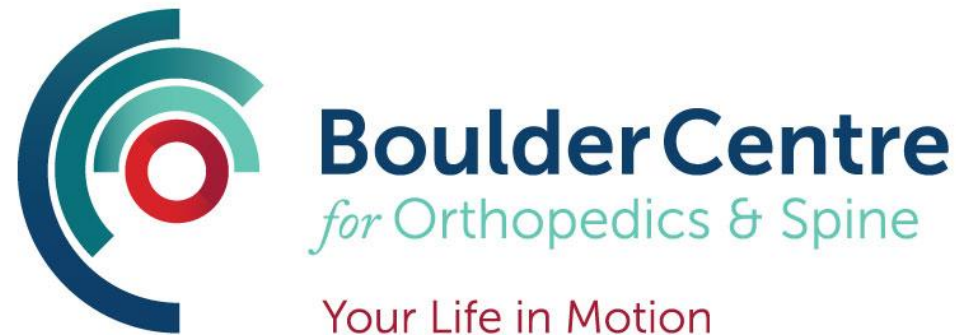


Innovative Treatments for Painful Hips and Knees

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Other Videos

- Please check out other videos at <https://www.bouldercentre.com/doctors/erik-c-bowman-md>



- These are my opinions on technology and implants where data is not presented.
- I have no royalties, personal or family connections to technology or companies presented.
- This is purely educational, don't try this at home.



Erik C. Bowman, MD
*Orthopedic Surgeon Specializing
in Hip and Knee Reconstruction*

Question?

- Have you ever been diagnosed or thought you have arthritis?
- How many people do you know who have had a knee or hip replacement?
- Ever wonder how we do hip and knee replacements?

Prevalence

- Over 54.4 million Americans have some form of arthritis
- More than 450,000 total hip replacements
- Nearly 1,000,000 total knee replacements
- Even in dogs!



- It is easy to put a joint replacement in!
 - I could teach a monkey how to do one



- But to do it well and repeat the same results each time, when you consider patient factors, it becomes extremely difficult.

- History Symptoms
 - Associations
 - Activities
 - Quality and severity
- Previous treatments
 - NSAIDs, Tylenol, arnica, Voltaren, etc.
 - Bracing
 - Physical therapy
 - Injections
 - Steroids, hyaluronic acid (HA/gel), PRP, stem cells, ozone?
 - Arthroscopy
- Medical issues
 - Diabetes, stroke, vascular disease
- Medications



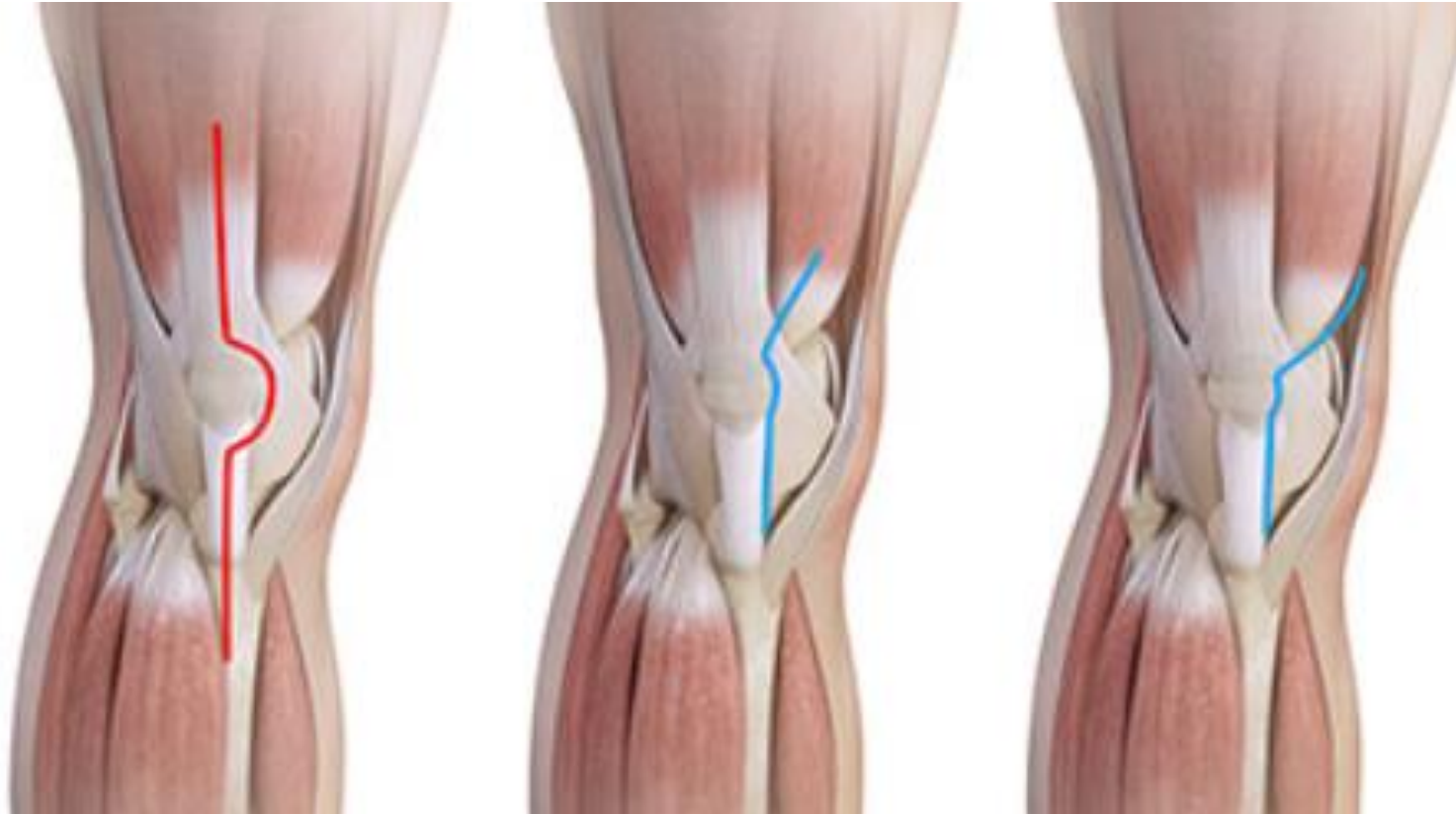
- Physical exam
 - Previous scars
 - Shape of leg/fat distribution
 - Strength and quality of muscles
 - Status of skin
 - Contractures
 - Deformity
 - Bone loss
 - Alignment
 - Hardware



- Characteristic incision



Arthrotomy



Medial Parapatellar Midvastus Subvastus (SubV/ Jiffy™)

Medial Parapatellar

- The workhorse (like the posterior hip replacement)
- Excellent exposure
- Cut the quad tendon
 - More pain
 - Earlier weakness
 - Risk of rupture of repair
 - Subluxation of patella (kneecap)
 - 90% of surgeons use



- Does not violate tendon
- You cut through your vastus medialis obliquus (VMO) muscle
- Risk denervation of muscle
- Very uncommon
- More of niche
- “Tendon sparing”
- Harder exposure than parapatellar
- Better range of motion?

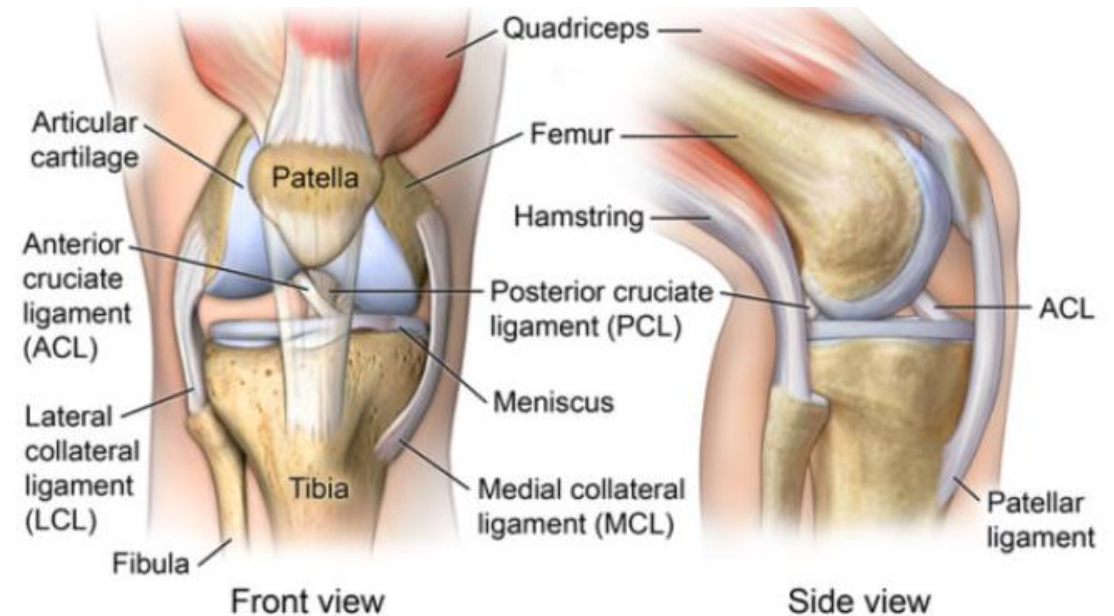


- Lift the VMO up and retract out of the way
- Much harder due to limited exposure
 - Patellar resurfacing difficult
 - Severe contractures and alignment
- No violation of muscle or tendon
 - Less pain
 - Faster recovery
 - Less risk of patellar subluxation
- Not common
- Heavily marketed



What Stays, What Goes?

