results: Complication

Study Sample Size (n=1072 TKAs)

- 90-day complication rate was **7%**

Most Common Complications

1. DVT: n=26 (2.4%)
2. MCL Injury: n=12 (1.1%)*
3. Stiffness: n=10 (0.9%)
4. Wound: n=10 (0.9%)
5. All other complications <1%.

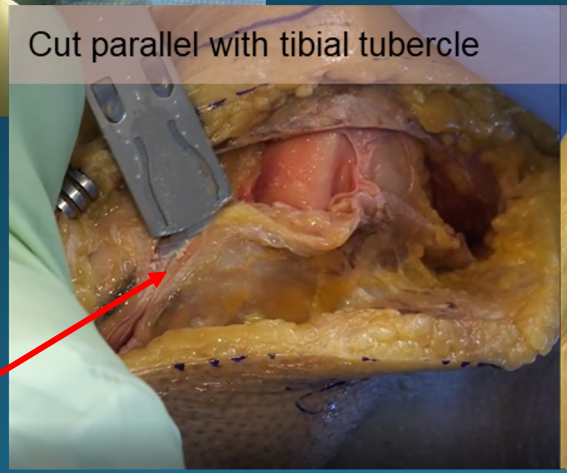
MCL injuries were documented from the time the MCL retractor was introduced. Greater proficiency with MCL retractor reduced incidence of MCL injury.

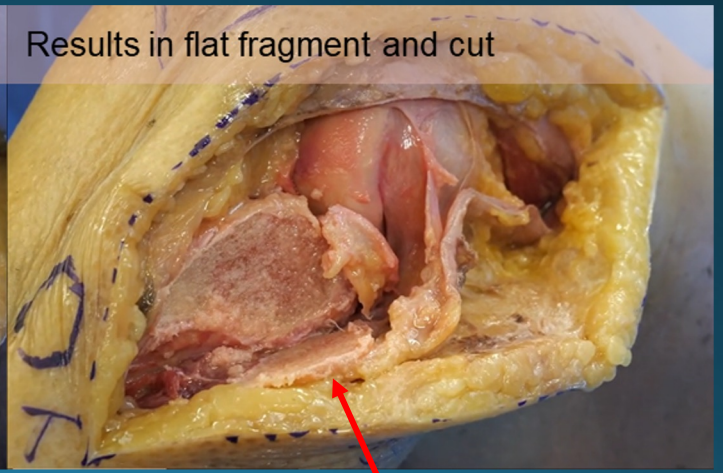
Conclusions

- The lateral subvastus approach optimizes ROM, increases outpatient candidacy, results in few complications, and improves patient-reported kneeling ability. These results remain stable over two years.
- No patients were required to stay for observation, average discharge time is <4 hours.
- Poor wound closure and MCL injuries are more prevalent risks in a lateral subvastus approach to TKA but can be reduced given some adjustments.
  - MCL retractor
  - Osteotomized Gerdy's Tubercle

