Primary Total Knee Replacement

David J Weir

Knee arthroplasty

- Implant design
- Bearing surfaces
- Surgical technique
- Outcomes

Primary TKR

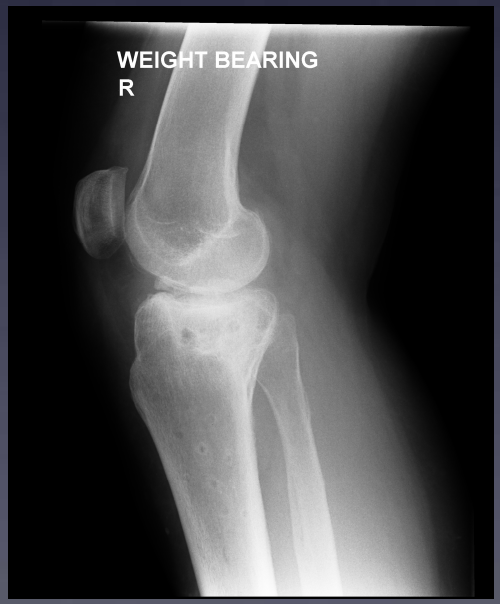
- Starts with referral from GP
- History
- Clinical exam
- Investigation

Osteoarthritis

Total Knee Replacement

- Subchondral sclerosis
- Deformity
- Osteophytes
- Loss of joint space

Knee arthroplasty



- Post traumatic

Knee arthroplasty

- Inflammatory arthritis

Primary TKR

- Treatment options
- Non surgical
- Surgical

Indications

Total Knee Replacement

- Relieve pain
- Improve quality of life
- Provide motion & stability
- Correct deformity

Knee arthroplasty

- Total Knee Replacement
- Unicompartmental
- Bicompartmental

Unicompartmental

- Medial/lateral compartment
- Patello-femoral

Total Knee Replacement

Patello femoral

Bicompartmental

- Medial compartment combined with patello femoral replacement

Primary TKR

- Wear
- Infection
- Life and health
- Stiffness
- Nerve and vessel damage

Primary TKR

- Preop assessment
- Fitness for surgery
- Fitness for anaesthesia
- Consent

Total Knee Replacement

- Recent or current joint sepsis
- ? Neuropathic joints

Primary TKR

- Surgery just one step in treatment of patient

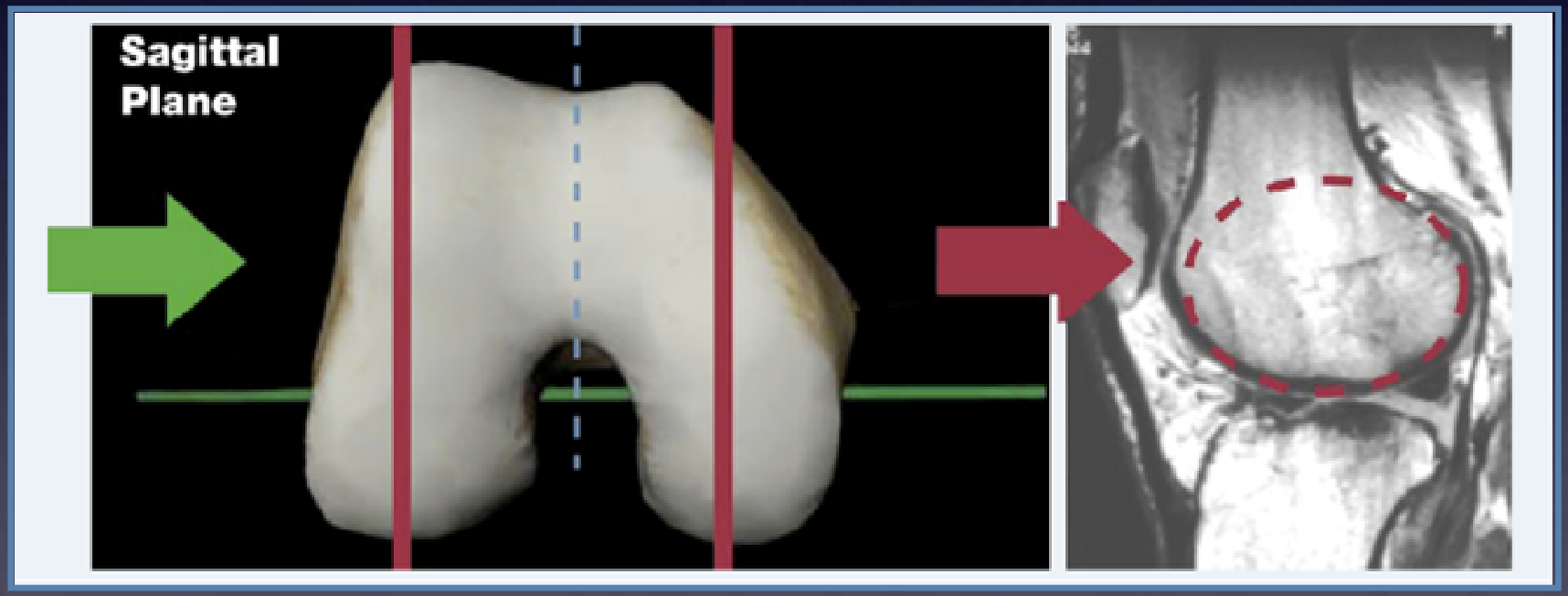
Implant design

- Most commonly unconstrained for primary knee replacement.
- Femur can have multiradius or single radius curve.
- Single radius curve reinvention of an old concept.
- Single radius seems to be the way forward

