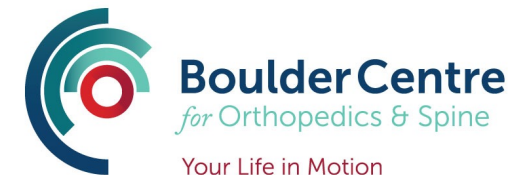


# Innovative Treatments for Hip & Knee Arthritis

Erik Bowman, MD  
BoulderCentre for Orthopedics & Spine  
720-370-7853



- 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.



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

- Joint Reconstruction fellowship – Louisville, KY
  - Trained by Dr. Arthur Malkani designer of Stryker Accolade, one of the highest consulted surgeons for Stryker and MAKO robotic surgery
  - 500+ cases in revision hip and knee surgery and MAKO
- Residency – Omaha, Nebraska
  - Trained by Dr. Kevin Garvin 2019 president of the Hip Society
  - 18 months/60 months of training in joint reconstruction (20 weeks for most residency programs)

# 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?

# 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!



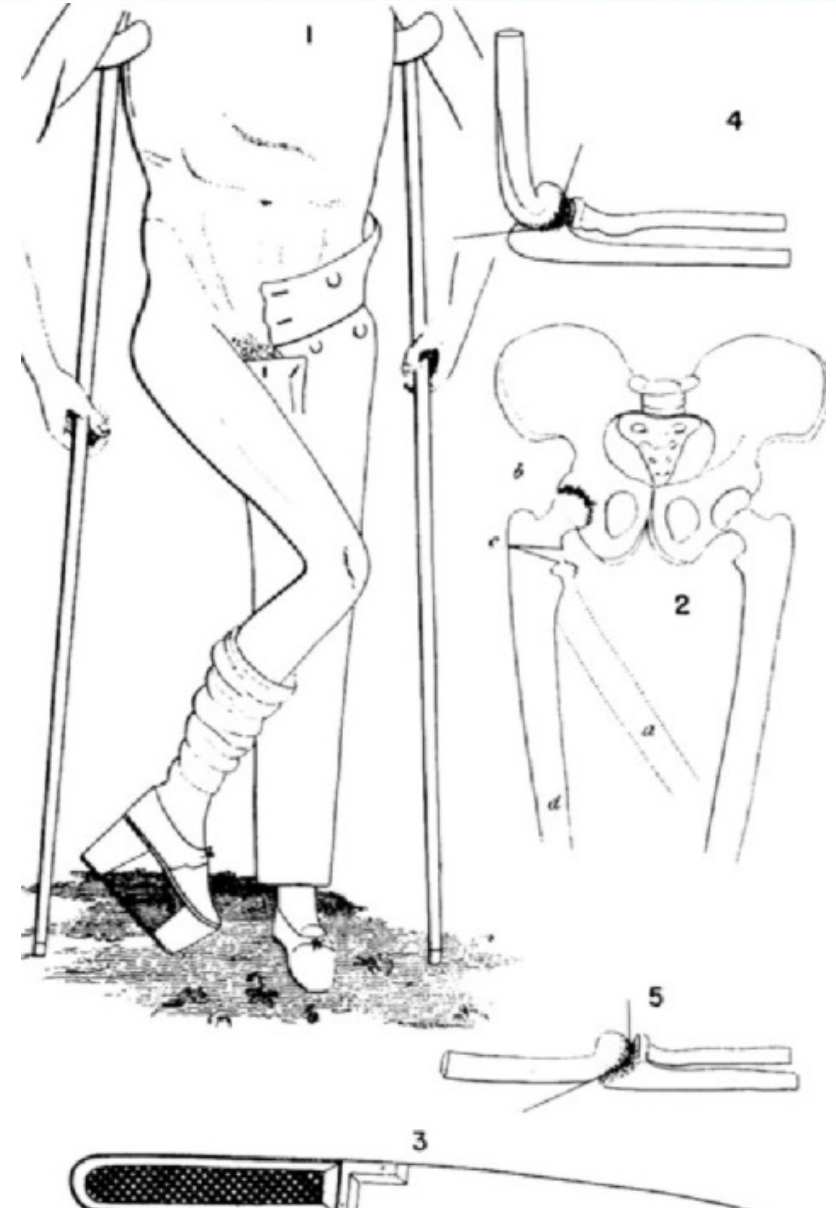
- Arthritis was caused by an imbalance of the 4 humors
  - Elixirs
  - Blood letting
  - Herbal medicines
  - Mineral water
- Demons and gods
  - Prayer
  - Precious metals
  - Good behavior
  - Tithes
- Egyptians
  - Fat, oil, honey, bone marrow

- Hippocrates treated with willow bark (salicin).
  - Cold water therapy
- Dioscorides recommended ivy.
- Chinese used acupuncture.
- 1850s salicylic acid (aspirin) was synthesized.
- Late 1800s Payne used quinine to treat rheumatoid disease.
- 1950s corticosteroids were introduced for treatment of arthritis.



# Joint Surgery

- In 1826, John Rhea Barton performed an osteotomy for pain relief for an arthritic fused hip.
- He also advocated for osteotomy of the knee as well.



- In 1891, Professor Gluck presented femoral head replacements with ivory for patients whose hip joints were destroyed by tuberculosis.
  - Fixed with nickel plated screws, Plaster of Paris, and powdered pumice with resin





Peter Ring from Surrey, developed a cementless MoM designed for self-locking.



Sivash 1960's developed the first fixed fulcrum with a c.c. head/cup with a titanium stem.