The Approach

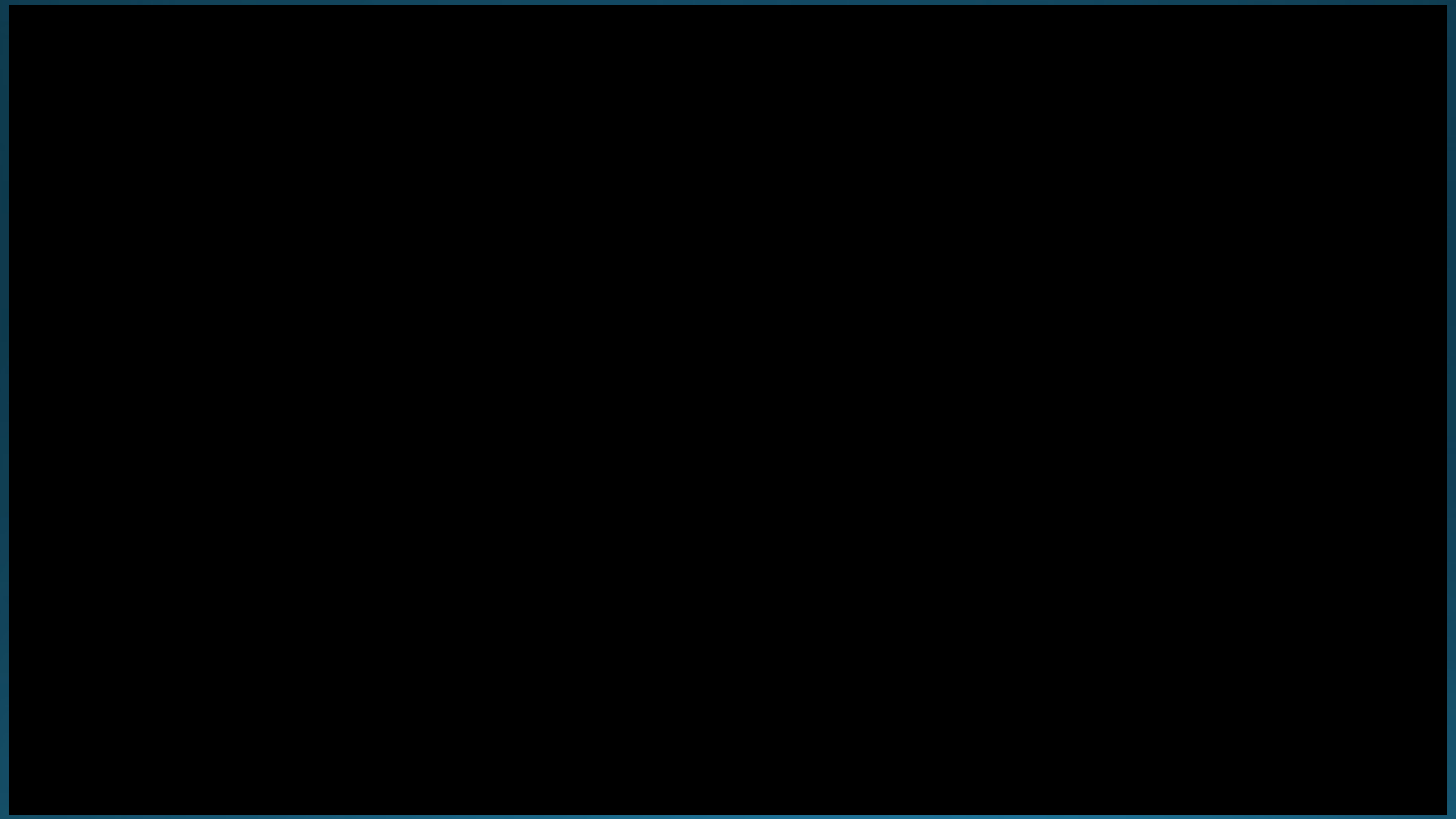
Incision: Landmarks are the tibial tubercle, Gerdy's tubercle, and the patella, curves off of the patella lateral to the vastus lateralis[3]





Osteotomizing Gerdy's Tubercle provides a bone fragment that is used to fortify wound closure, compensating for the thin fascia.

Surgical Video: Cadaver- AAOS SVT



MCL Retractor insertion

Video segments taken from: A Lateral Subvastus Approach to Total Knee Arthroplasty, A Novel Approach. American Academy of Orthopaedic Surgeons, Orthopaedic Video Theater. https://www.aaos.org/videos/.[3]

Steps to a lateral approach : 7 steps Important to follow these steps in this sequence

- Exposure: (90 Degrees of Flexion then extension)
- Tibial cut and removal: (Semi-extended 0-30 degrees of flexion)
    - Space creating function
- Patella preparation: (fully extended)
- Femoral preparation: (90 degrees of Flexion)
- Balancing: (fully extended with traction)
- Tibial keel preparation and Insertion of final implants: (70 degrees of flexion)
- Closure: (semi-extended)