Total Knee Replacement

Issues Patients have after TKA

Traditional Theory of Kinematics



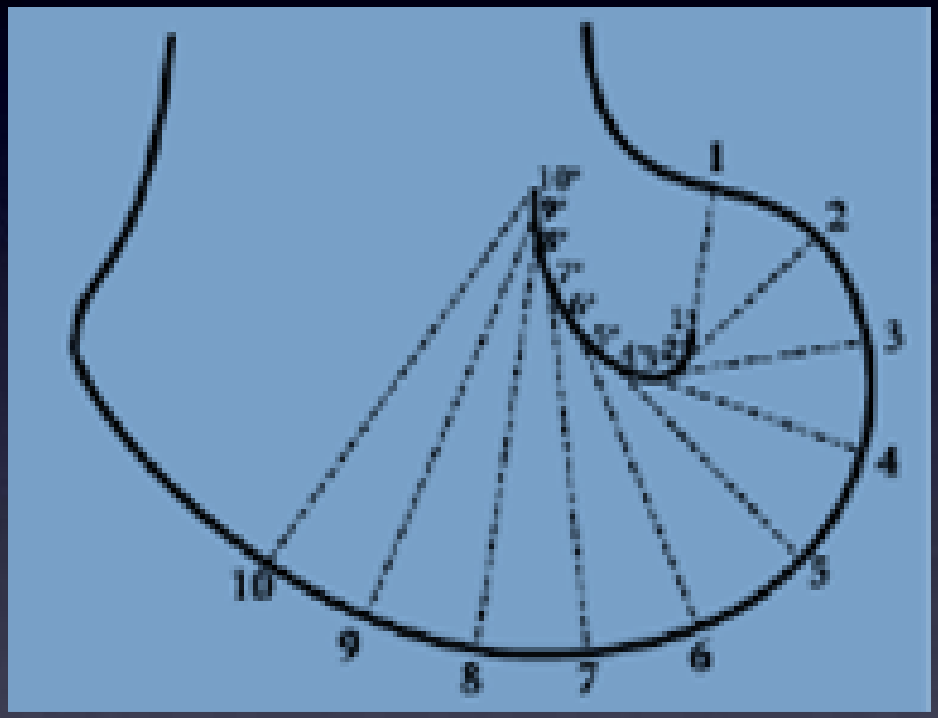
Kinematics

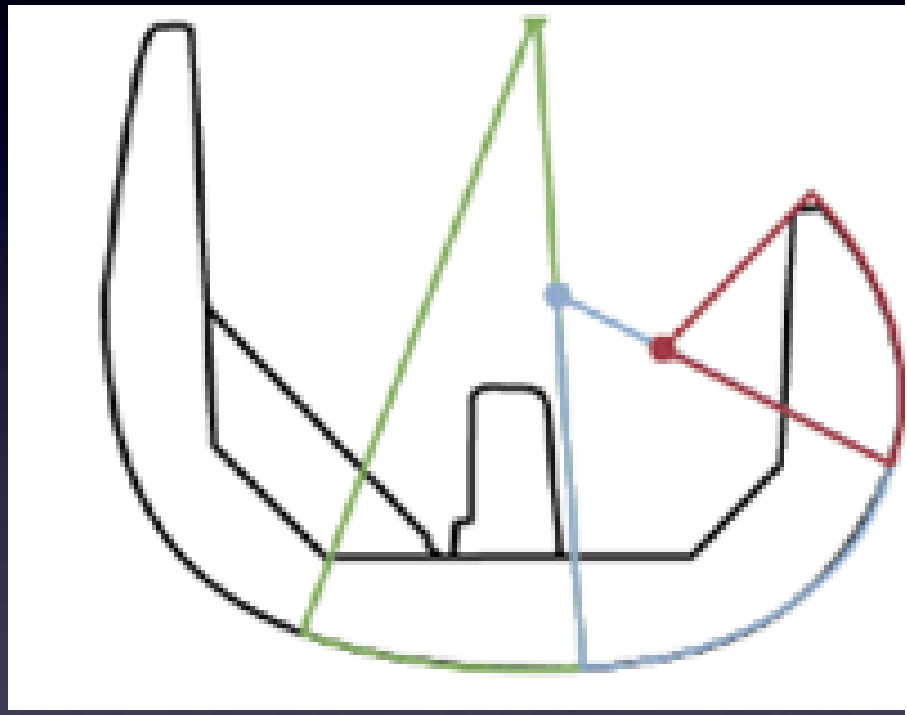
Result: Instant Centre of Rotation

Frankel and Burstein concluded:

- The posterior condyles of the femur are egg-shaped and not circular when viewed directly in the saggital plane.
- No single fixed axis of flexion-extension exists. There is instead a moving instant centre of rotation.