- Stays:
 - Medial collateral ligament (MCL)
 - Lateral collateral ligament (LCL)
 - Patellar and quadriceps tendon (cut or not)
 - Most of your bone such as your knee cap!
- Goes:
 - ACL
 - PCL (most doctors remove)
 - Medial and lateral meniscus
 - Arthritis! (If you do a full total knee, that is)



Goal of Total Knee

- Pain relief
- Correct alignment
- Functional motion
 - Patella tracking
 - Functional range of motion
- “Balanced” knee

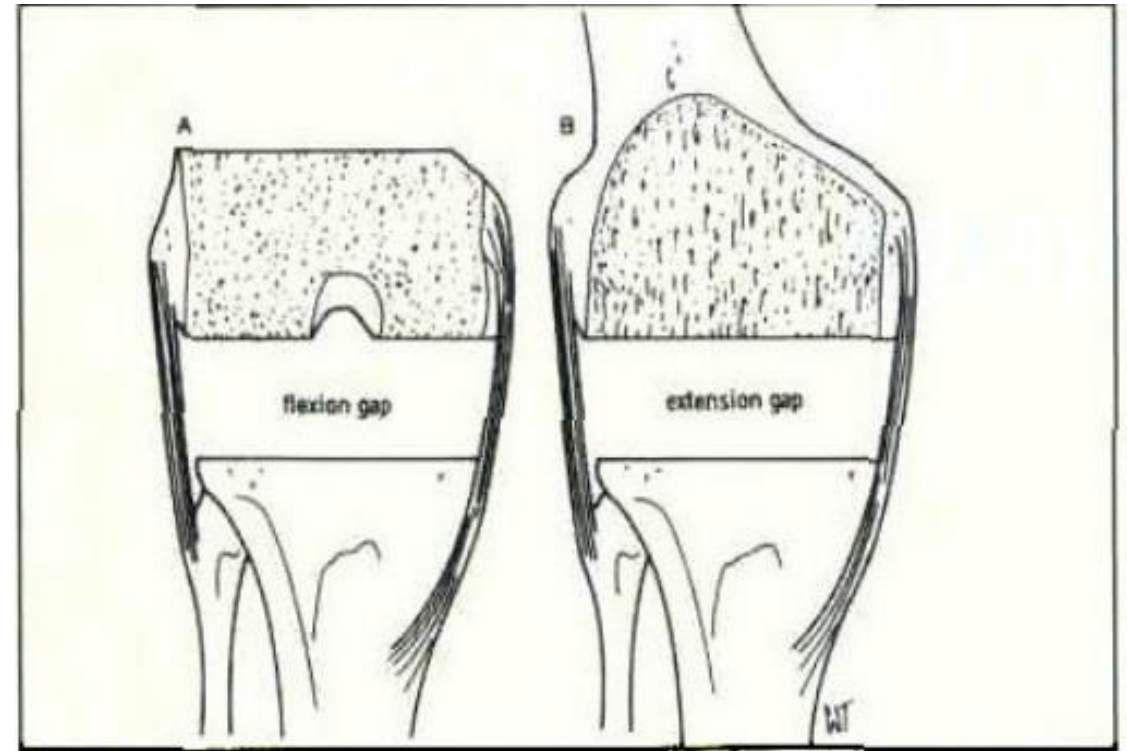
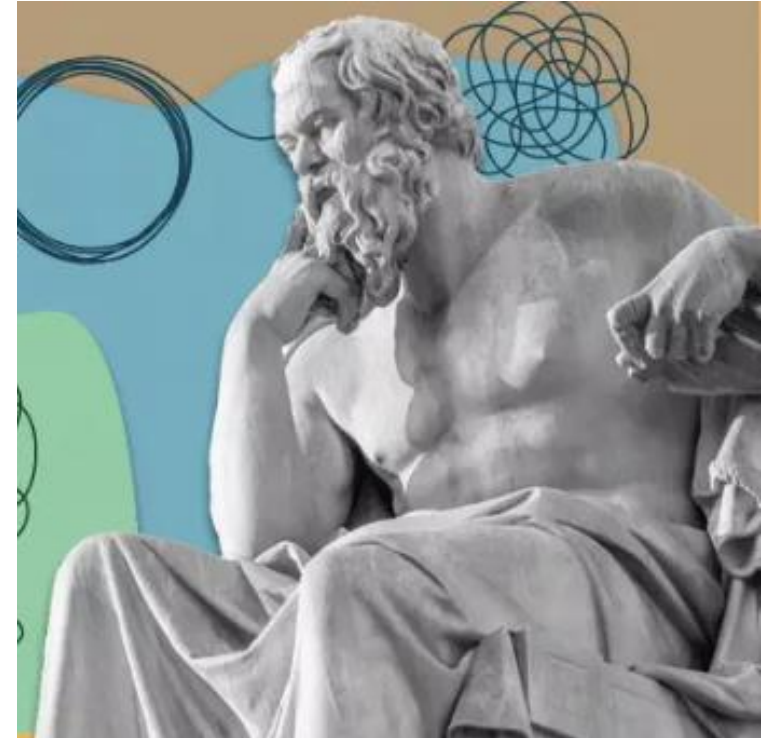


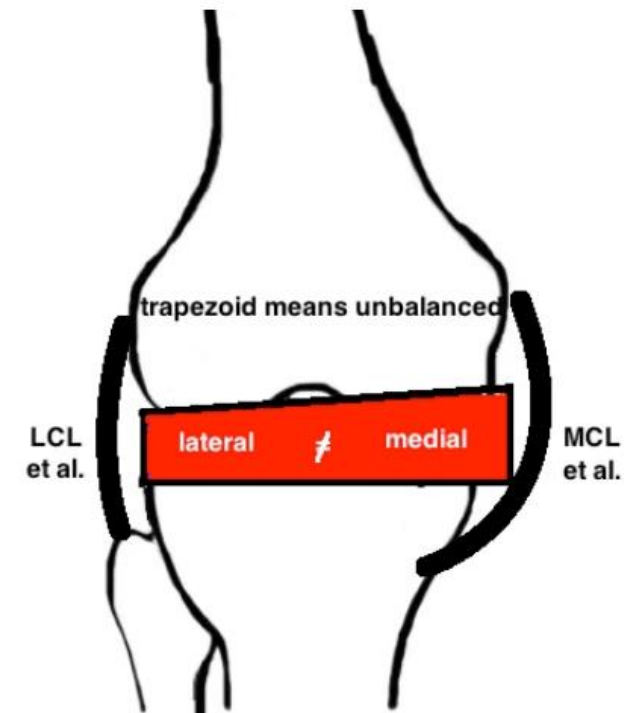
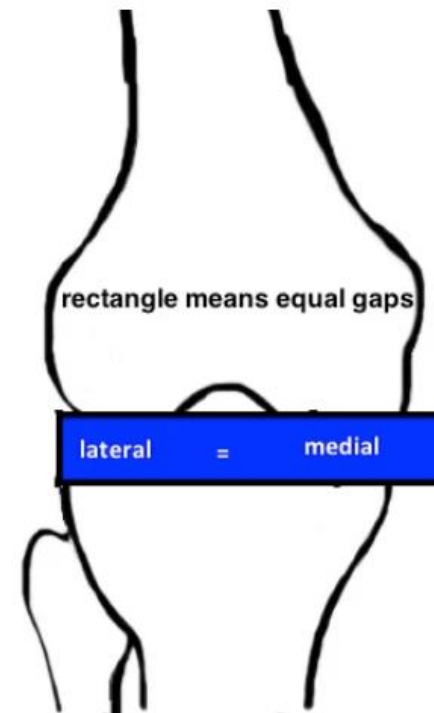
Figure 3: The flexion-extension gaps are rectangular, balanced, and equal in size.

- Measured Resection
- Gap Balancing
- Kinematic Alignment (KA)
 - Restricted
 - Unrestricted
 - Inverse



Measured Resection

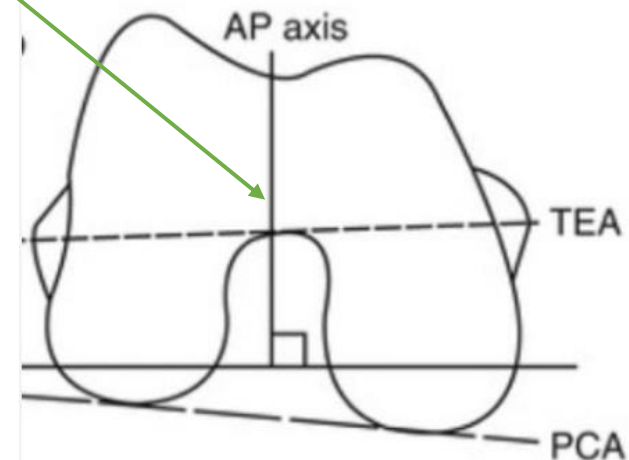
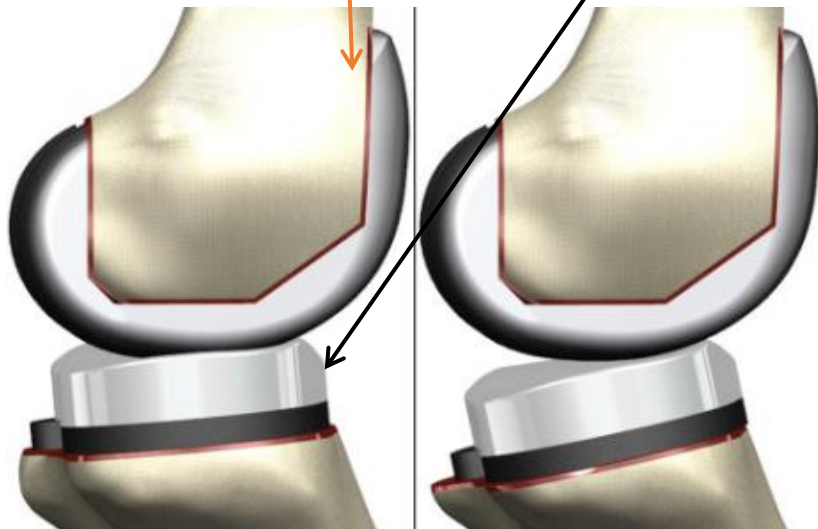
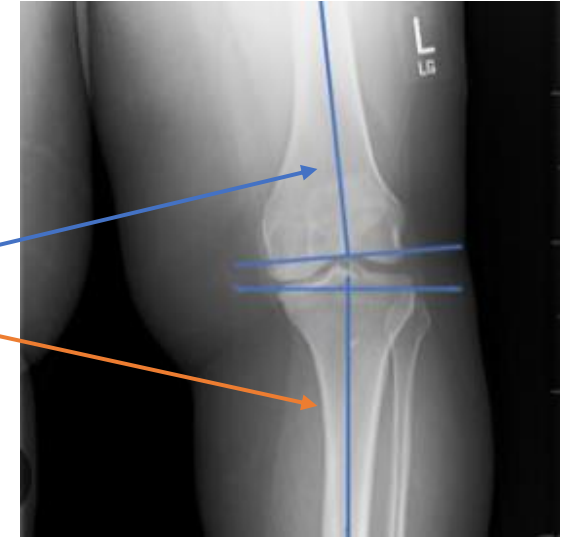
- Bone cuts first
 - Femur cut is most important
- Then release tissues to balance knee