Sivash, Russin & Noiles 1970's improved the design that eventually led to the S-Rom® Stem



- Life Style Modifications
- Medications
- Therapy
- Bracing
- Injections
- Surgery





- Healthy Weight
  - BMI > 30
    - Women 4x and Men 5x greater risk of joint arthritis
  - 6-9 times more force (weight) in knee and hip joint
- Exercise
  - Aerobic exercise
  - Low-impact
  - Balanced strength



- Low-inflammatory diet
  - Very low level evidence
  - Meta analysis did not improve function, general health or joint pain
- Turmeric
  - Limited evidence
  - Systematic study showed some benefit
  - High levels
  - GI upset
- Glucosamine and chondroitin
  - 2018 – small, but non statistical difference compared to placebo
  - 2022 meta analysis no difference
  - AAOS strongly recommend against use
- CBD
  - Small and level 4 evidence
- Collagen
  - Small, short (1 month), poor quality



- Tylenol (acetaminophen)
  - Weak evidence for pain relief
  - Very long term liver
- Non specific NSAIDs (Advil, Motrin, Aleve, ibuprofen, naproxen)
  - Moderate evidence for pain relief
  - Side effects of GI problems
  - Serious kidney, ulcer, bleeding
  - Judicious use, short term (month)
  - Voltaren (diclofenac) cream
    - Limited evidence, less side effects
- Cox-1 Inhibitors (Celebrex, celecoxib)
  - Moderate
  - Less GI side effects
  - Sister drug rofecoxib pulled off market due to heart thrombosis
- Tramadol
  - **Opioid-like medication**
  - Slight addiction
  - Less common constipation, nausea



# Disease Modifying Drugs

- Anti-cytokine
  - **Tanezumab**
  - AMG 108
  - Adalimumab
- Enzyme Inhibitors
  - M6495
  - Cindunistat
- Growth factors
  - Bone Morphogenic Protein-7
  - Sprifermin
- Gene Therapy
  - Micro RNA
- Peptides
  - Calcitonin
- Others
  - **SM04690**
  - **Lorecivivint**





- Physical therapy
  - Muscular balance
  - Neuromuscular control
- Hydrotherapy
  - Reduces weight bearing
- Stretching
  - Improve range of motion
  - Can make pain worse
- Chiropractic therapy
  - Temporary relief
- Acupuncture
  - Temporary pain relief



- Supportive sleeves
  - Neoprene
- Off-loader brace
  - Bulky
  - Expensive
  - Only used with correctable deformities
  - Uncomfortable



- Corticosteroids
- Visco-supplementation
- Platelet rich plasma (PRP)
- Stem Cells



- Conventional (methylprednisone, triamcinolone)
- Long-acting (Zilretta)
  - Lipase-activated release of triamcinolone
- Reduces inflammation
- Pros
  - Cheap and effective
- Cons
  - Multiple injections in short period or over many years can lead to damage
  - Every 3-4 months
  - Increase blood sugar in diabetics
  - Zilretta needs insurance approval



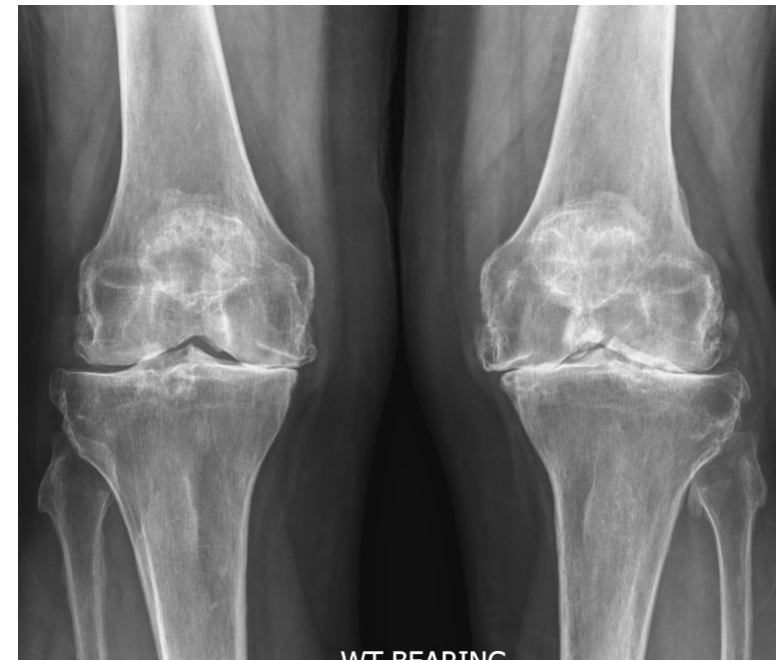
- Hyaluronic acid (“chicken shot”, gel injection)
- “Try to “mimic” cartilage and lubrication
- Avian vs synthetic
- Pros
  - Non-toxic
- Cons
  - Need some cartilage left
  - Expensive
  - Multiple injections
  - Insurance approval