The ”J Curve” was born





Multi Radius & “J” Curve

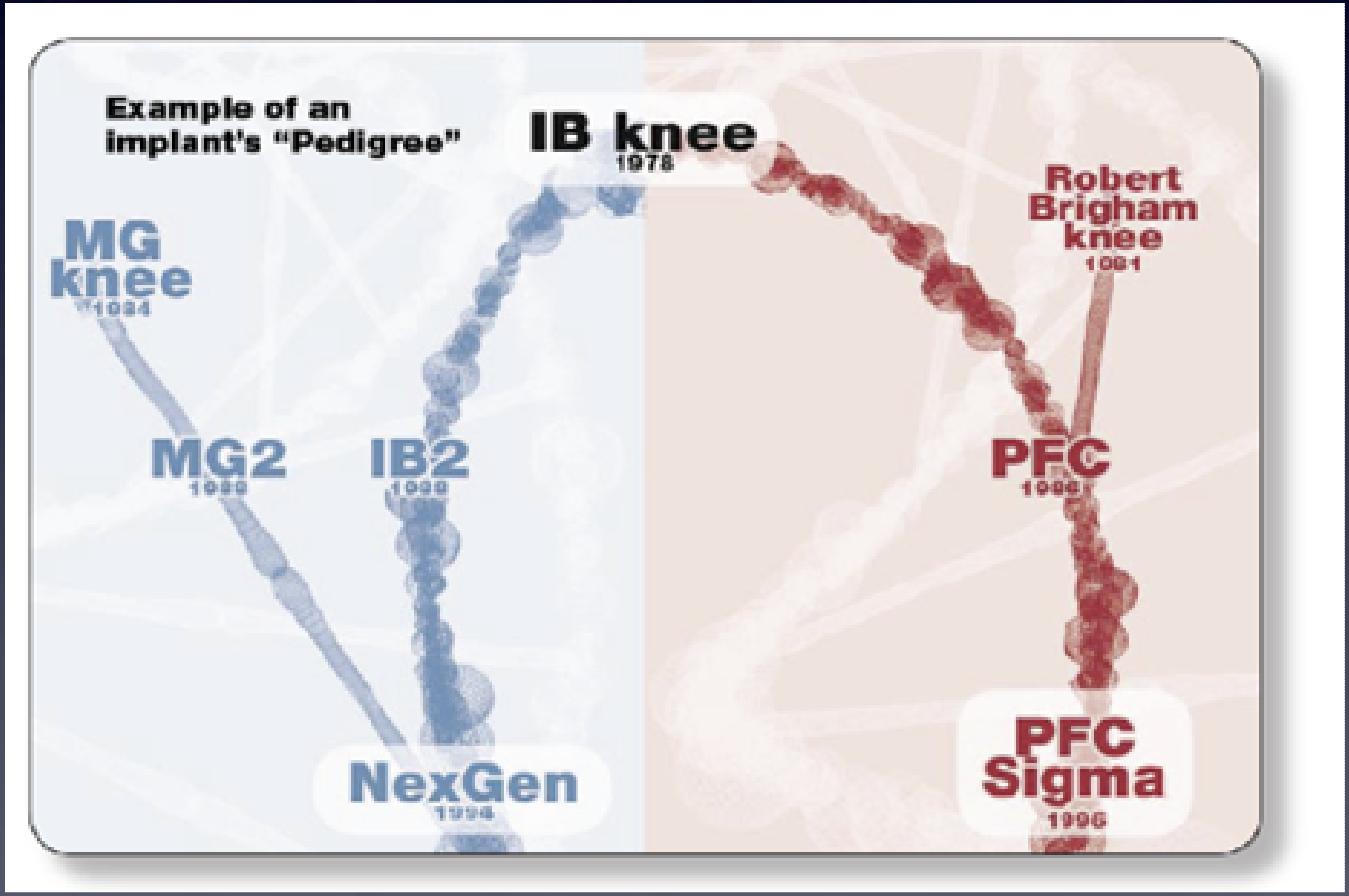
Effect on TKA Design

John Insall Al Burstein

Insall Burstein Knee

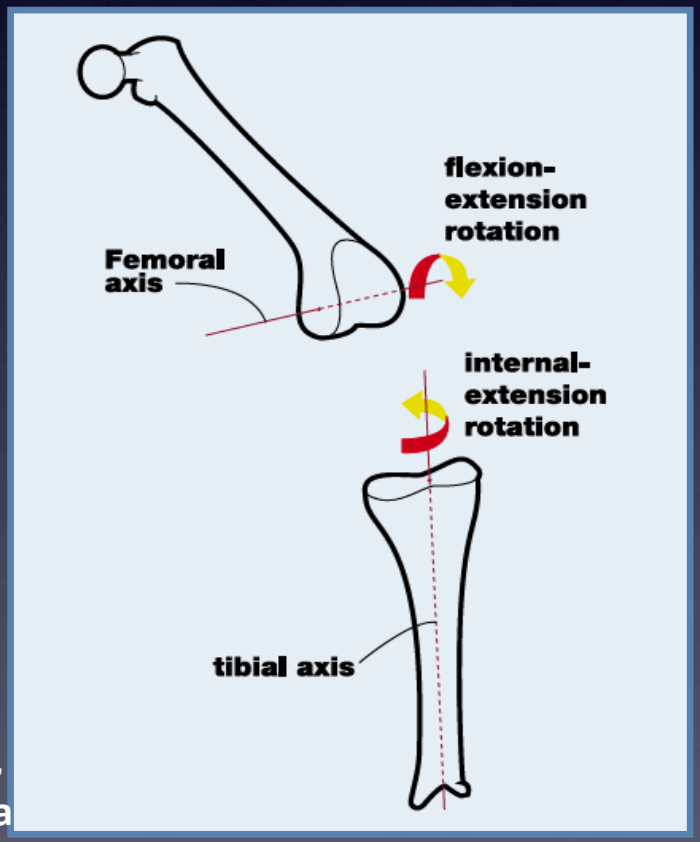
1978

Traditional theory



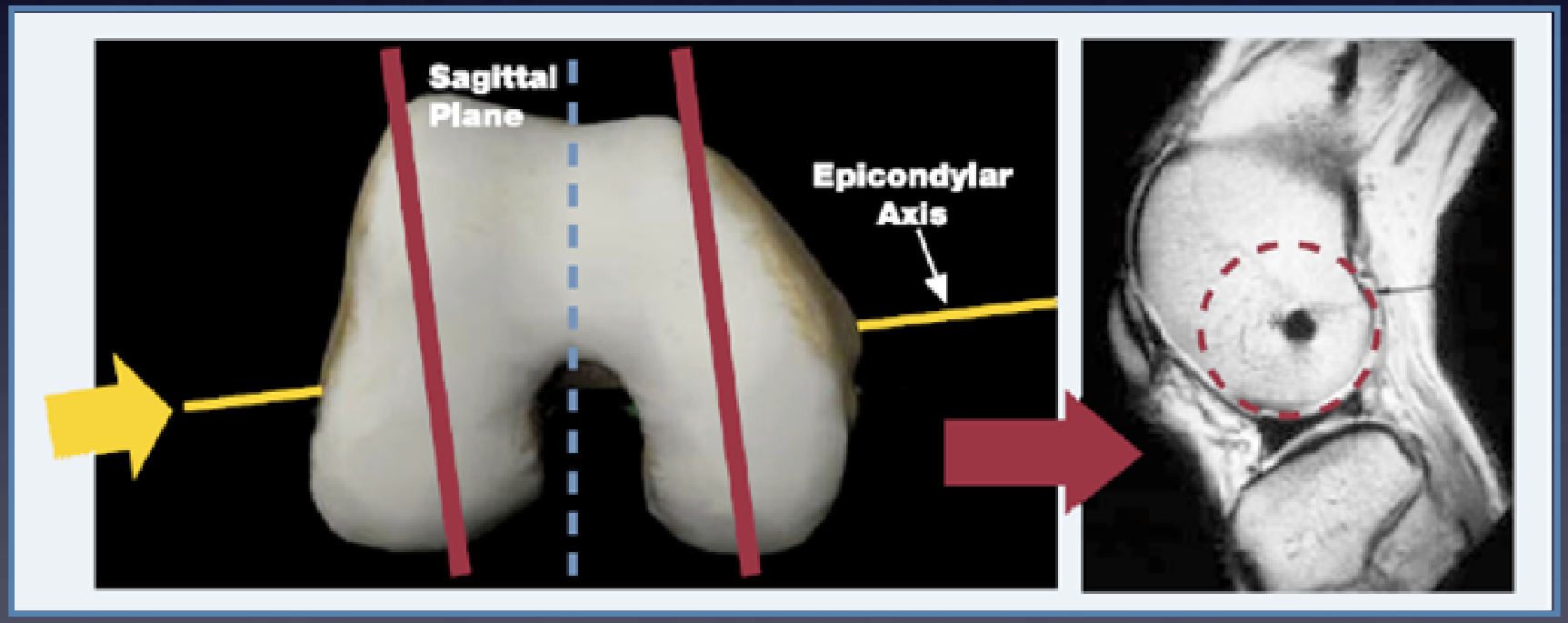
Modern theory

- Flexion-extension occurs around a single fixed axis in the femur
- This Axis closely corresponds with the Transepicondylar axis