1. Exposure: Steps to be done in flexion.

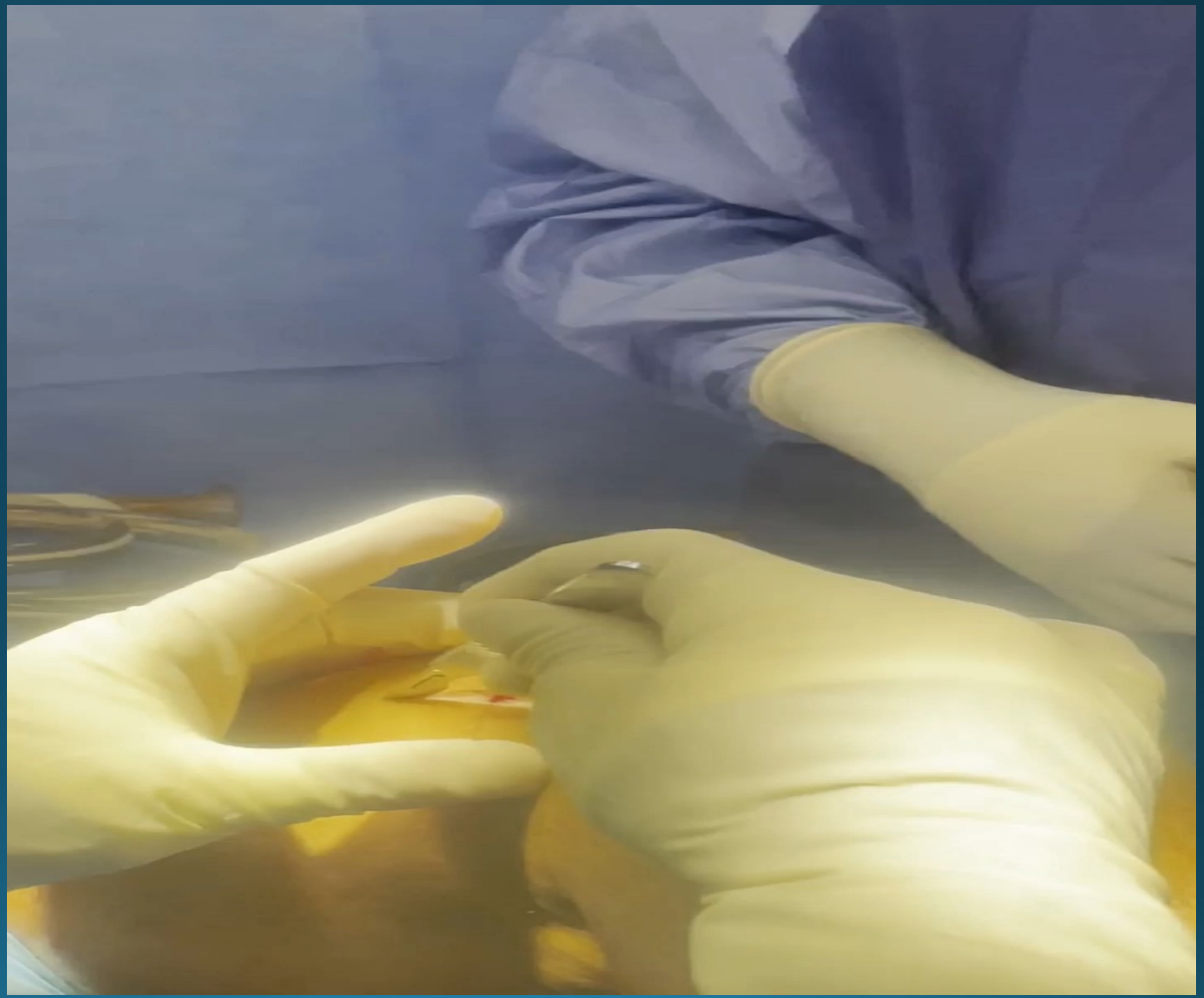
- Incision is made with the knee bent at 90 degrees
- Deep incision is through the IT band and curves around the medial aspect of the Gerdy's tubercle and splits the Anterior tibial compartment distally leaving a fascial layer to close
- Bovey the superior and inferior genicular artery.
- Release the anterior Horn of the Lateral Meniscus
- Release the soft tissue off the lateral tibial plateau as far as it can go
- Perform Gerdy's osteotomy