Measured Resection

- Uses anatomic landmarks to set implants

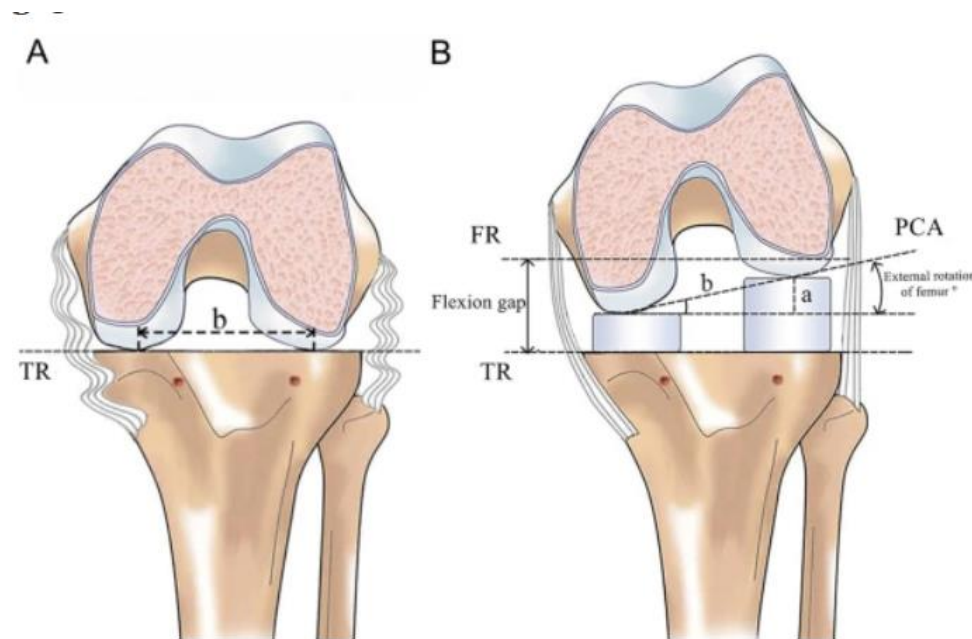
- 0 degrees coronal
- 0-5 degrees tibia slope
- 0 degrees femur flexion
- 3 degrees of external rotation
- 5 degrees valgus



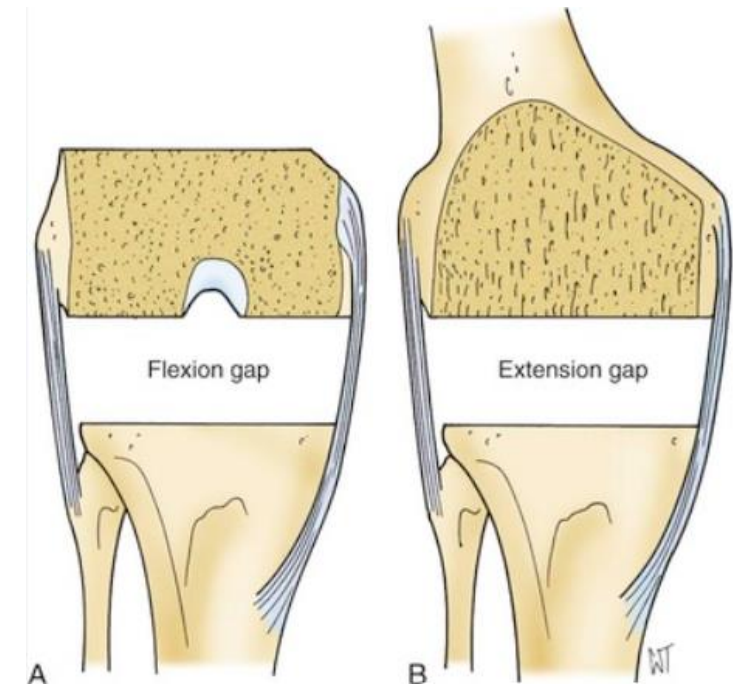
NOT EVERYONE IS BUILT THIS WAY!

Gap Balancing

- Cut tibia **flat**
- Insert tensioning device to measure tension of MCL and LCL
- Release tissue to make the medial and lateral gaps equal both in flexion and extension
 - Extreme deformities can have extremely tight sides or very loose sides
- Then cut femur
 - Can lead to femoral internal rotation which can make your patella sublux or dislocate



- Most doctors use a Gap balancing and measured resection
 - Use anatomic landmarks and cut accordingly
 - Gap balance by releasing tissue to make equal gaps
- This simplifies the steps and less catch up
- Still requires soft tissue release in the end to balance the knee
 - Can over release at the beginning of surgery
 - Removing the PCL makes it easier

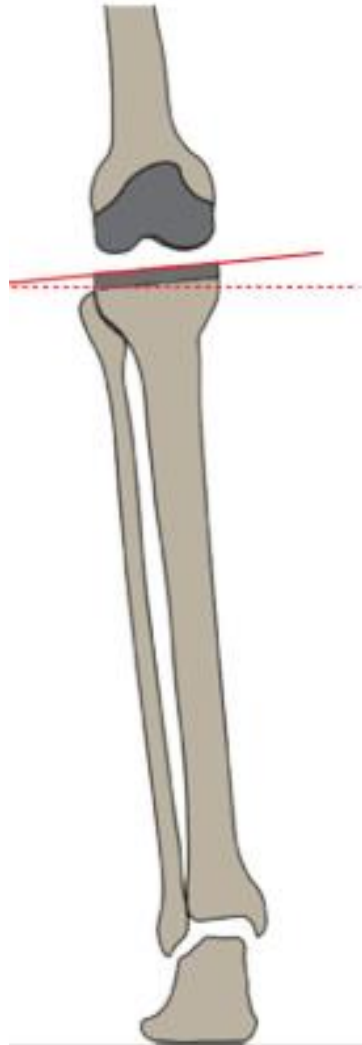


Kinematic Alignment (KA)

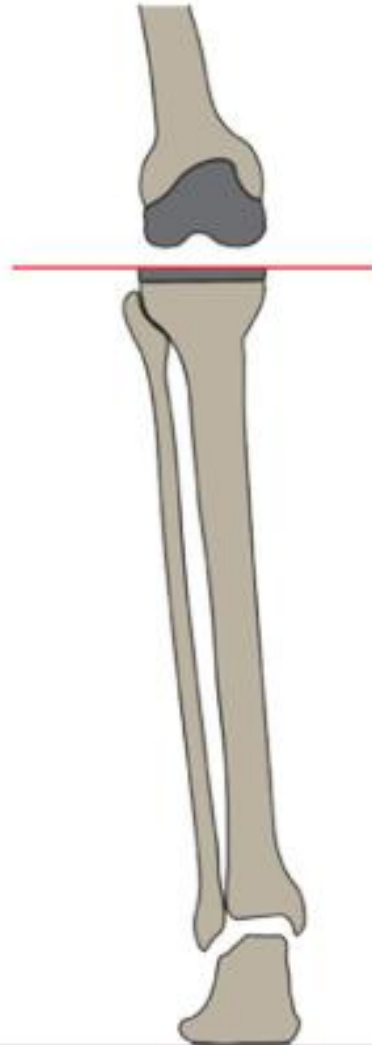
- New hot thing
- KA aims to reconstruct patient's native alignment
- Relies on bone cuts rather than releasing ligaments
- Restore the cartilage and bone you have lost
 - Extreme deformities or bone loss different story
- Not everyone's knees are the same



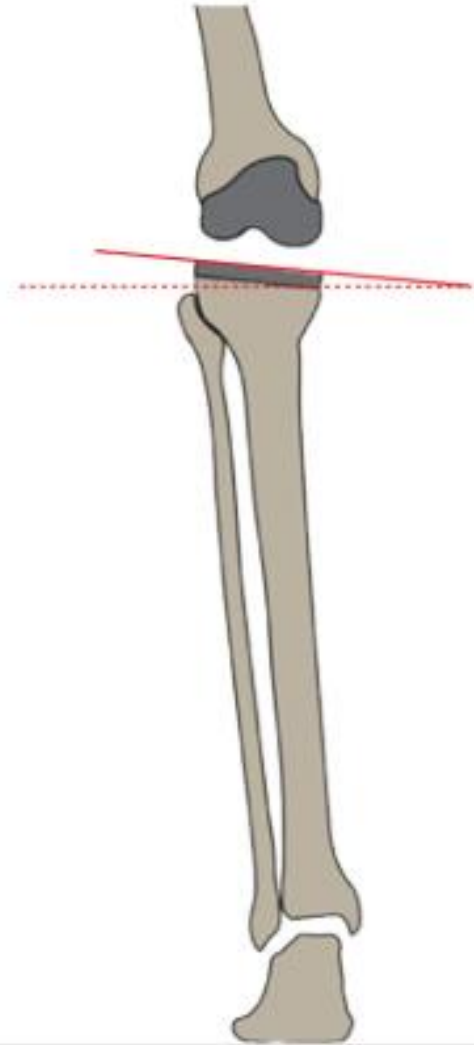
Negative TJLA



Parallel (0°)



Positive TJLA



- MCL and LCL are tightest in extension
- Medial side is tighter than lateral side in flexion
 - “medial pivot” allowing femur to roll and rotate
 - “screw home mechanism”
- But how do you know the actual tightness?