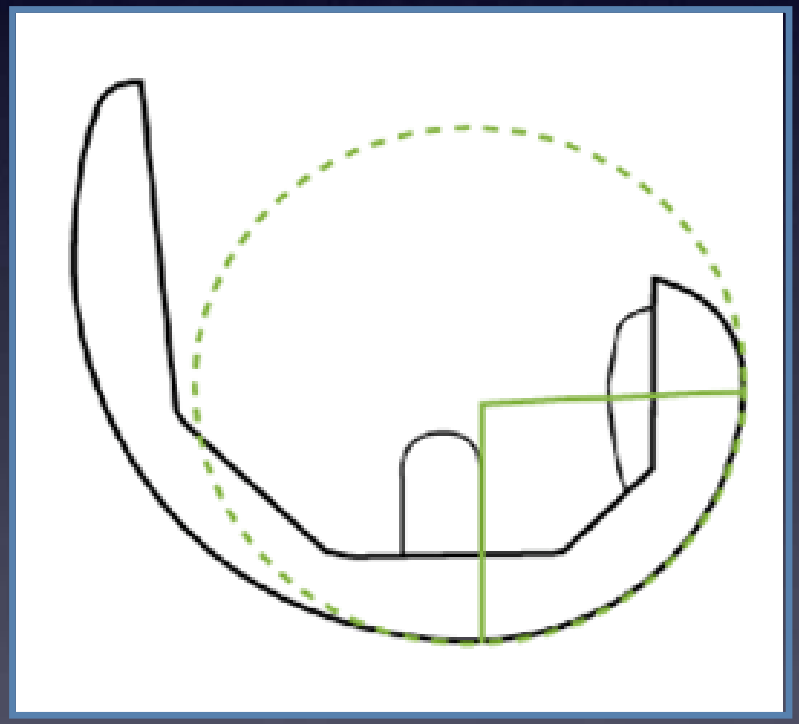


Kester, Hollister,
Freeman & Pinskerova

Modern Theory of Kinematics

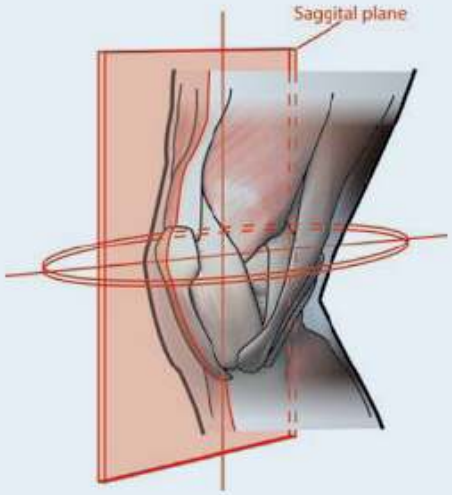
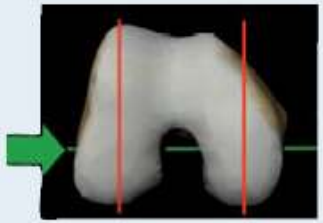
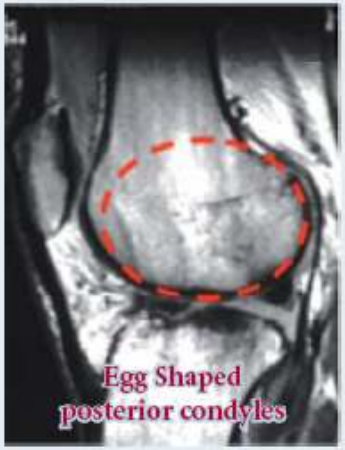
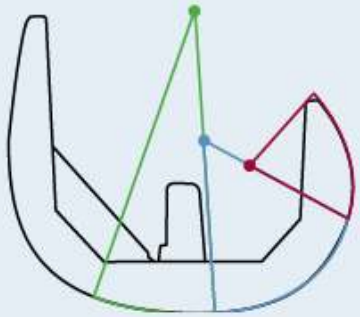
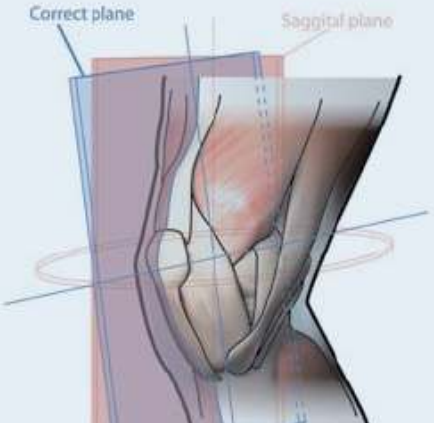
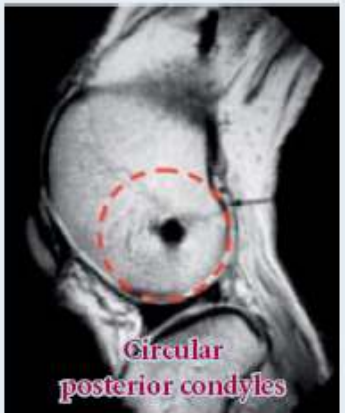
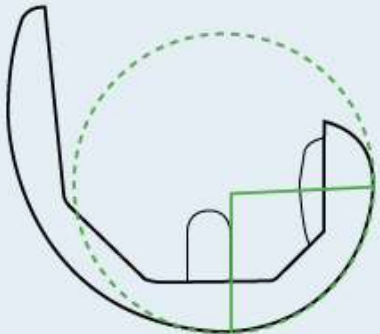


Resultant design



Single Radius

Traditional vs Modern

	Planes	Axes	Shapes	Implant
Traditional		 Changing instant centre of rotation		Multi Radius / J curve 
Modern		 Fixed axis of flexion extension		Single Radius 

Single radius benefits

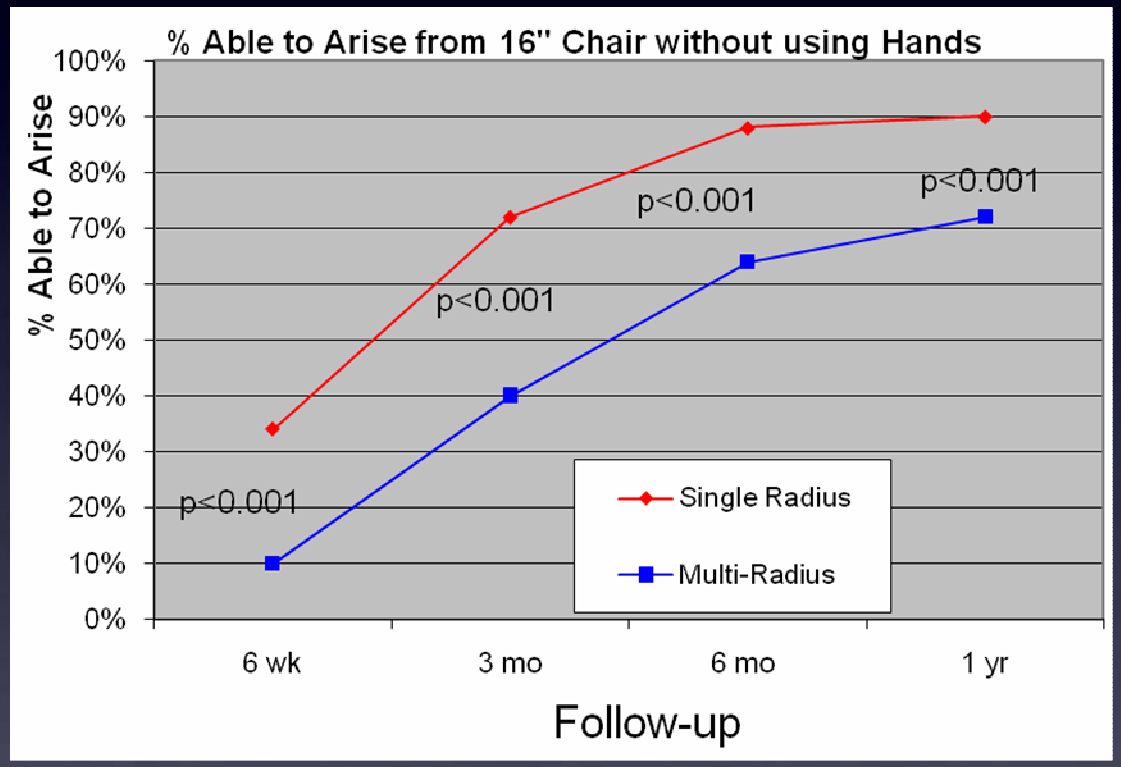
- Better gap balancing
- Improved extensor mechanism