1. Exposure: steps to be done in extension

- Following Gerdy's osteomy bring the knee to full extension
- Using a small Hohmann retractor placed medially release the suprapatellar fat pad
- Resect the infrapatellar fat pad
- Bring the knee into slight flexion and release the ACL and anterior horn of the lateral meniscus
- Sublux the tibia forward with Hohmann at 30 degrees of flexion
- Bent cobb elevator 30 or 45 degree over the surface of the medial plateau and release the meniscal tibial ligaments as far posterior medial as possible
- Insert the MCL retractor

1. Exposure:

- Pearls
- Curve incision around Gerdy's
- Gerdy's osteotomy size: be larger than a penny and smaller than a quarter
- 1mm thick
- Valgus knees do not have a tubercle
    - Have to shave a thin layer of bone where Gerdy's is



Tibial resection

1. When beginning to try to learn the approach. Aim for 11-13 mm insert. Makes life easier
2. Align the tibial cut guide along the tibial spine, Should bisect around the 2nd toe
3. Cut the lateral tibial plateau first
4. Leave large Hohmann posteriorly to protect PCL
5. Bring the knee into full extension to slide the cutting slot more medially
6. 1" Osteotome is wedged into the cut tibia surface to remove the tibia fragment: The Hohmann retractor is used to slide to tibial cut piece anteriorly until the Posterior Horn of the Lateral meniscus is visualized and released with a large knife
7. Sliding the knife either posterior or just anterior to the Hohmann retractor will {blind procedure} release the posterior horn of the medial meniscus. If you can successfully do this then your surgery will be infinitely easier.
8. If the knee does not go into hyperextension at this point you will have to resect 2-4 mm more

2. Tibial resection

Pearls

1. Bring the knee to full extension to slide the cut slot more medial
2. Release the posterior horns of the medial and lateral meniscus f irst
3. Try to remove the tibia cut in one piece

2. Patella preparation

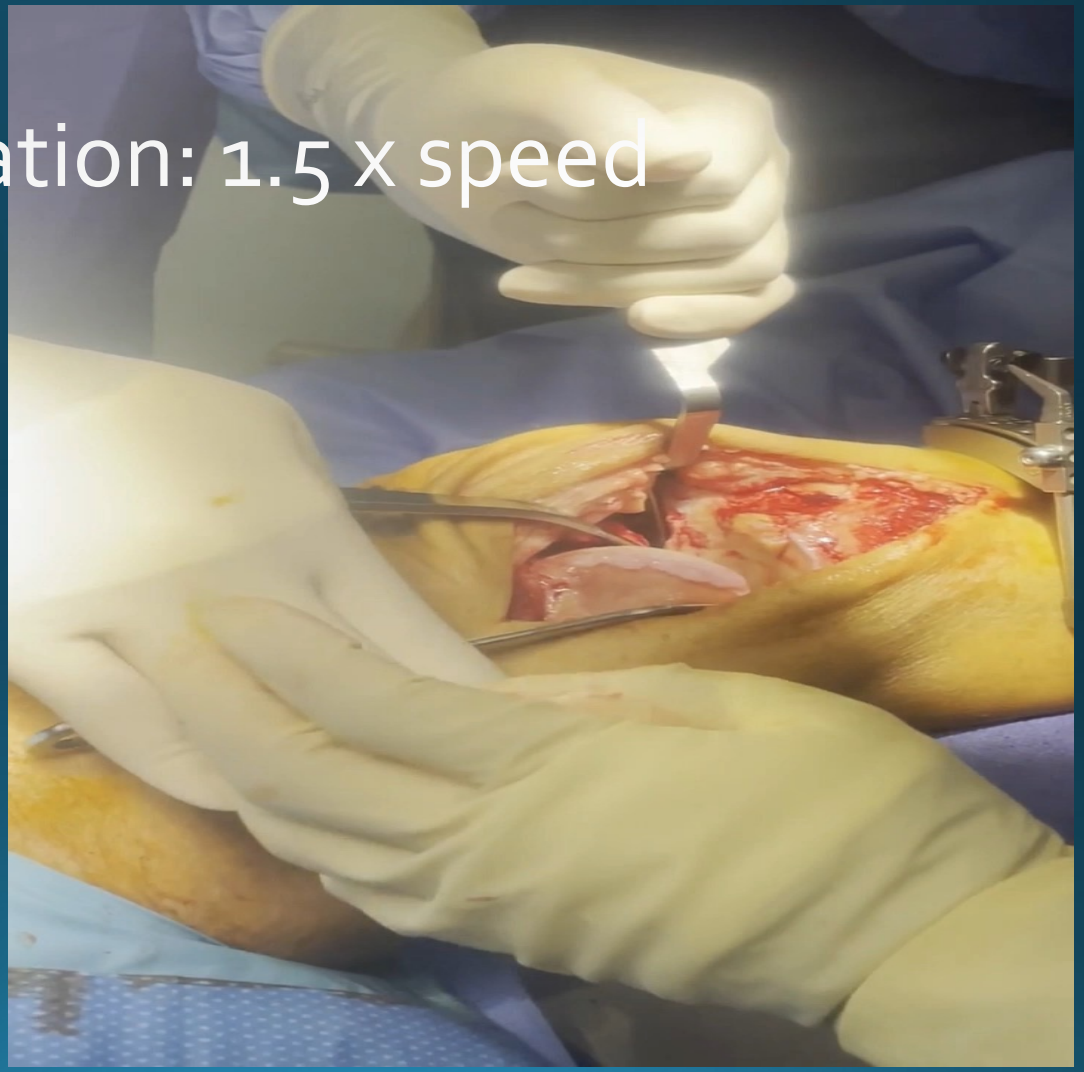
- Pearls
  - evert the patella 90 degrees vertical
  - Saw cut at the edge of lateral patella facet
  - Direct saw the saw cut torwards the medial facet edge