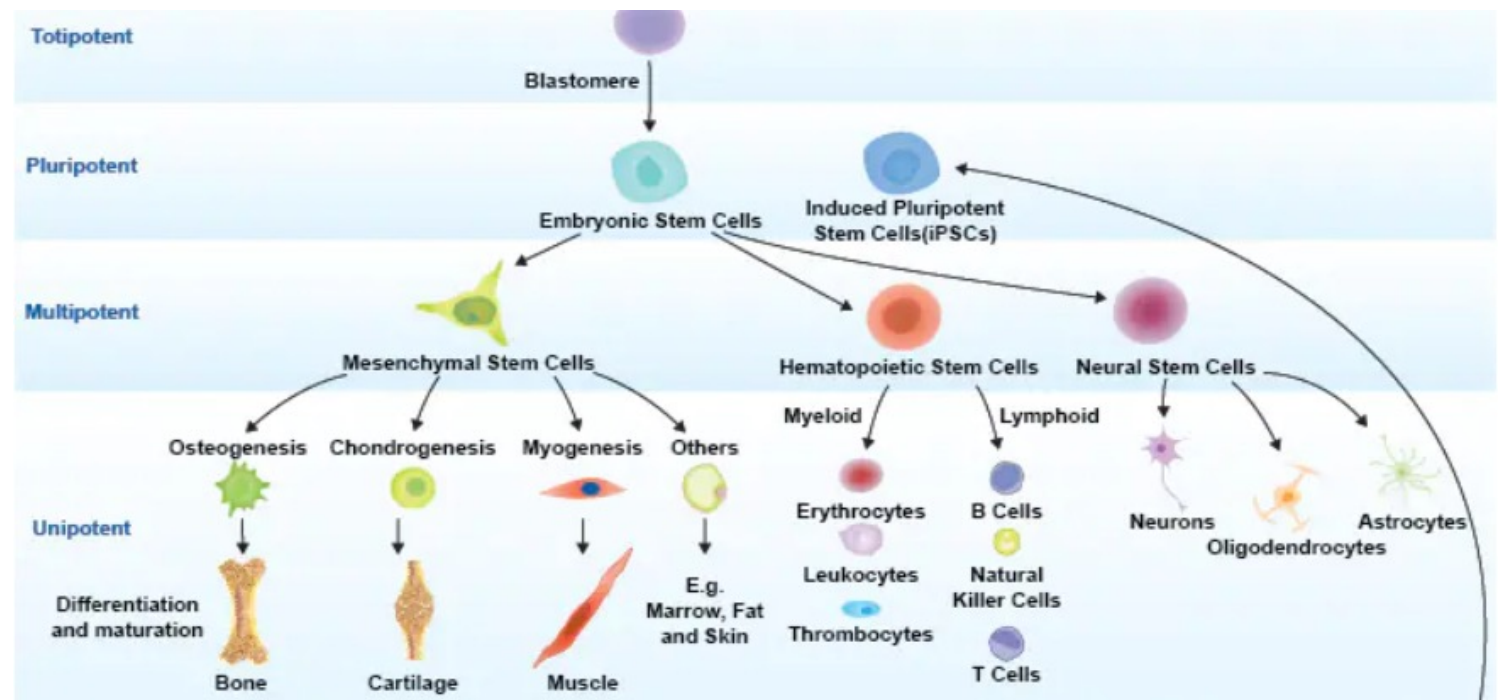


# PRP: Platelet Rich Plasma

- Injections of concentrated blood products to enhance healing
- Cannot heal irreversible changes
- OOPC > \$800 per injection



- Obtain stem cells, concentrate them and inject them into the joint to decrease inflammation and promote healing
- How do they know what to turn into?
- OOPC > \$5,000



- Technique
- Technology
  - Navigation
  - Artificial Intelligence
  - Augmented Reality
  - Robotics



## Traditional Hip Replacement

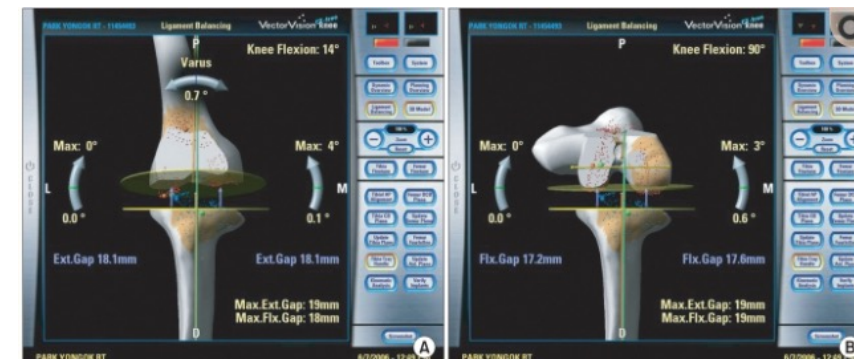
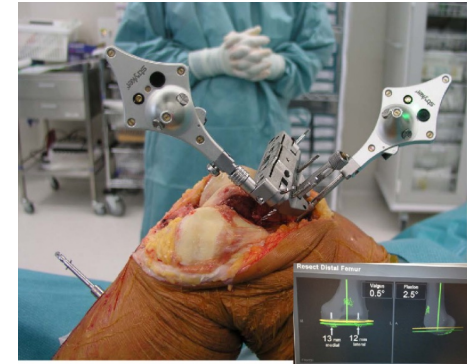
- 8-12 inch incision
- Surgical approach - side (lateral) or back (posterior)
- Disturbance of the joint and connecting tissues
- Easier
- Longer recovery

## MIS with Direct Anterior Approach

- 4-5 inch incision
- Surgical approach – front (anterior)
- Muscles or tendons not detached
- Heavy learning curve
- Higher risk of complications