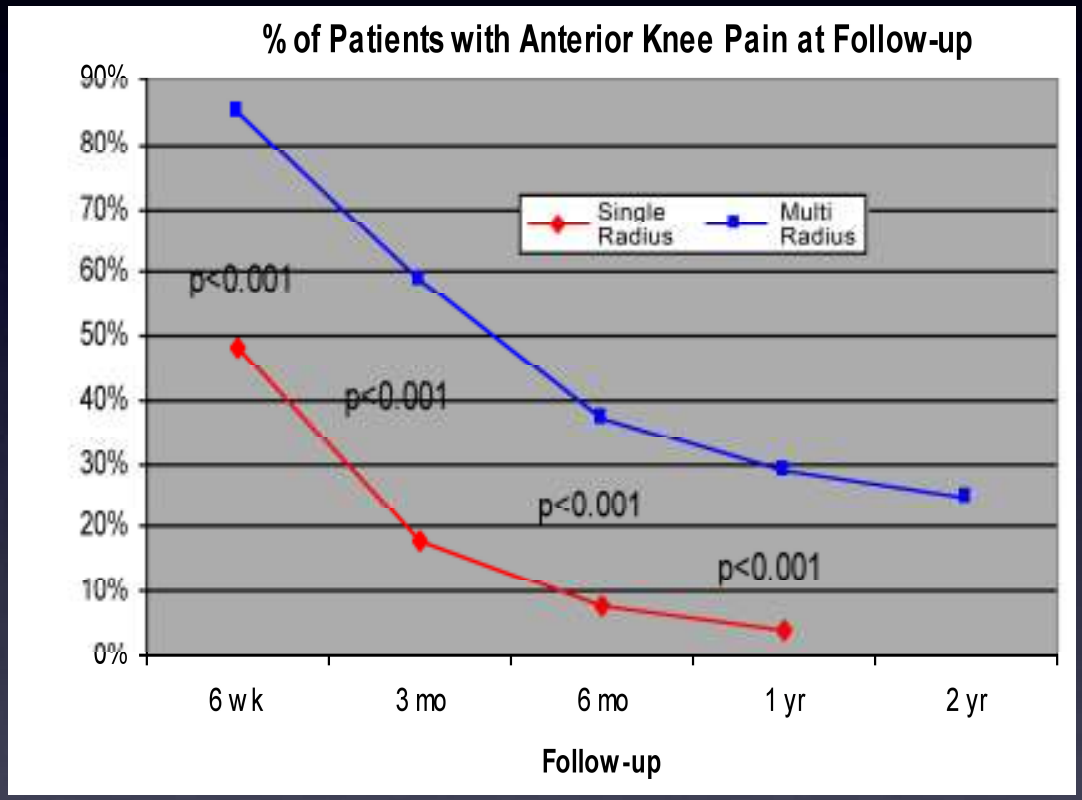
Patient benefits

- Functional stability, especially mid range flexion
- stairs, driving getting up from chair

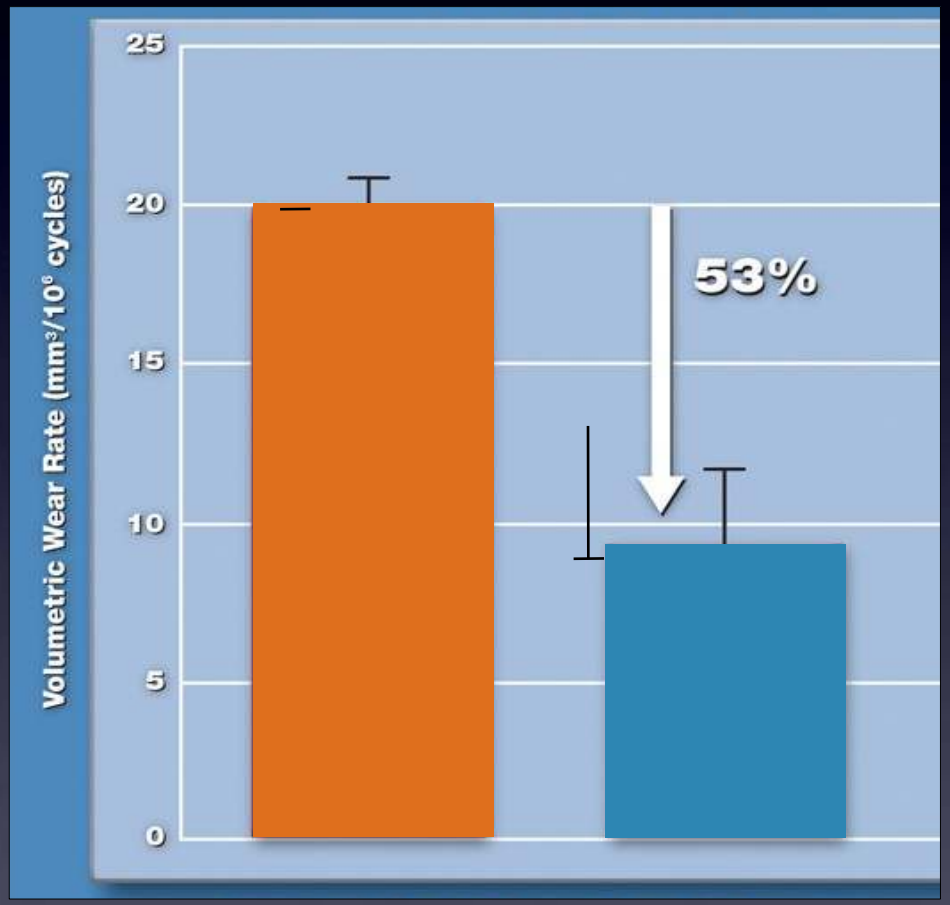
Patient benefits

- Earlier rehab
- Less anterior knee pain
- Enhanced muscular function
- Less fatigue


% Able to Arise from 16" Chair without using Hands
% Able to Arise
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
p<0.001
p<0.001
p<0.001
p<0.001
Single Radius
Multi-Radius
6 wk
3 mo
6 mo
1 yr
Follow-up


% of Patients with Anterior Knee Pain at Follow-up
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Single Radius
Multi Radius
p<0.001
p<0.001
p<0.001
p<0.001
6 wk
3 mo
6 mo
1 yr
2 yr
Follow-up

Effect of Single Radius – In the lab



Multi Radius

Single Radius

Issues Addressed by Single Radius

Instability

- Mid Flexion
- Balance
- Confidence

Anterior Knee Pain

Muscle Function

- Strength
- Stamina

Range of Motion

Implant design

- Tibial component can be a fixed bearing or mobile bearing

Femoral Bearing Surface

- Cobalt Chrome (+/- LFIT)
- Ceramic
- Ceramic Type Material (Oxinium)