Algorithm

Tight in Flexion & Extension	Tight in Flexion Well-Balanced in Extension	Tight in Extension Well-Balanced in Flexion	Well-Balanced in Extension and Loose in Flexion	Tight Medial & Loose Lateral in Extension	Tight Lateral and Loose Medial in Extension
Recut tibia and remove 1-2mm more bone.	Increase posterior slope until exposure A-P offset is restored at 90° of flexion.	Remove posterior osteophytes. Strip posterior capsule. Insert trial components & gently manipulate knee into extension.	Add thicker insert and recheck knee extends fully. When knee does not fully extend check PCL tension. When PCL is incompetent use Cruciate Substituting (CS) Insert.	Remove medial osteophytes. Reassess. Recut tibia in 1-2° more varus. Insert 1 mm thicker insert.	Remove lateral osteophytes. Reassess. Recut tibia in 1-2° more valgus. Insert 1 mm thicker insert.

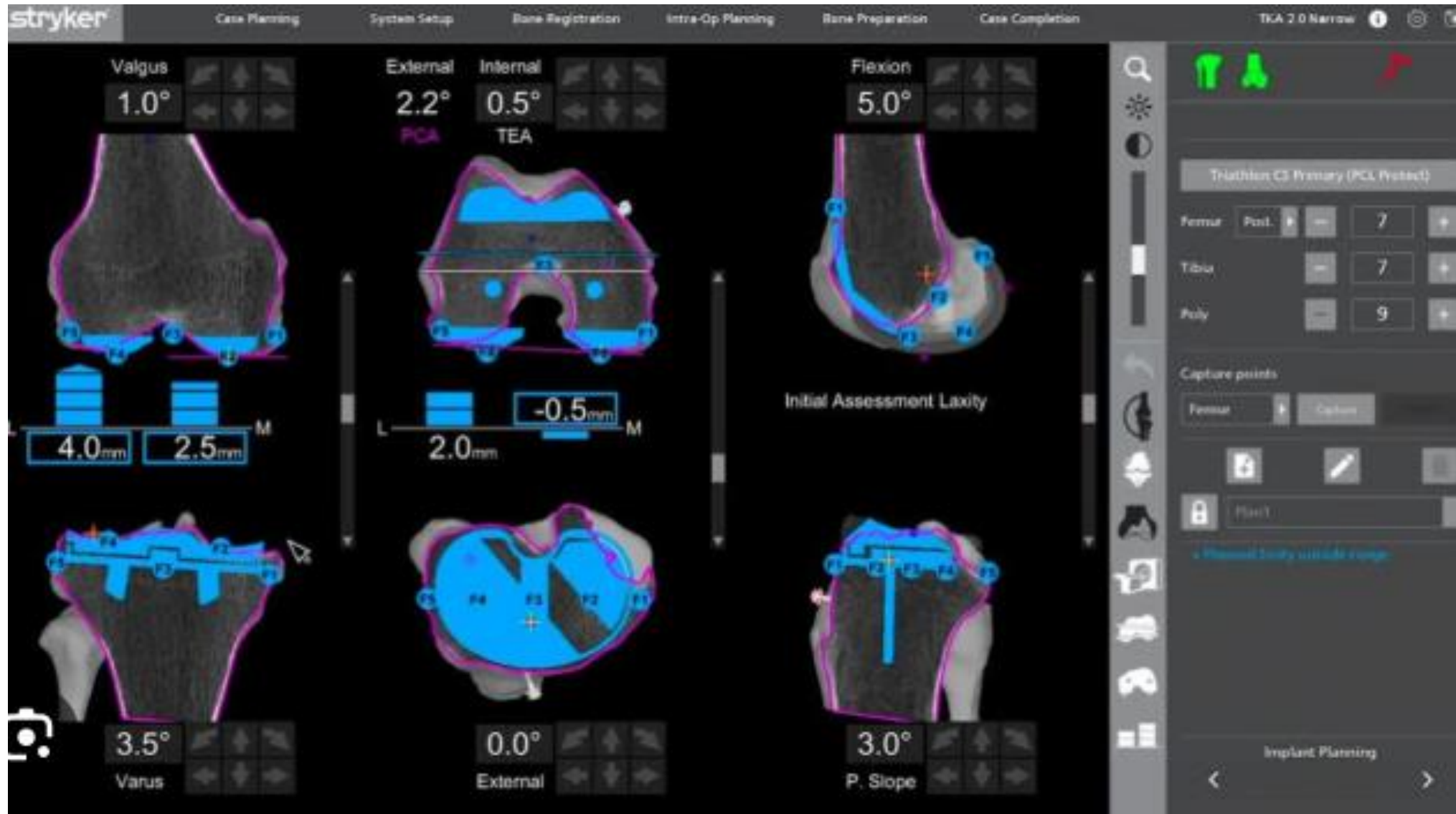
Many Limitations

- Severe deformities
- Severe bone wear
- Extreme contractures
- Ligament deficiency
- Manual
 - Difficult to make accurate cuts
 - Recutting tibia multiple times to balance
 - Difficult to know how tight everything is
- Use “restricted” KA



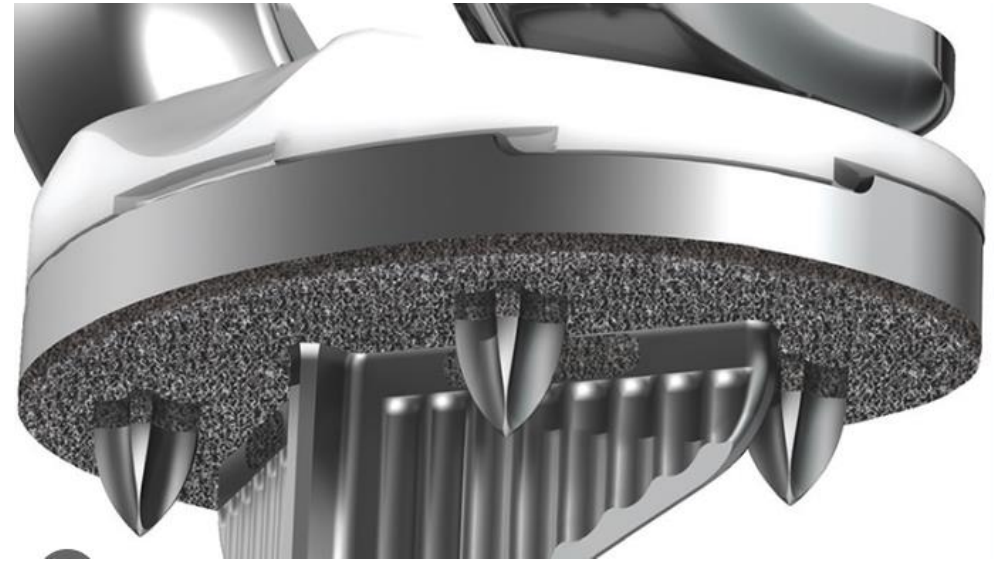
- Advantages:
 - Pre-operative planning
 - Already know your sizes before surgery
 - Dialing in objectively tightness of ligaments
 - Haptic feedback and boundaries
 - Longest track record
 - Hip, knee, and unicompartmental
 - Extremely efficient
- Disadvantages
 - Bulky
 - Requires CT
 - Expensive





Final Steps

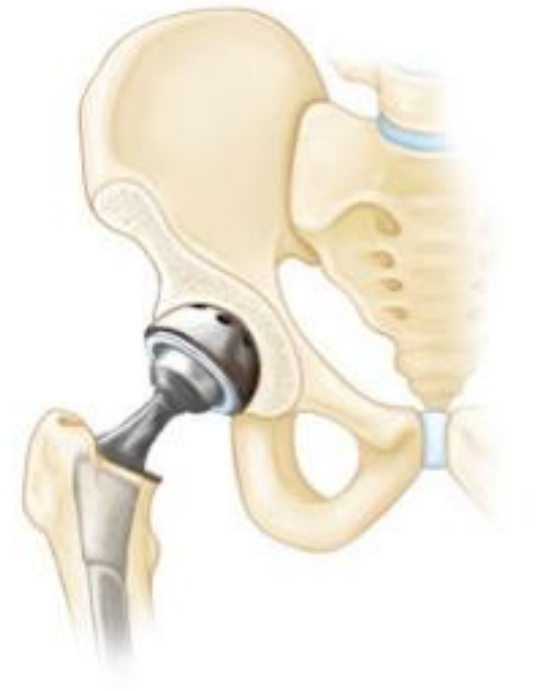
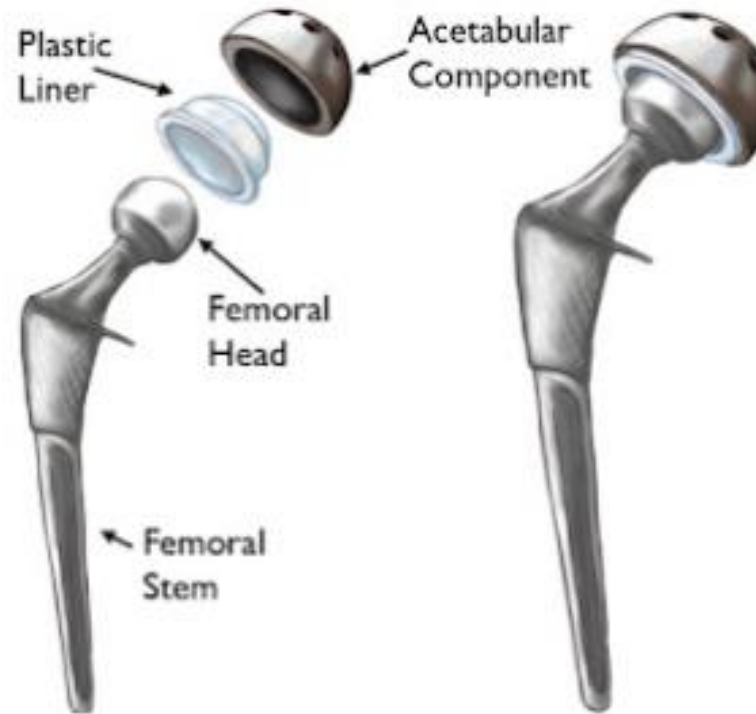
- Fine tuning the tightness
- Finalize sizes
- Execute
 - Robot assists in control of cuts
- Trials placed
- Final implants impacted
 - Cement vs pressfit (bone grows in to metal)
- Close the wound