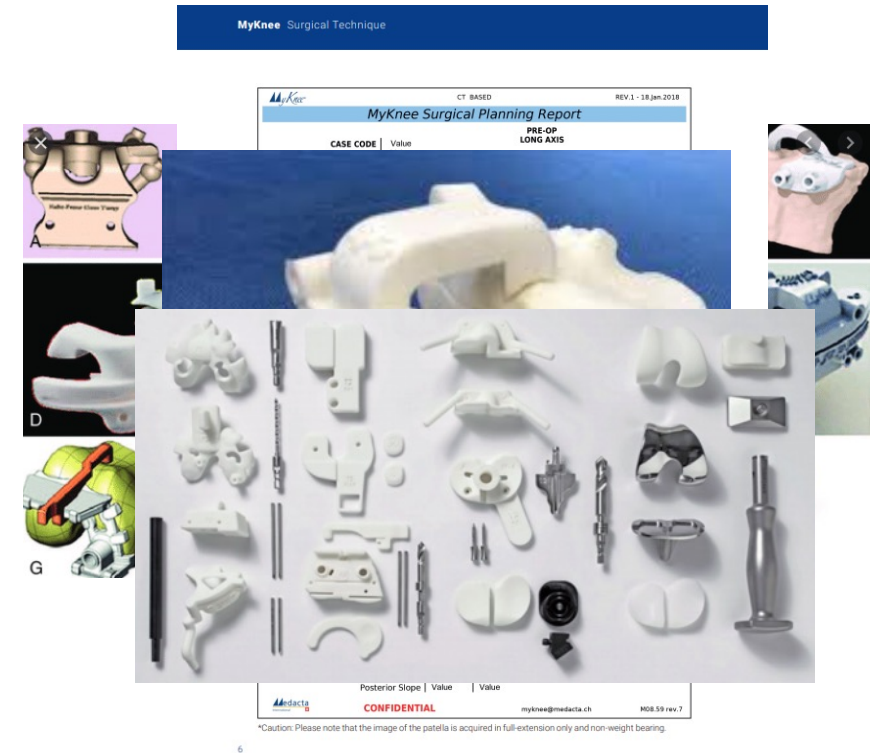
# Computer-assisted Navigation

- At least 20 different navigation systems worldwide
- Vary from hand held devices to full computer supported structure
- Advantages
  - Cheaper
  - Can be used with any implant system
  - Pre-operative imaging may not be required
- Disadvantages
  - Learning curve
  - Inconsistent
  - Some do not help prior to surgical steps
  - Not all navigation systems are equal
  - Do not make the surgery safer
  - Up to 20 minutes longer surgery



# Patient-Specific Instrumentation

- Personalized instrumentation that is unique to the patient
- Advantages
  - All planning is done before surgery
  - Can be customized to your anatomy and arthritis
  - Theoretically decreases surgical time
  - 3D printed body part to help with implant position
  - Can be disposable and less instruments on the table
- Disadvantages
  - MRI or CT currently required
  - Cutting guides may break
  - Very finicky
  - Can still make an error
  - Personal cutting guides expensive



- Four “Robots”
  - ROSA
  - NAVIO
  - VELYS
  - MAKO





- Advantages
  - Implant allows cementless
  - 3 implant designs for knees
  - X-ray based
- Disadvantages
  - Uses conventional cutting guides
  - Can only be used for knees
  - No haptic feedback
  - No boundaries



- Advantages
  - No prior imaging needed
  - Implant can be used for Nickel allergy\*
  - Less expensive
  - Dynamic balancing
- Disadvantages
  - Longer surgery
  - No cementless option
  - No haptic feedback
  - Only for knee joint



- Advantages
  - No prior imaging needed
  - Robotic arm is less expensive
  - Robotic arm highly transportable
  - Dynamic balancing
  - Haptic feedback
- Disadvantages
  - Only for knee joint