Tibial bearing surface

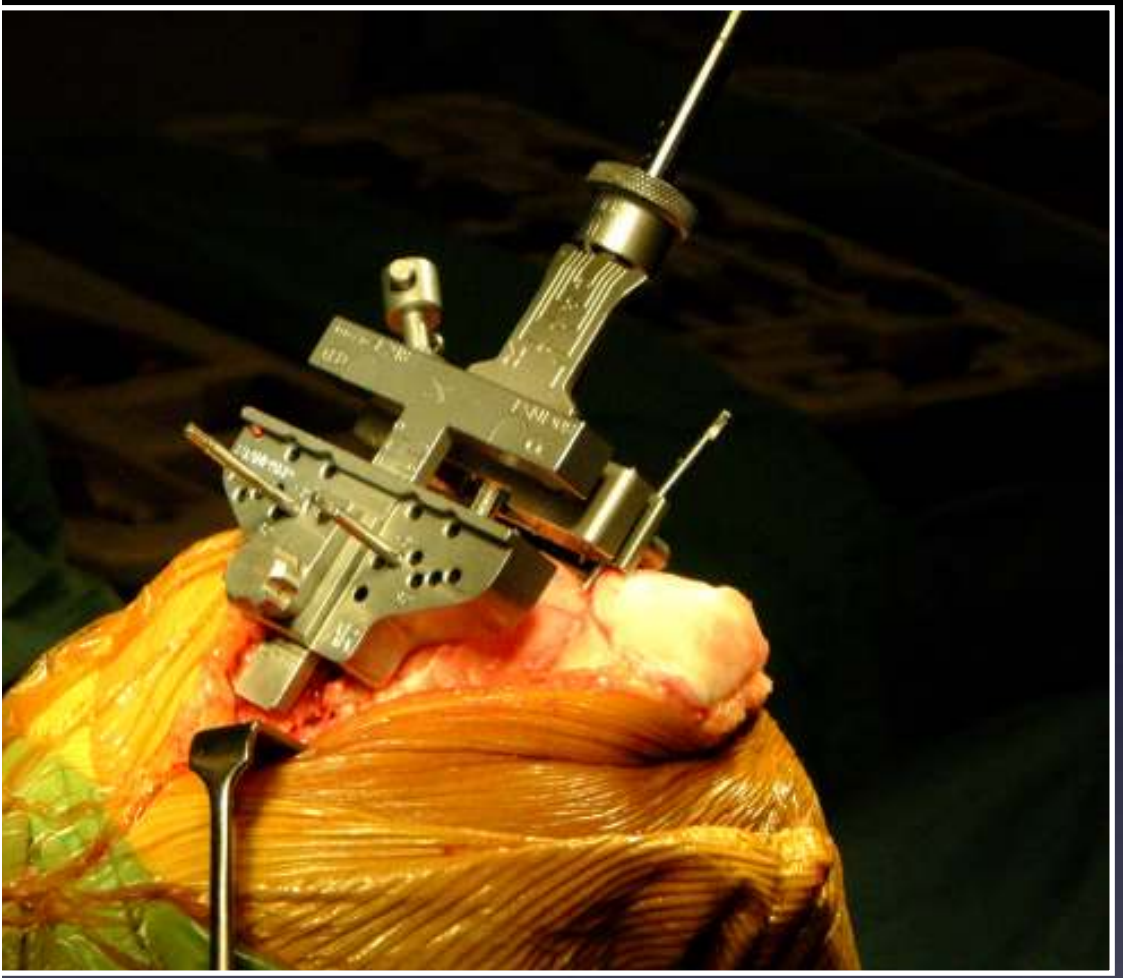
- Polyethylene (Oxidation)
- Techniques developed in order to reduce degredation
- Crosslinked (X3, Longevity)
- Vitamin E

Trendy terms

- High flexion knees
- Gender specific (Zimmer)
- Gender friendly (Triathlon)