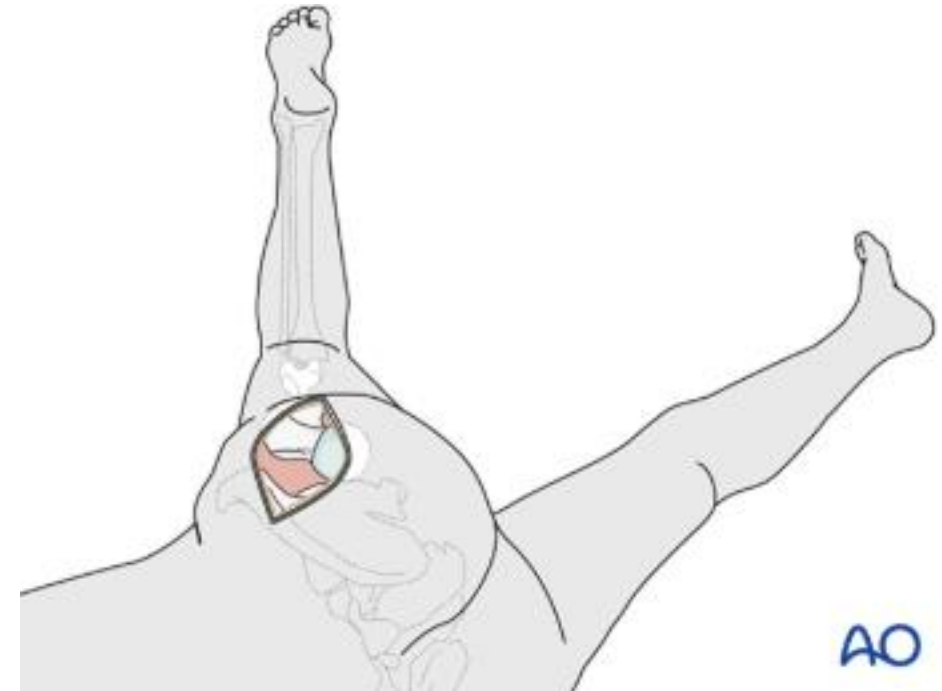
Hip Replacement

- Approaches
 - Posterior
 - Work horse
 - Lateral
 - Outdated
 - Violates hip tendon
 - Anterior
 - Muscle separating



Posterior Approach

- 8-12 inch incision
- Curvilinear on the side of hip and buttocks
- Incise through gluteus maximus and IT Band fascia
- Peel off short external rotators and piriformis
 - Super Path approach spares this part
- Pros
 - Easier
 - Can do anything
- Cons
 - Higher risk of dislocation
 - Spine stiffness
 - Retroverting acetabular component
 - Leg length discrepancy
 - Longer recovery



Anterior Approach

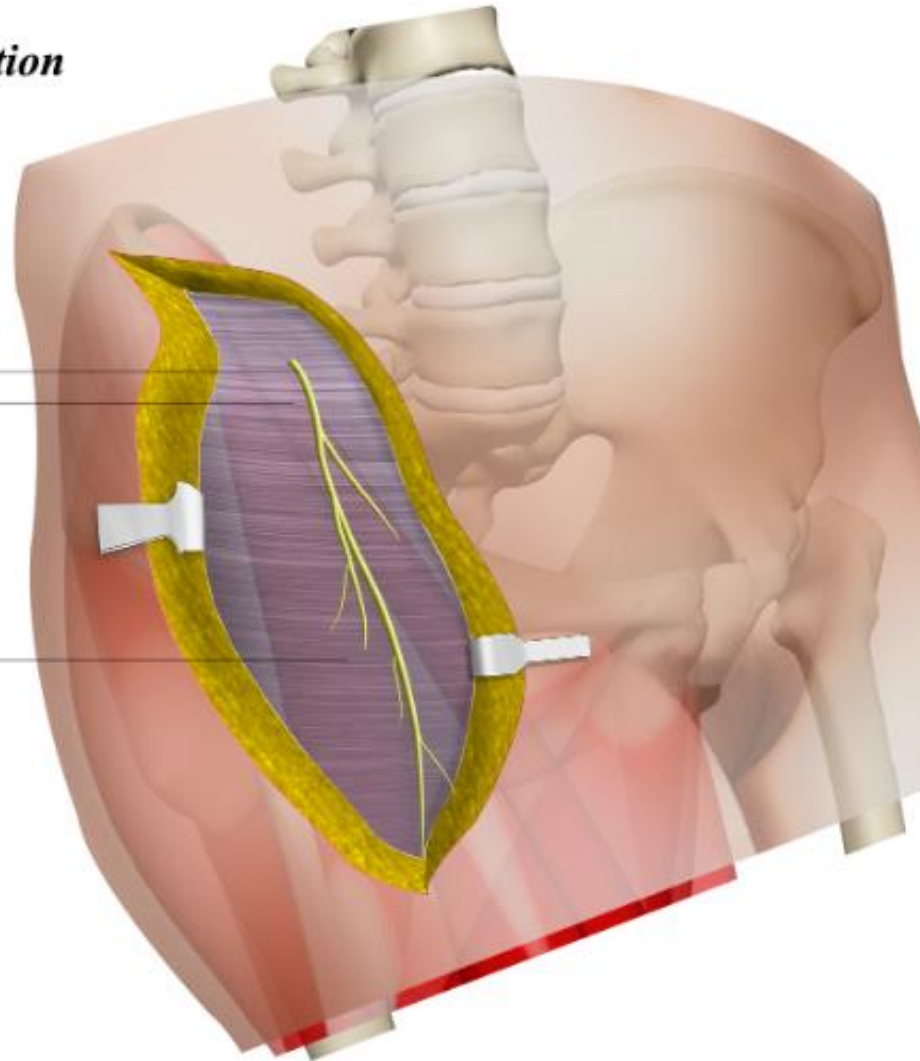
- 4-5 inch incision “in the pocket”
 - Get cute with “bikini” incision
- Move muscles aside to get to hip joint
- Pros
 - More accurate placement of components
 - Easier to X-ray
 - Easier for leg lengths
- Cons
 - Difficult exposure
 - Muscular males
 - Higher risk of femur fracture
 - Lateral femoral cutaneous nerve injury



Superficial dissection

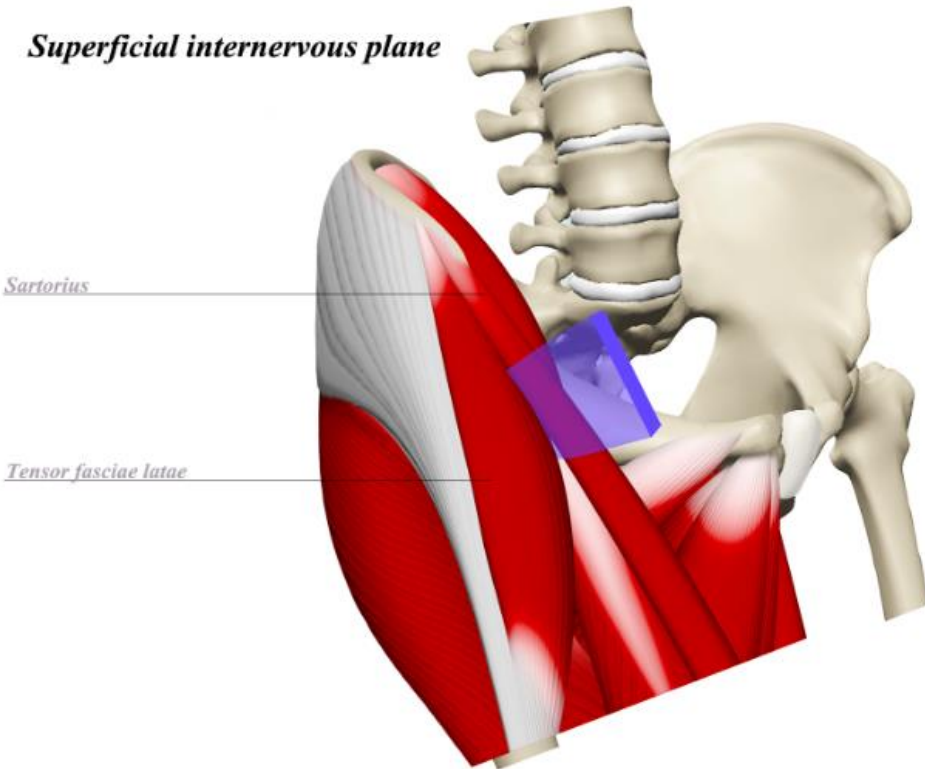
*Lateral femoral cutaneous n.
Sartorius (under fascia)*