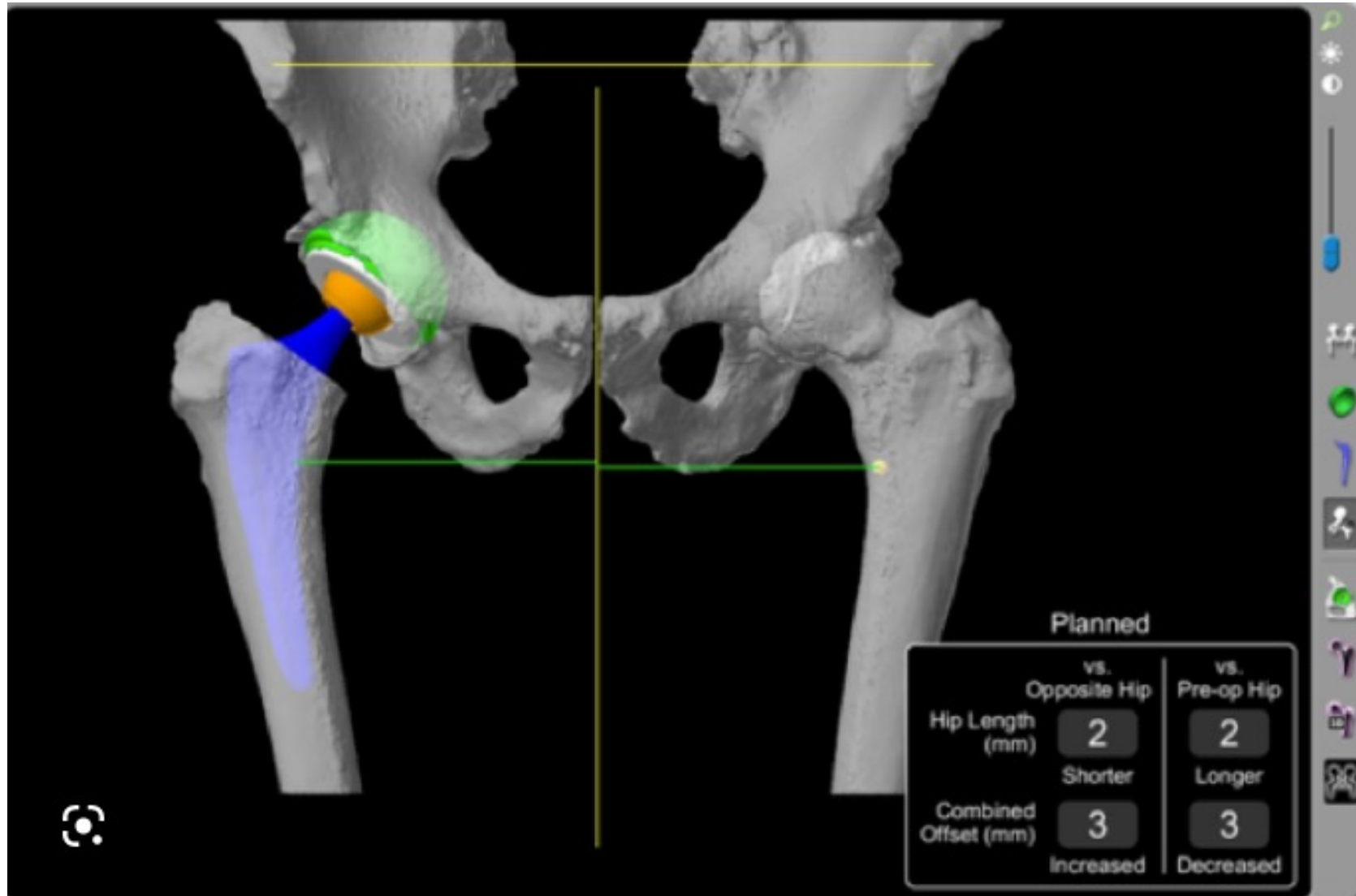



- Advantages
  - Pre-operative planning
    - Already know your sizes before surgery
  - Haptic feedback and boundaries
  - Longest track record
  - Hip, knee, and unicompartamental
  - Extremely efficient
- Disadvantages
  - Bulky
  - Requires CT
  - Expensive
















stryker

Case Planning        Femoral Prep                    Gavin Clark

	Actual	Planned
Supine Cup Inclination	49°	45°
Supine Cup Version	8°	15°
Superior (mm)	12	
Medial (mm)	19	
Posterior (mm)	3	