Surgical technique

- Conventional instrumentation
- Navigation
- Minimally invasive

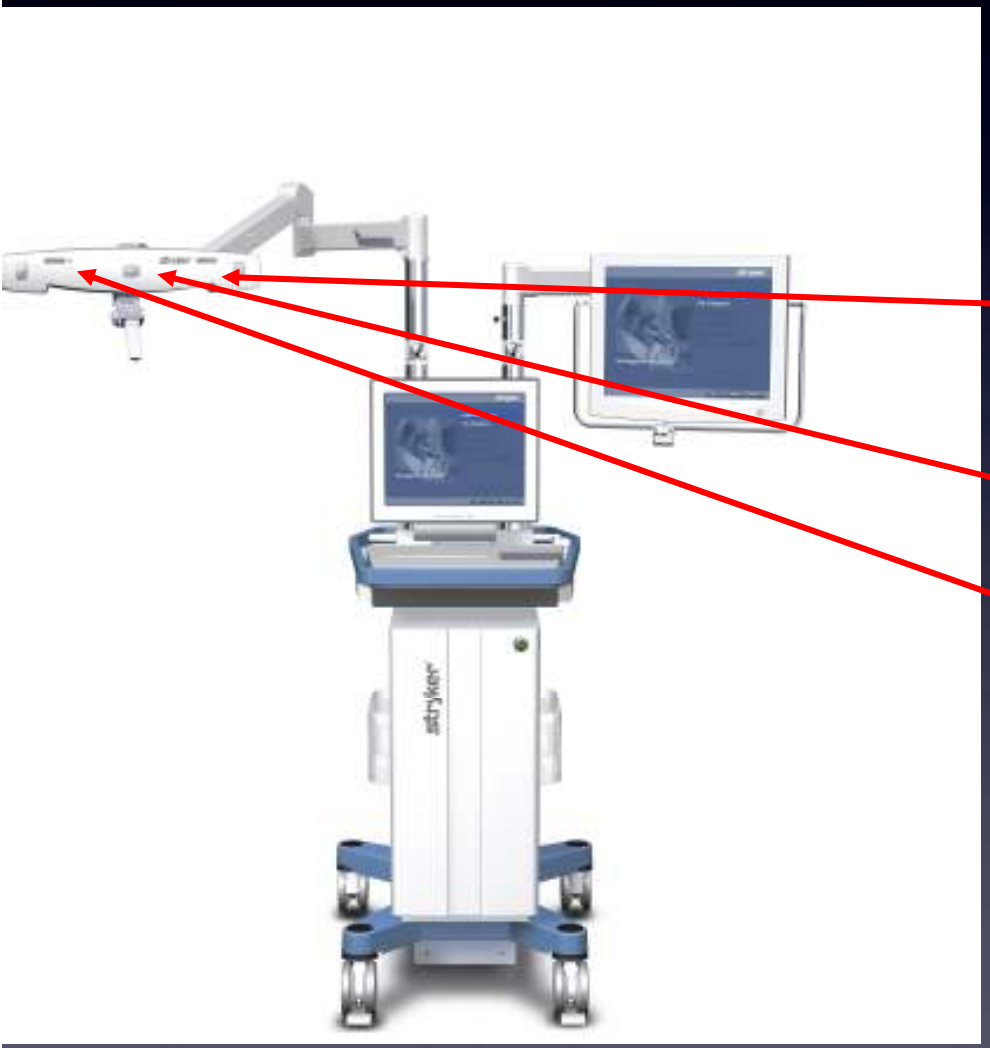


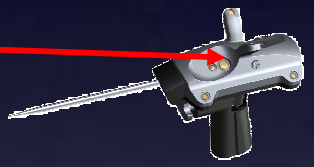
Conventional vs navigation

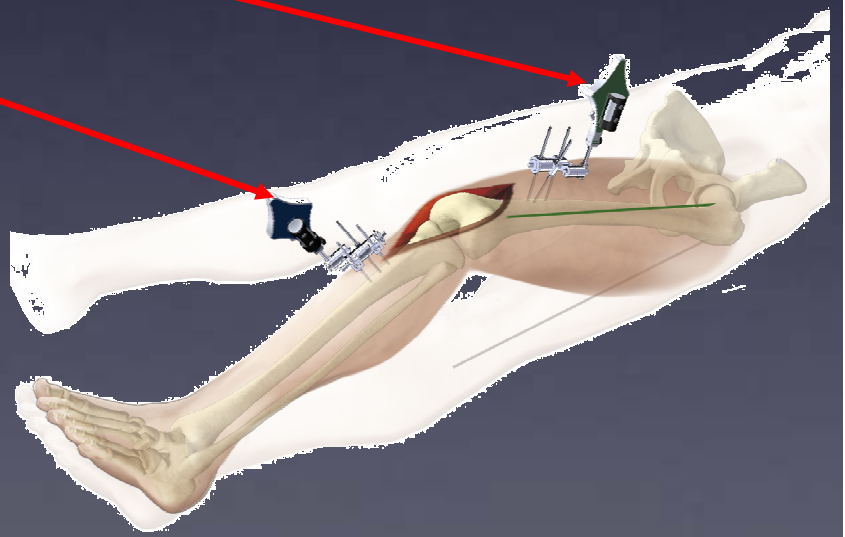
Navigation

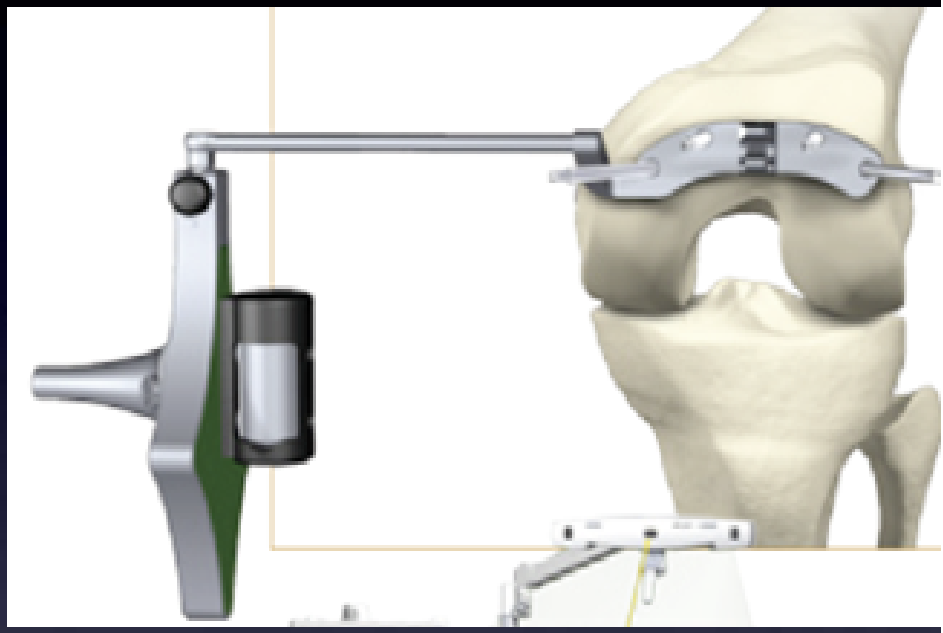
- You need this
- and cash

Navigation System Overview

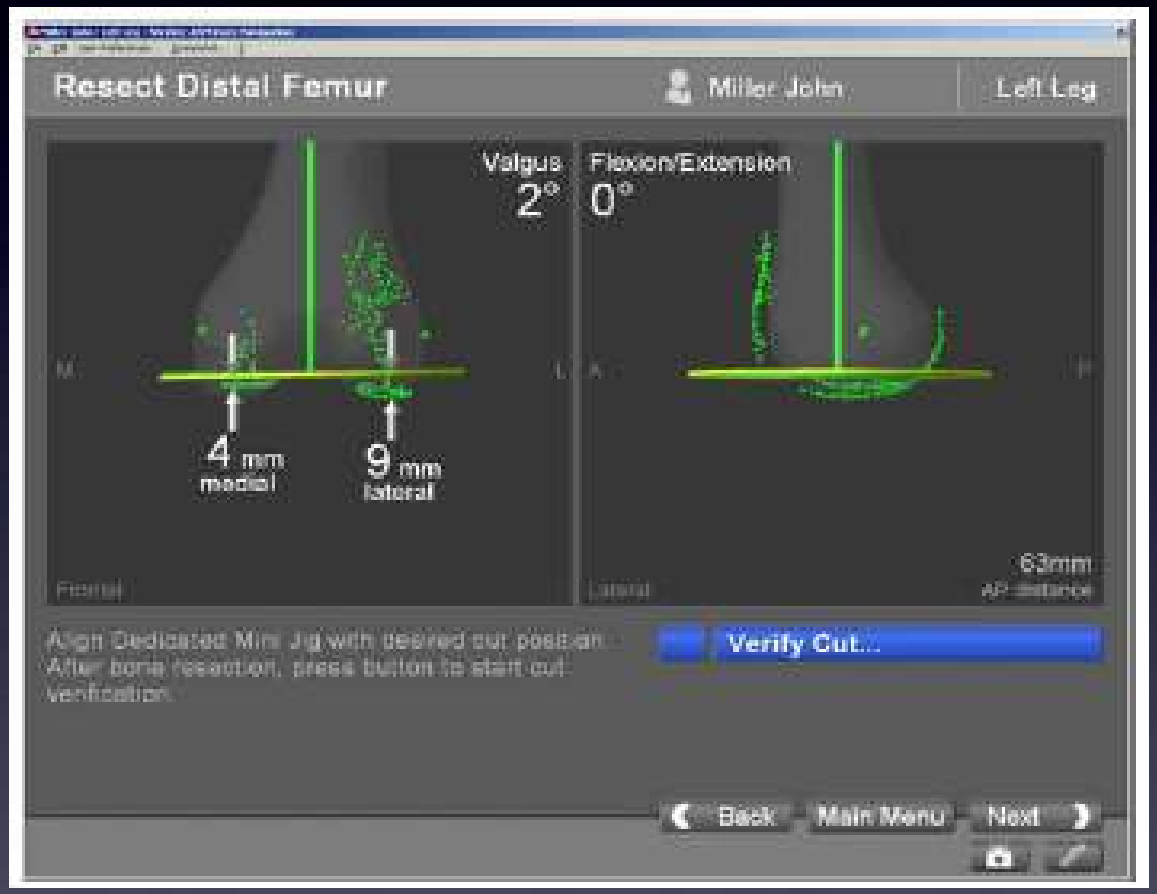


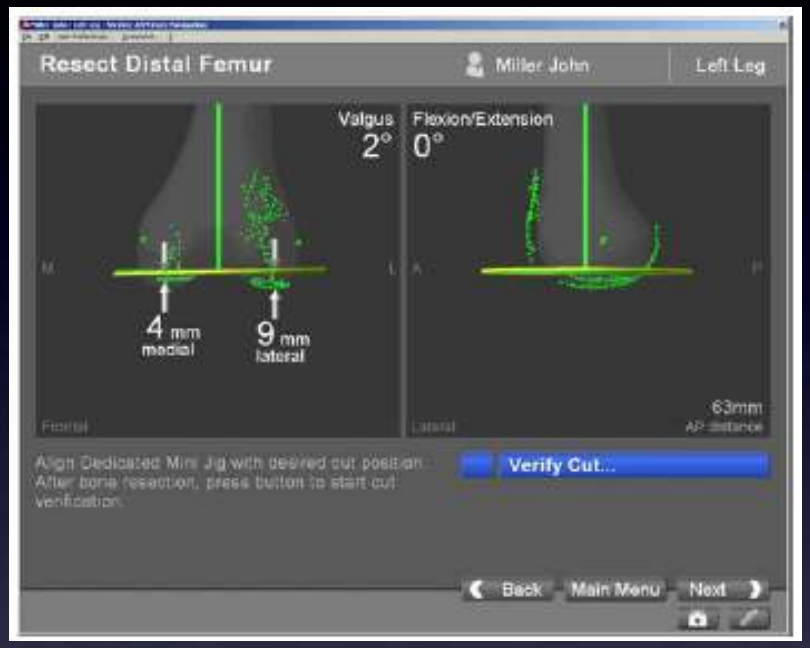






ASM Navigaton


Resect Distal Femur
Miller John
Left Leg
Valgus
2°
Flexion/Extension
0°
4 mm
medial
9 mm
lateral
63mm
Align Dedicated Mini Jig with desired cut position.
After bone resection, press button to start cut
verification.
Verify Cut...
Back
Main Menu
Next


Resect Distal Femur
Miller John
Left Leg
Valgus
2°
Flexion/Extension
0°
4 mm
medial
9 mm
lateral
63mm
Align Dedicated Mini Jig with desired cut position
After bone resection, press button to start cut
verification
Verify Cut...
Back
Main Menu
Next

Advantages of Navigation