3. Femoral Preparation

- Standard technique
- Placement of inferior z retractor(deep to posterior epicondyle) critical step.
  - 1st place it in extension then place Z retractor
  - Bring the leg up in flexion
  - Reposition the z retractor to ensure MCL safety
  - After you cut the distal tibial: remove the lateral meniscus to size the femur
  - 4:1 cut block designed to be used initially without auxillary fixation pins
- OI design
  - With minimal slope in the tibia and a neutral varus/valgus cut
  - All the correction is placed in the femur
  - Post referenced so upwards and downwards shift are made to adjust flexion instability
  - External rotation should balance the gap between medial and lateral

4. Femoral Preparation: 1.5 x speed

- Pearls
  - Make sure the z retractor is placed deep to MCL in flexion
    - Reposition when you are at 90 degrees
  - You should be able to see a empty space between the medial condyle and the inferior z retractor

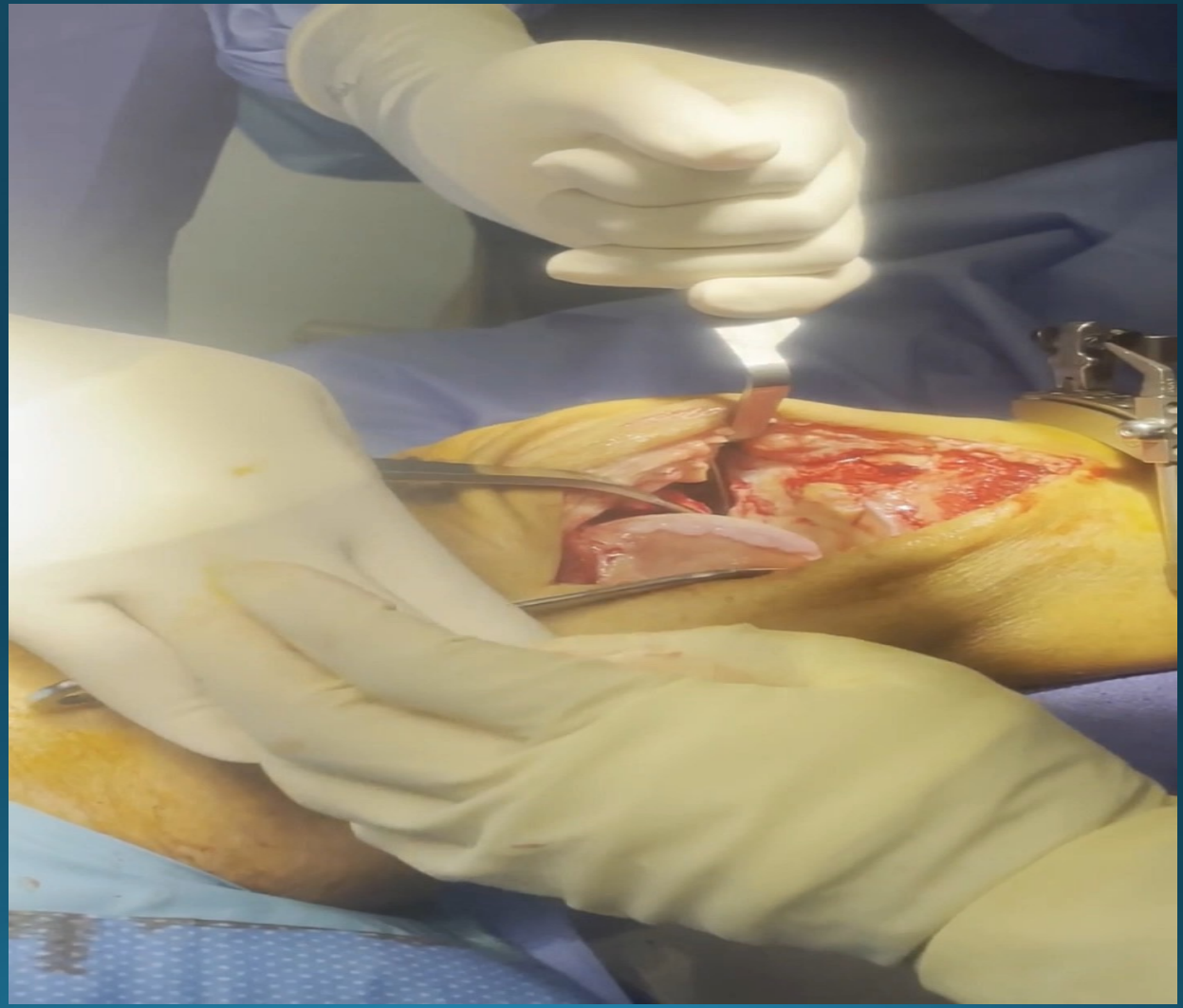


5. Balancing, Removal of soft tissue, posterior medial osteophytes,

- In extension under traction remove the medial and any remaining lateral meniscus
- Posterior Medial Osteophyte removal
  - Hohmann retractor placed medial PCL
  - Knee subluxed forward at 30 degrees of flexion
  - Placed fork retractor to protect the MCL
  - Curved osteotome used to osteotomize the posterior medial tibial plateau osteophyte
- Balance with gap balancer in extension and 90 degrees of flexion
- Inject pain med cocktail
  - Posterior Capsule 40mg of Kenalog 9ml of 0.5% Marcaine
  - Exparel diluted 60Ml around capsule (not posterior) and lateral subvastus muscle and sub Q skin