Tensor fasciae latae

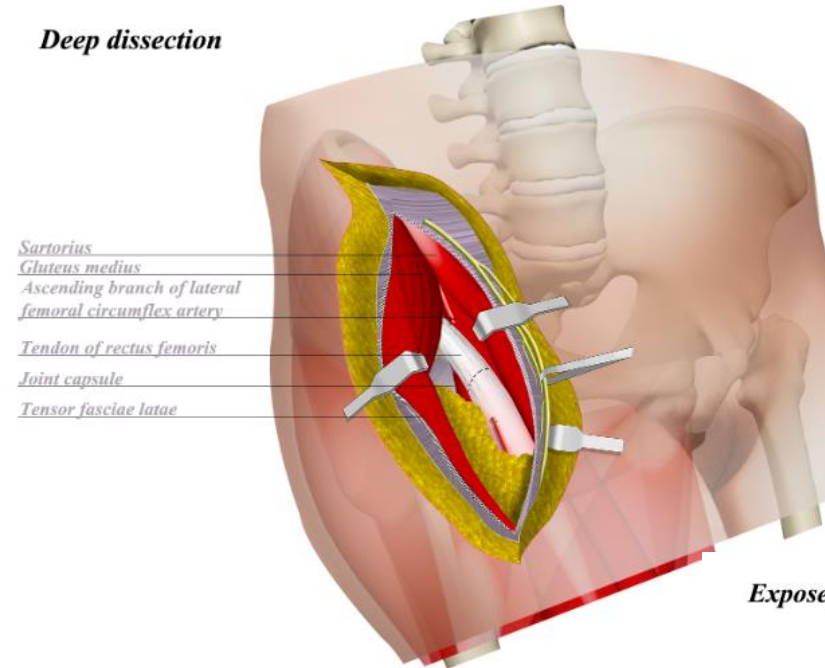


Muscle Sparing

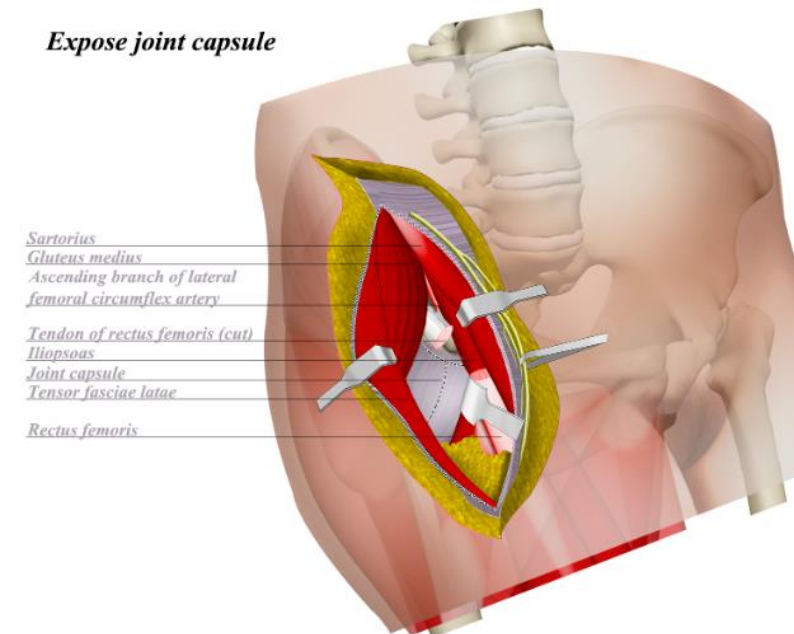
Superficial internervous plane



Deep dissection

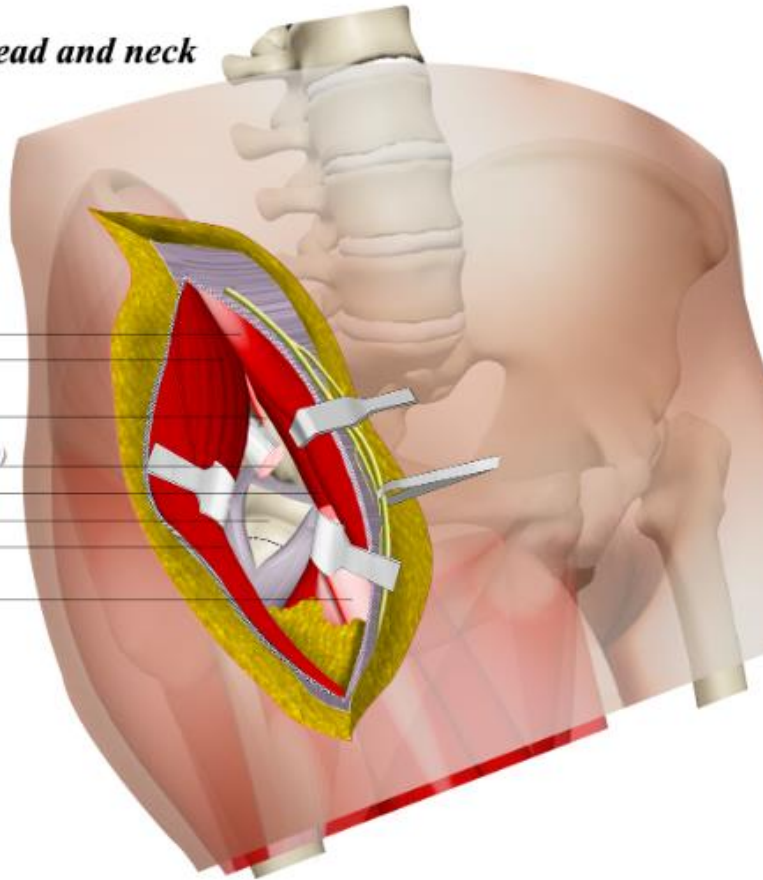


Expose joint capsule



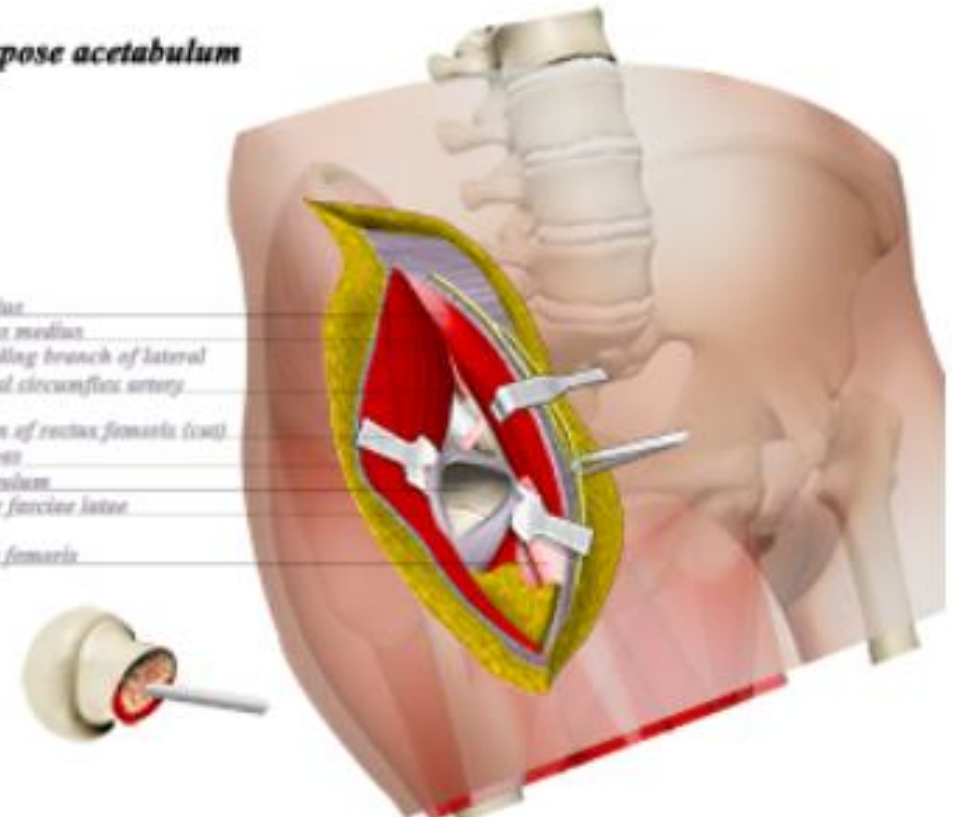
Expose femoral head and neck

Sartorius
Gluteus medius
Ascending branch of lateral femoral circumflex artery
Tendon of rectus femoris (cut)
Iliopsoas
Femoral head and neck
Tensor fasciae latae
Rectus femoris