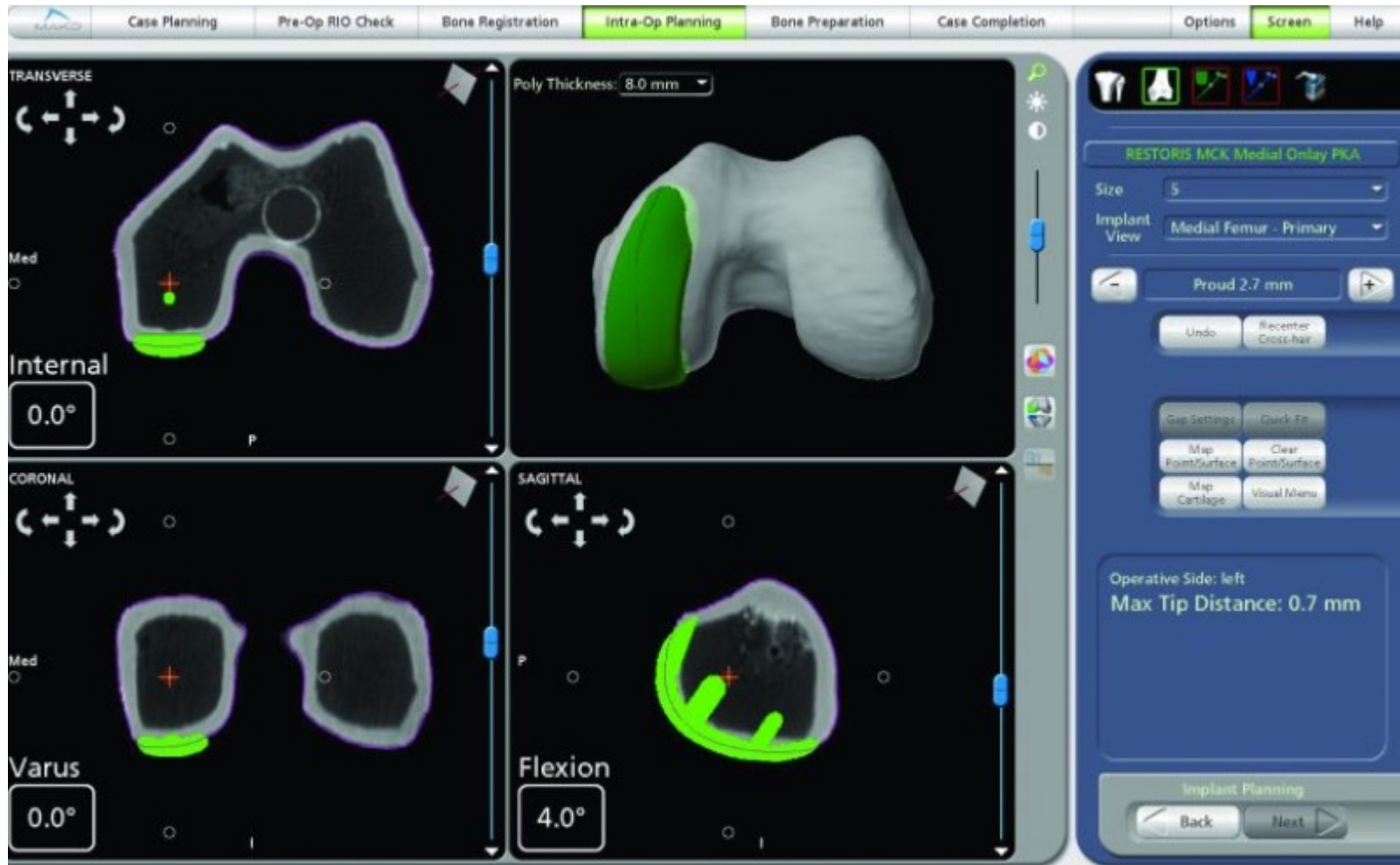
Cup Size 52 mm  
Reamer Size 52 mm

Reamer : Offset 135  
Reamer Size : 52 mm

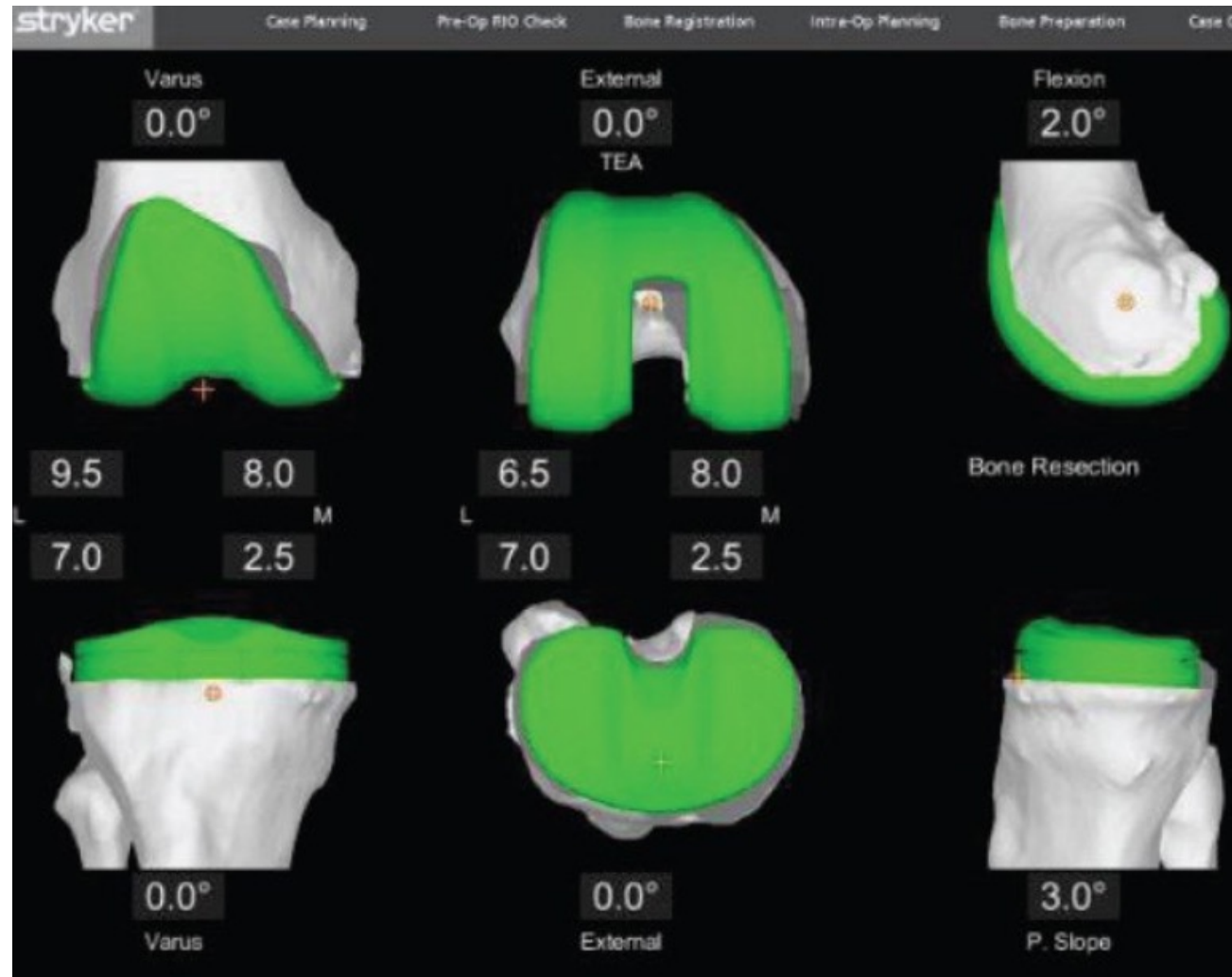
Free Arm  
CT View  
Manual Reaming  
Reverse