5. Balancing

- Remove meniscal with leg in extension and under traction
- Remove posterior medial osteophytes by repositioning the fork retractor and translating the tibia forward



6. Final component insertion: part 1

1. Place big Hohmann behind and just medial to PCL
2. Place large forked retractor around tibial plateau
3. Surgeon should control all the retractor as assistants bring the knee into flexion
4. Optimal angle for exposing the tibia is 60-70 degrees of flexion
5. Pearl: PCL Hohmann should lay flat against the anterior chamfer cut of the femur
6. At the Fork retractor can be used to gently but forcefully displace the extensor mechanism medial and distal to tibial plateau
    1. Additional retraction anterior to the fork retractor can be placed to aid visualization

Final Component insertion: part 2

1. Size the tibia.
    1. Pearl: the tibia will often look internal rotated because on the lateral approach the tibial is internally rotated bc of the extensor mech being displaced medially by the fork retractor
    2. Use the anterior lateral curve of the tibia as reference to determine optimal placement
    3. Common beginners error: placing the tibia too lateral. Make sure that the tibia tray sits on the medial edge. Additional force may be necessary to accomplish this in a big person.
2. Finish tibial keel prep (determine if a auxillary stem is needed)
3. Implant in sequence
    1. Tibia then insert
    2. Bring the leg into extension: place the z retractor in place and flex and internally rotate to expose the femur
    3. Impact the femur in place
    4. Insert the patella in extension.