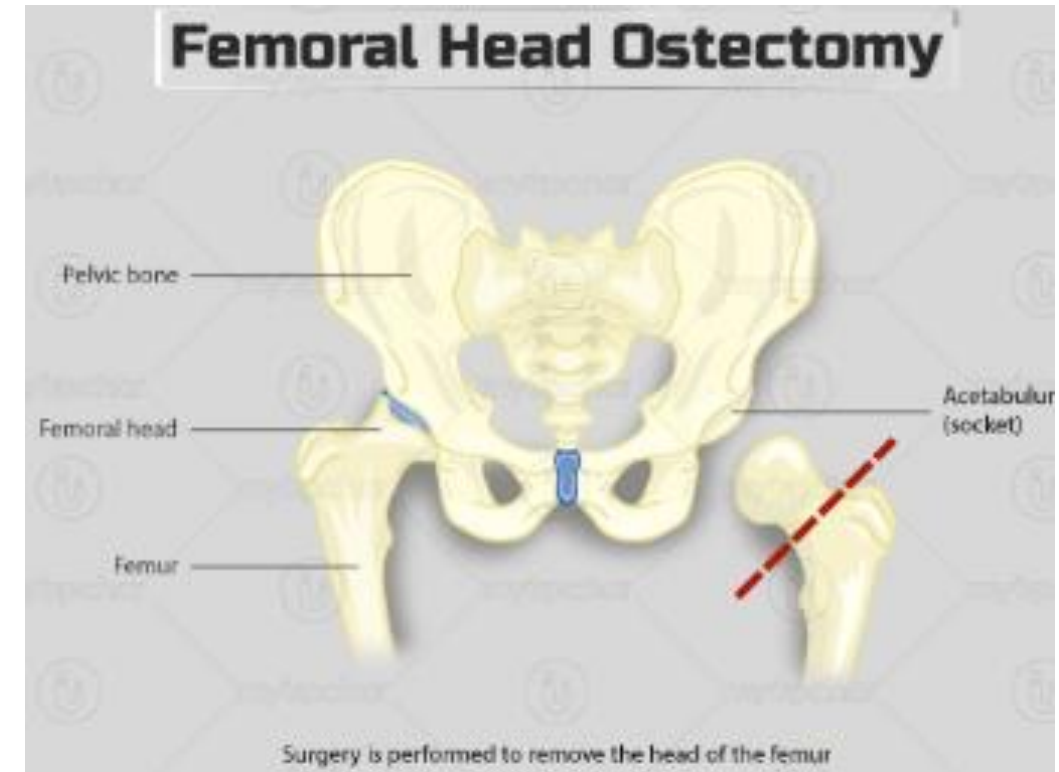
Expose acetabulum

Sartorius
Gluteus medius
Ascending branch of lateral femoral circumflex artery
Tendon of rectus femoris (cut)
Iliopsoas
Acetabulum
Tensor fasciae latae
Rectus femoris

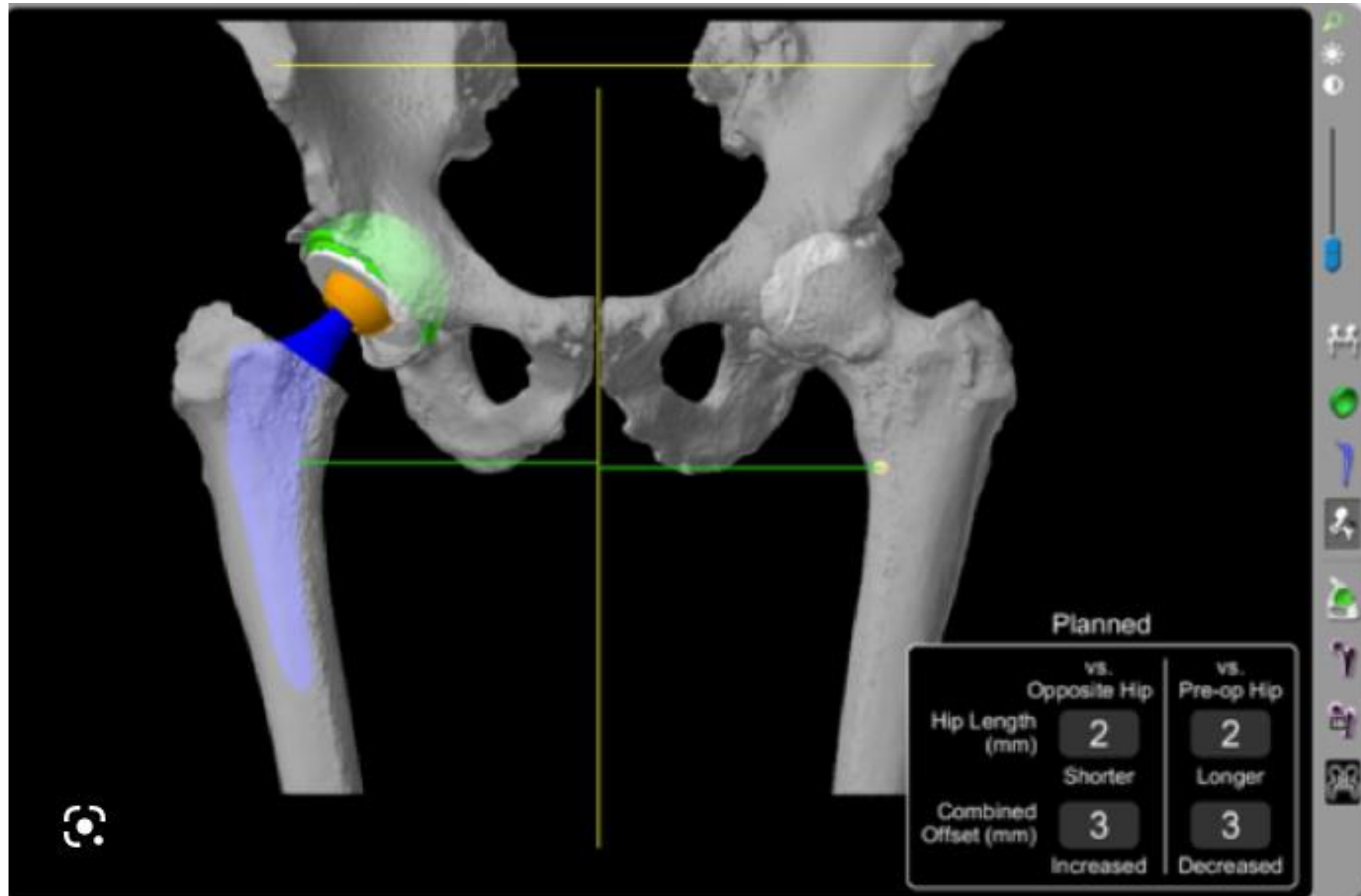


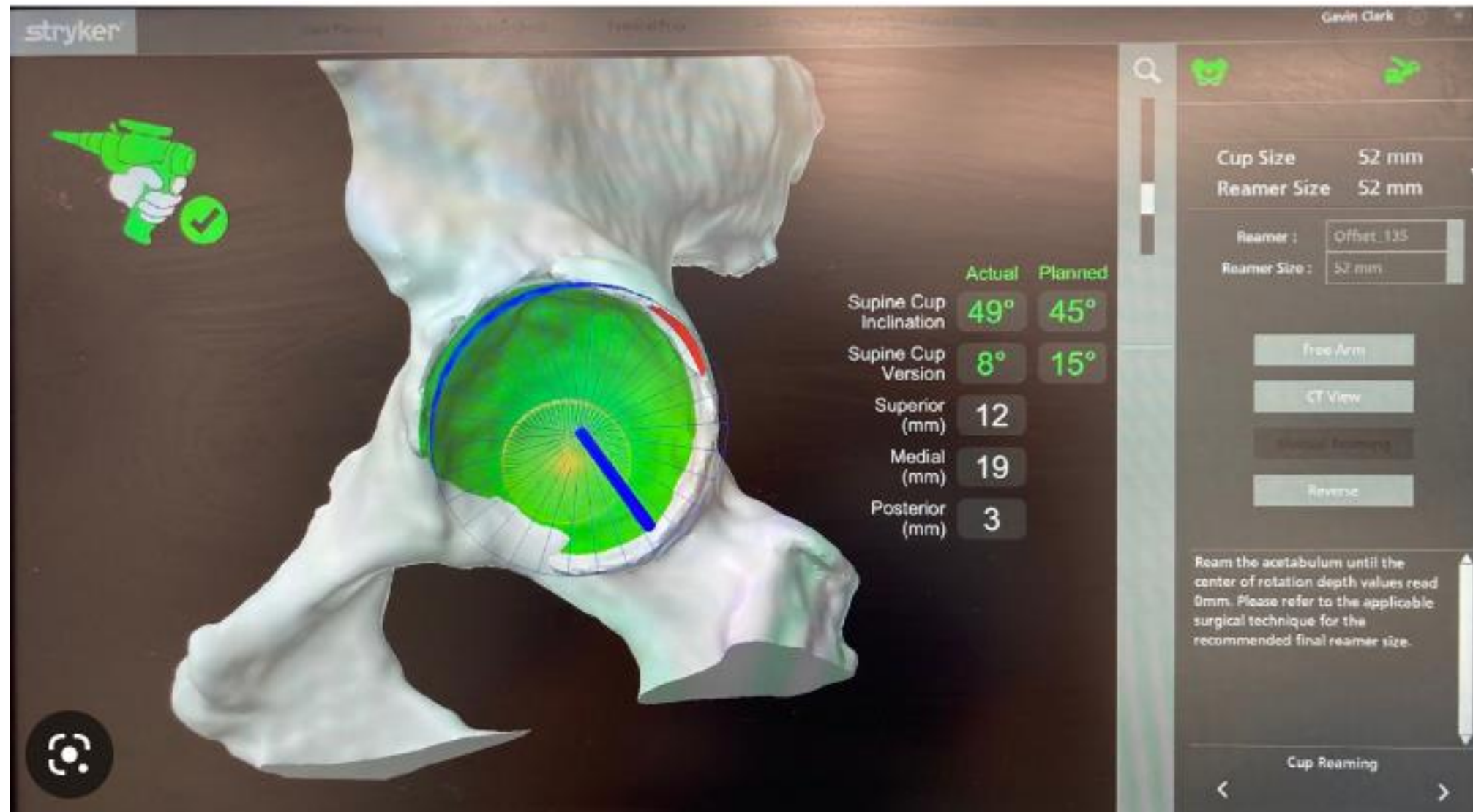
What Stays, What Goes?