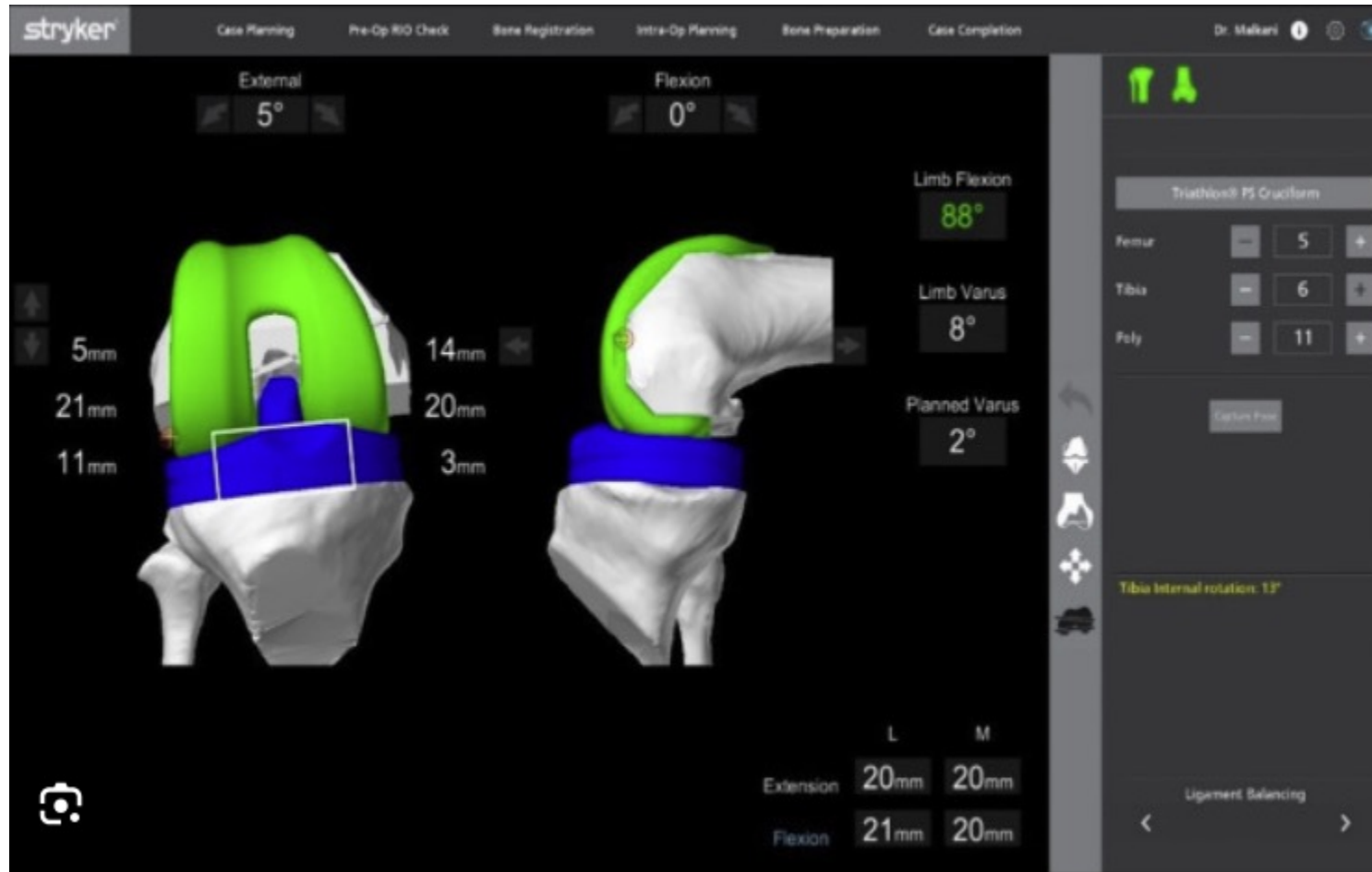
Ream the acetabulum until the center of rotation depth values read 0mm. Please refer to the applicable surgical technique for the recommended final reamer size.