6. Final Component

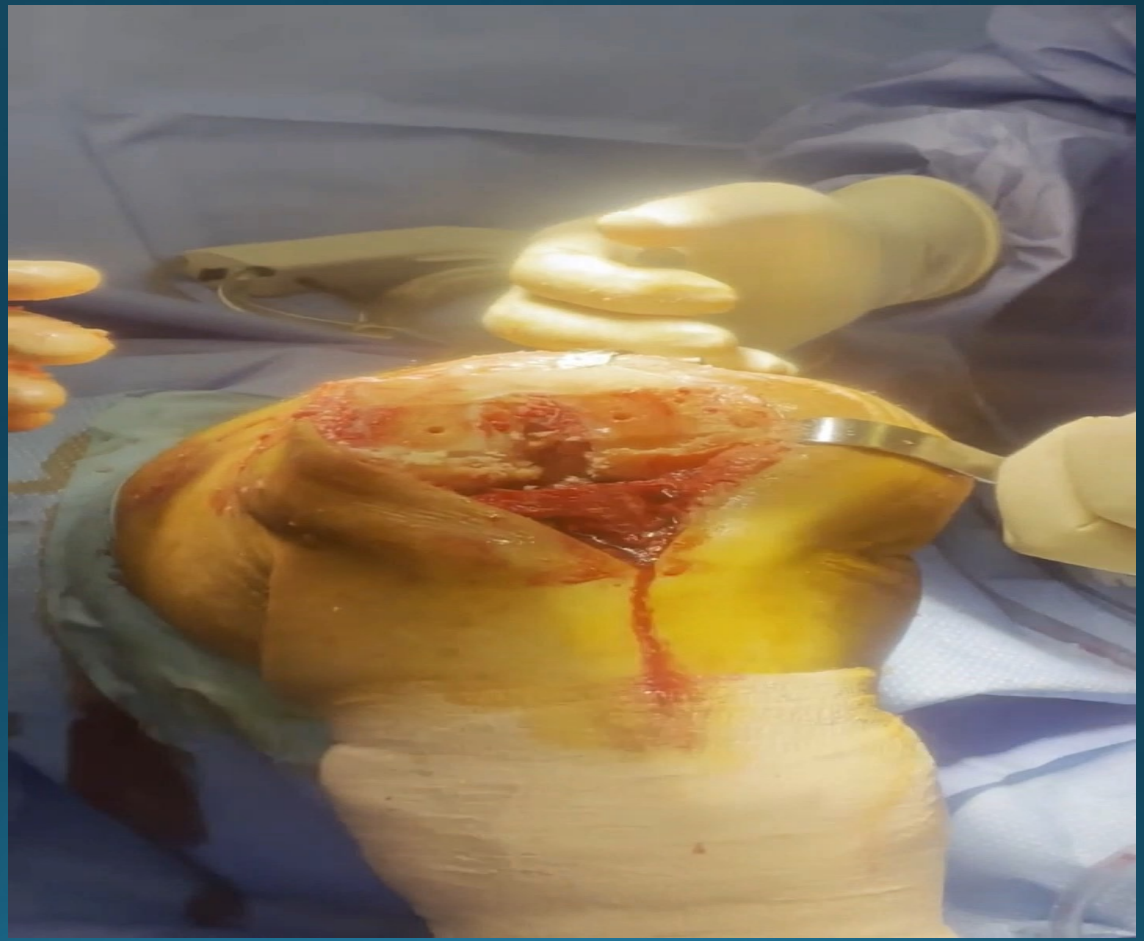
- Finish tibial preparation
- Insert final components
  - Tibia
  - Then insert
  - Femur
  - Extend
  - Patella.

Closure

1. Close the distal half very tight: always use interrupted sutures here
2. The proximal half standard
3. Have alloderm available or be able to harvest a patch of ITB to patch a defect
    A. Especially in Valgus knees who are already tight on the lateral side.
    B. Wound deshiscence occurs most likely along the lateral edge of the patella tendon
4. Draining wounds between 1-3 weeks means there is a wound dehiscence and should be taken back to the OR immediately with a patch ready to close the dehiscence.

7. Closure

- Bottom half of wound has to be closed tight.



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