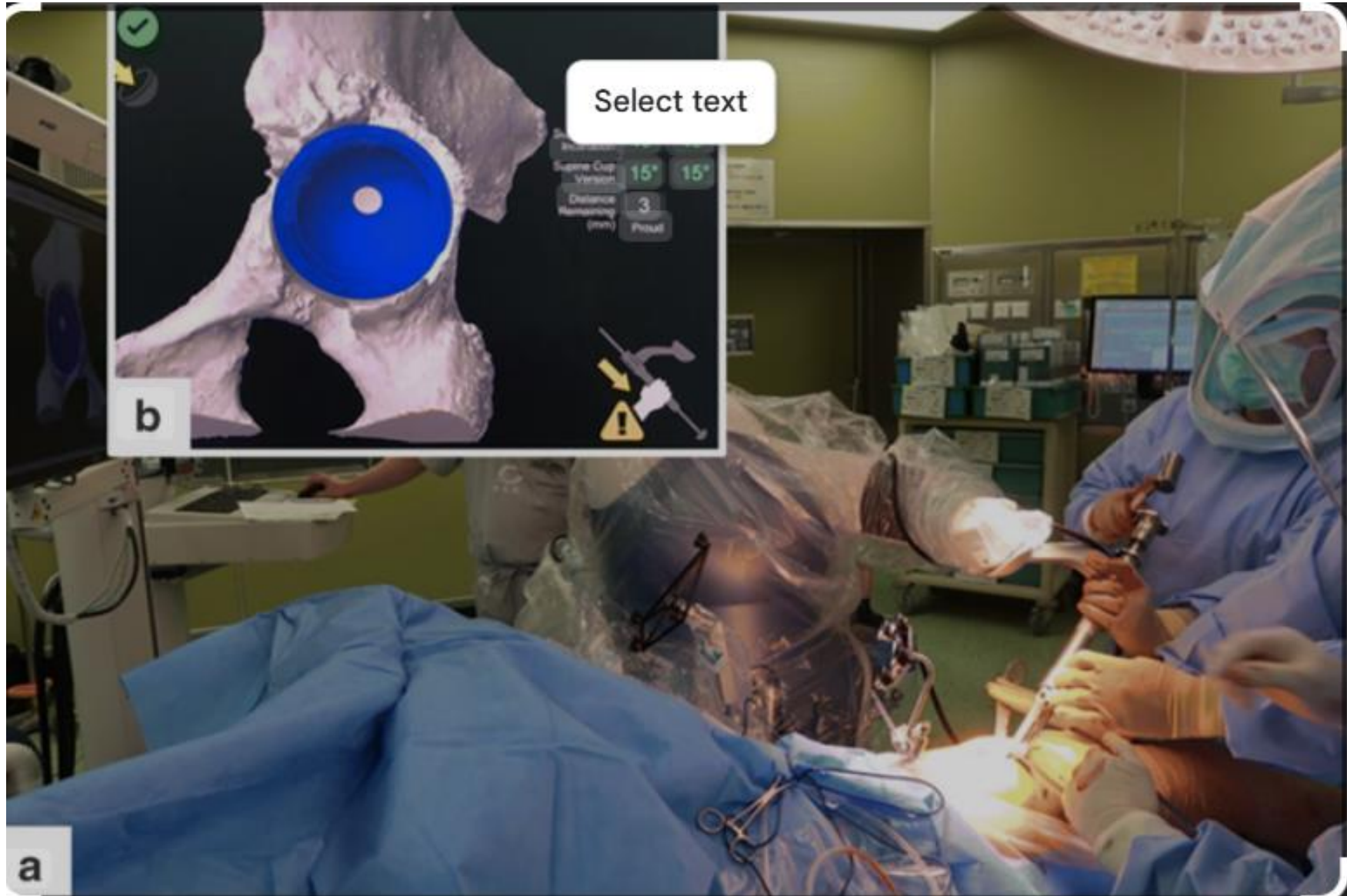
- Stays:
 - Structure of bone
 - Reshaped
 - Femur and Pelvis
- Goes:
 - Arthritis
 - Labrum
 - Ligamentum Teres
 - Femoral head and part of the neck











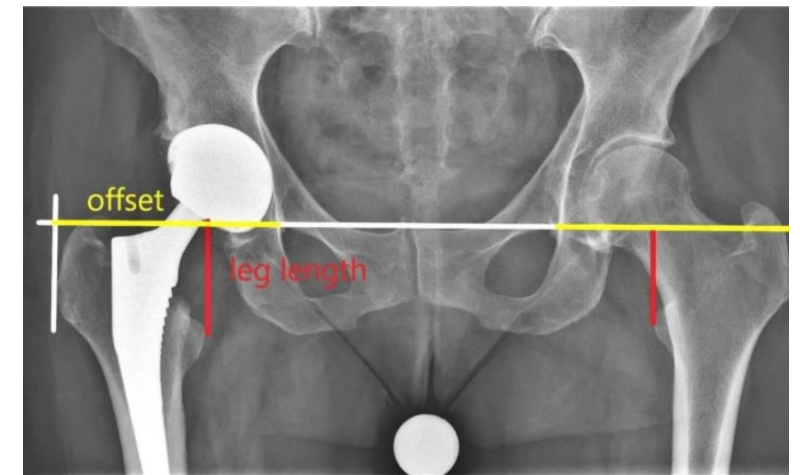
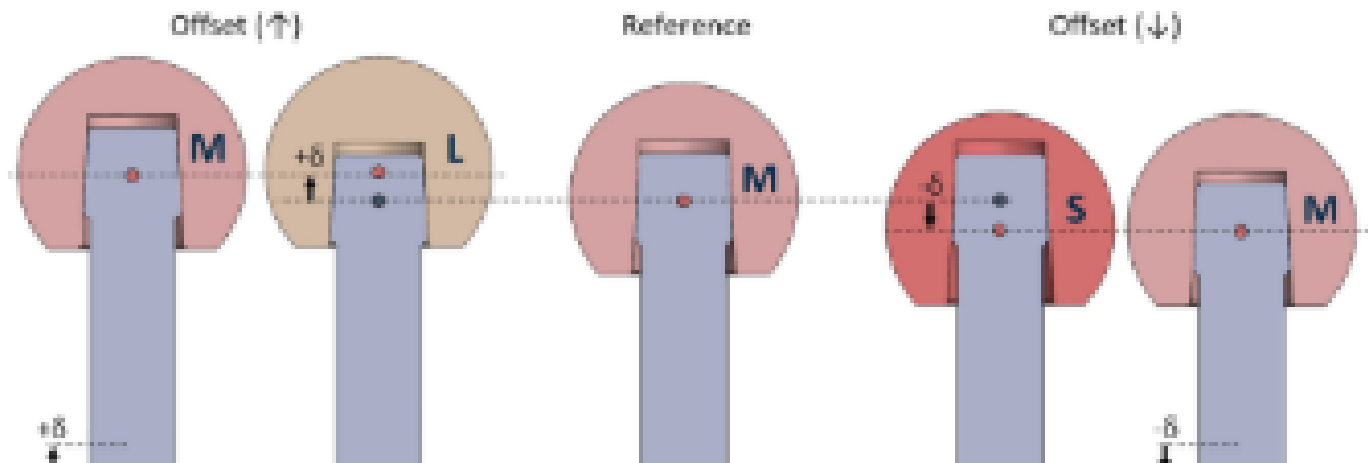
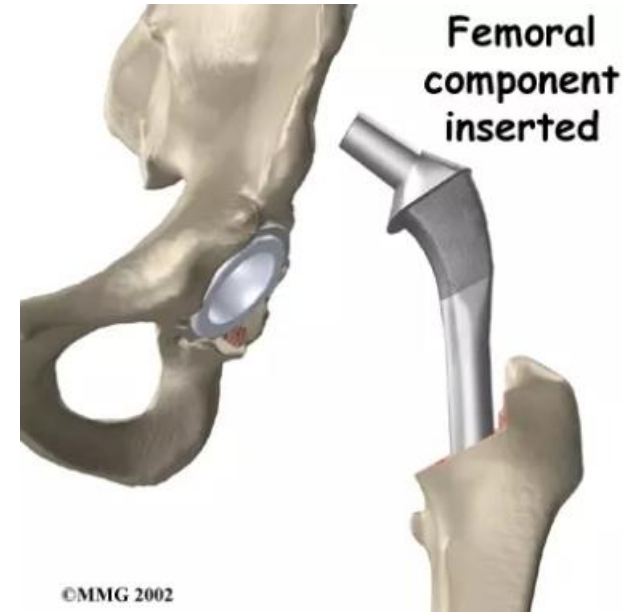
Expose Femur

- Must raise the femur up and laterally
- Most difficult part
 - Risk of fracture
 - Risk of malposition and alignment of femoral component
- Muscular people
 - Stretching
 - Abrasive damage



Femur Preparation

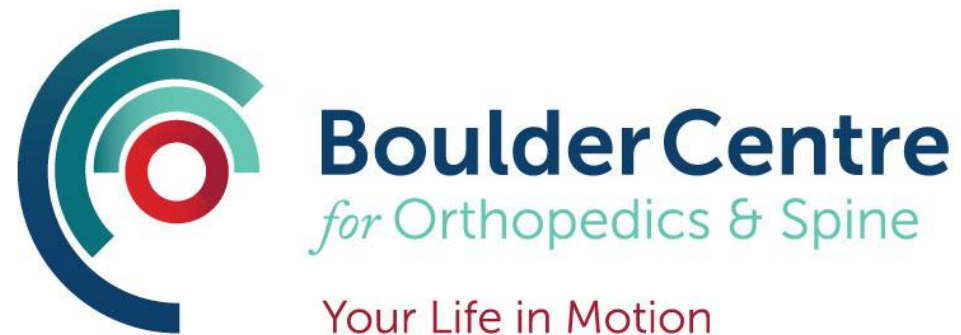
- “Machine” femur
- Place trial for fitting
- Fine tune
 - Offset
 - Leg lengths





Thank You

Questions?



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