Cup Reaming





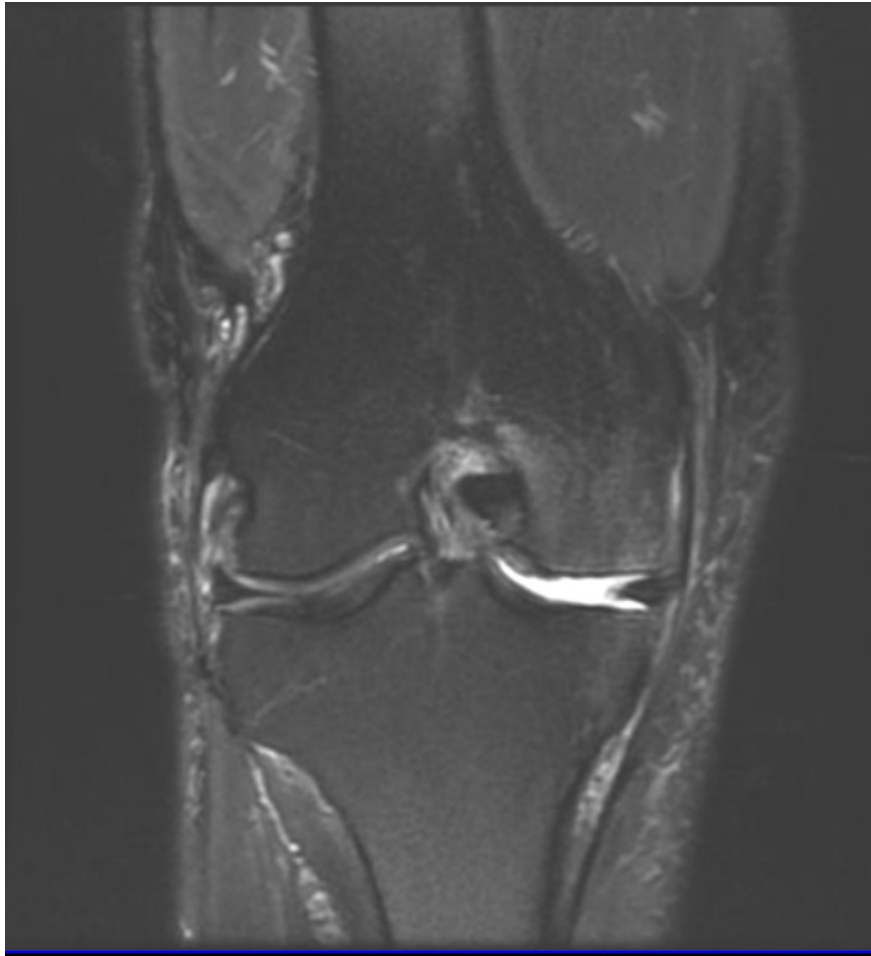






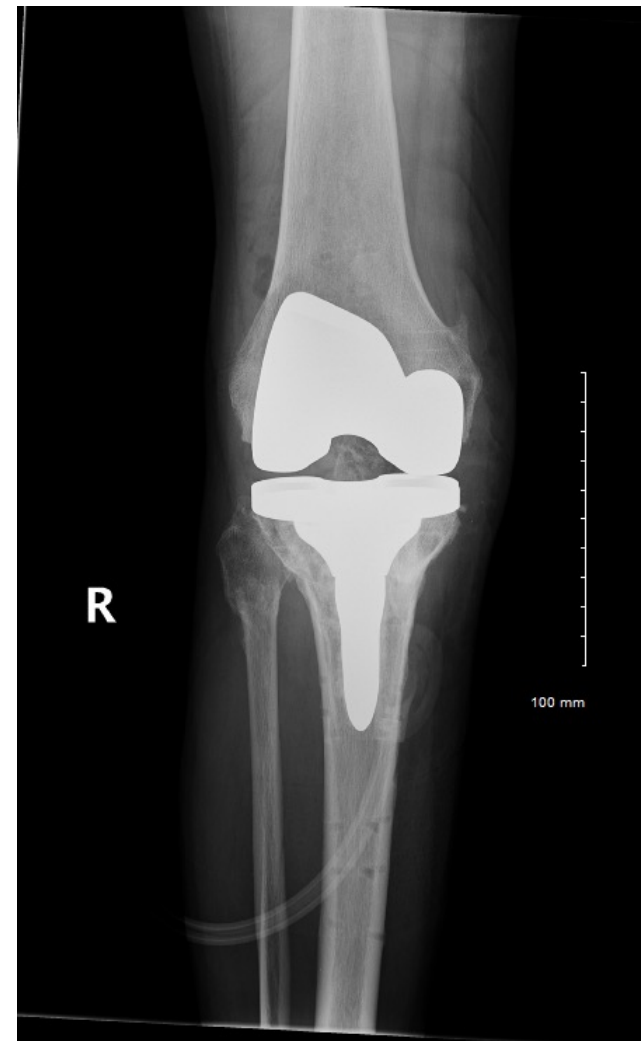


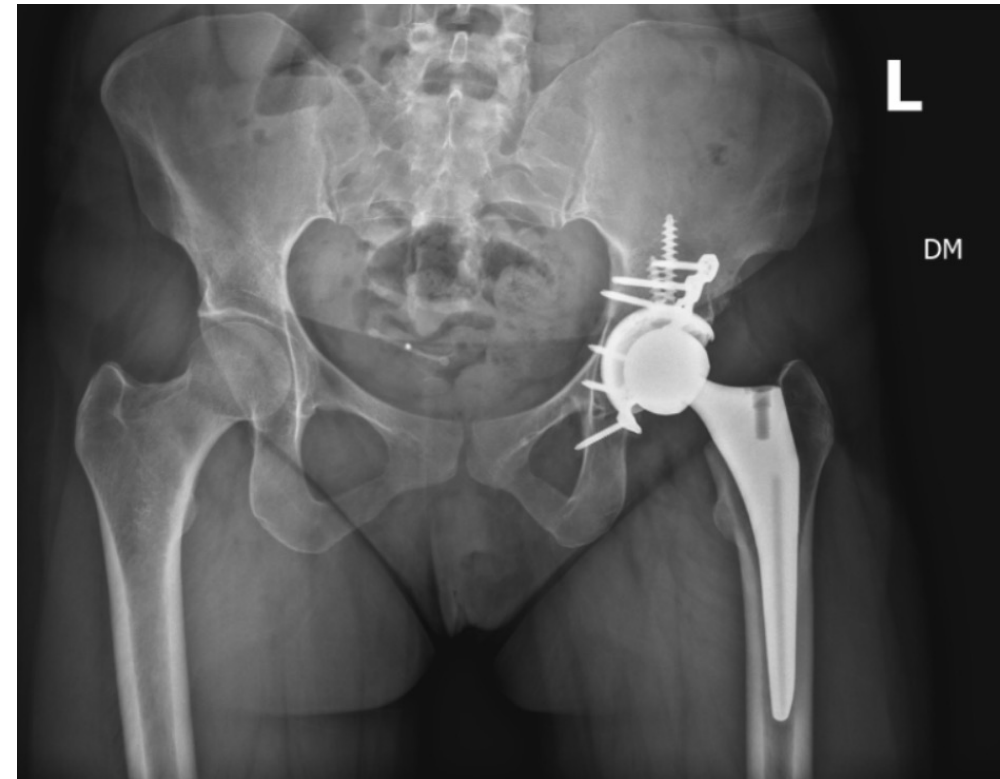




# Examples











# Questions

- Knight SR, Aujla R, Biswas SP. Total Hip Arthroplasty – over 100 years of operative history. Orthop Rev (Pavia) 2011 Sept 6; 3(2): e16.
- Moll JMH, Chesterman PJ, Meanock RI, Andrews FM. Walldius Arthroplasty of the Knee: Follow up study of 51 operations. Ann. Rheum. Dis. (1973), 32, 397.
- Insall JN, Clarke HD. Historic Development, Classification, and Characteristics of Knee Prostheses. Musculoskeletal Key. Ch 97.
- <https://archaeologynewsnetwork.blogspot.com/2016/05/arthritis-brought-ancient-romans-to.html>
- Goldberg, Cary. <https://www.wbur.org/commonhealth/2017/08/14/skeleton-study-arthritis-harvard>
- Power, D. Ipsissima Verba. Brit Jour Sur. Vol. XXIV No 94 October 1936.
- Matteo BD, Tarabella V, Maracacci M. John Rhea Barton: the birth of osteotomy. Knee Surg Sports Traumatol Arthrosc. 2013 Sep; 21(9): 1957-1962. Epub 2013 Jan 19.
- Hernigou P. Smith-Petersen and Early Development of Hip Arthroplasty. International Orthopaedics 38, 193-198(2014). 6 Sept 2013
- Lachiewicz PF, Henderson RA. Patient-Specific Instruments for Total Knee Arthroplasty. Journal of the American Academy of Orthopaedic Surgeons: September 2013- Vol 21 (9).
- Karkenny AJ, Mendelis JR, Geller DS, Gomez JA. The Role of Intraoperative Navigation in Orthopaedic Surgery. Journal of the American Academy of Orthopaedic Surgeons: October 1, 2019. Vol 27(19).
- <https://orthoinfo.aaos.org/en/treatment/revision-total-hip-replacement/>
- <https://www.columbian.com/news/2015/sep/28/technology-improves-surgical-accuracy/>
- <https://www.orthosensor.com/surgeons/verasense/>
- Stryker MedEd
- Johnson and Johnson Depuy
- <https://www.hopkinsarthritis.org/patient-corner/disease-management/role-of-body-weight-in-osteoarthritis/#:~:text=Overweight%20women%20have%20nearly%204,or%20obesity%20and%20knee%20OA.>
- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7503186/>
- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7812094/>

# Innovative Treatments for Hip & Knee Arthritis

Erik Bowman, MD  
BoulderCentre for Orthopedics & Spine  
720-370-7853