- Better soft tissue balancing
- Quicker rehab
- Less blood loss
- Training
- Obese patient

Advantages of Navigation

- Accurate placement of bone cuts
- Improved alignment
- Should translate to better survival
- Less risk of embolic phenomenon, ideal for bilateral TKRs at one sitting

Primary TKR

- Patient admitted
- Confirm surgery still desired/indicated
- Confirm no contraindications
- Side marked
- Instruments/prosthesis

Primary TKR

- Immediate preop checks
- Patient/site/surgery
- Antibiotic prophylaxis
- Position patient


stryker
Triathlon® X3™
Tibial Bearing Insert Cruciate Retaining
5530-G-619
Triathlon® X3
Tibial Bearing Insert - CR
13mm
CONSIGNMENT LEVEL 4
Triathlon®
Stryker

Instrumentation

Surgical technique

- Clean air theatre
- Adequate area for instrumentation

Surgical technique

- Surgery is carried out with the knee in flexion

Surgical technique

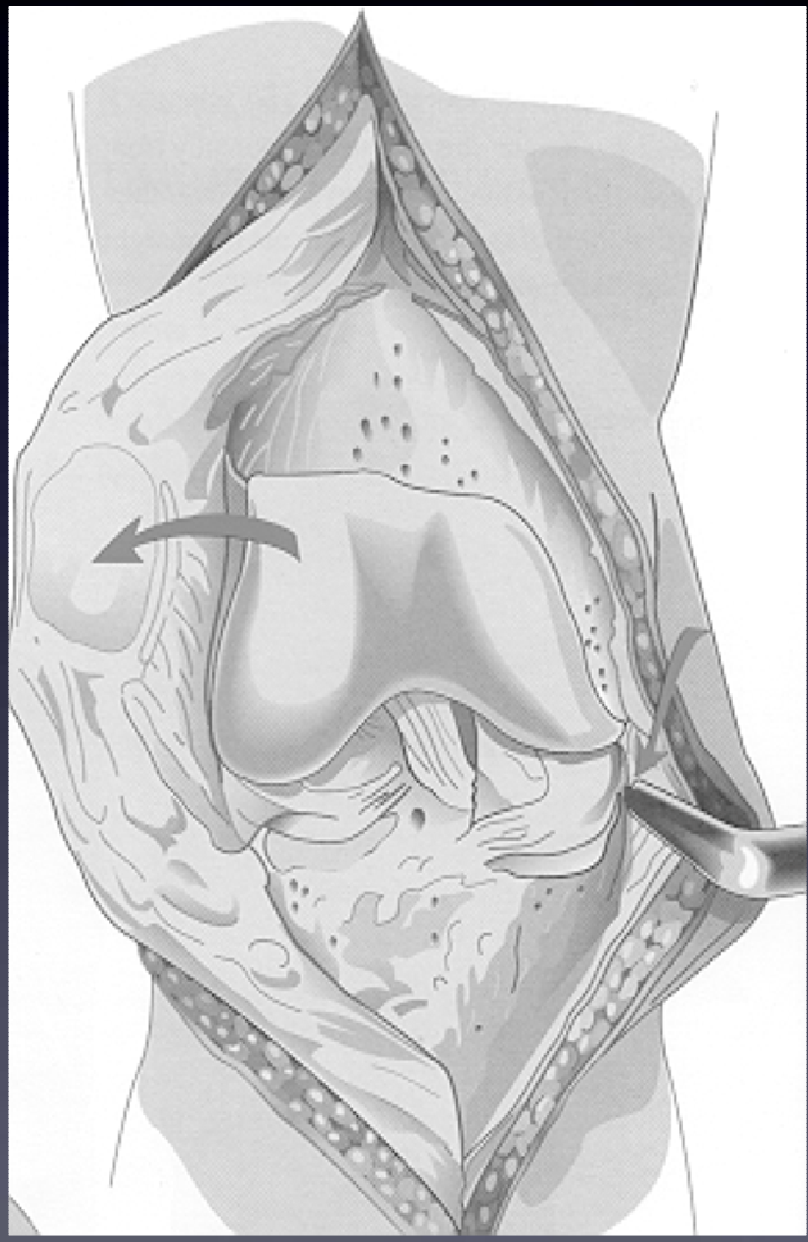
- Knee prepared with betadine and isolated

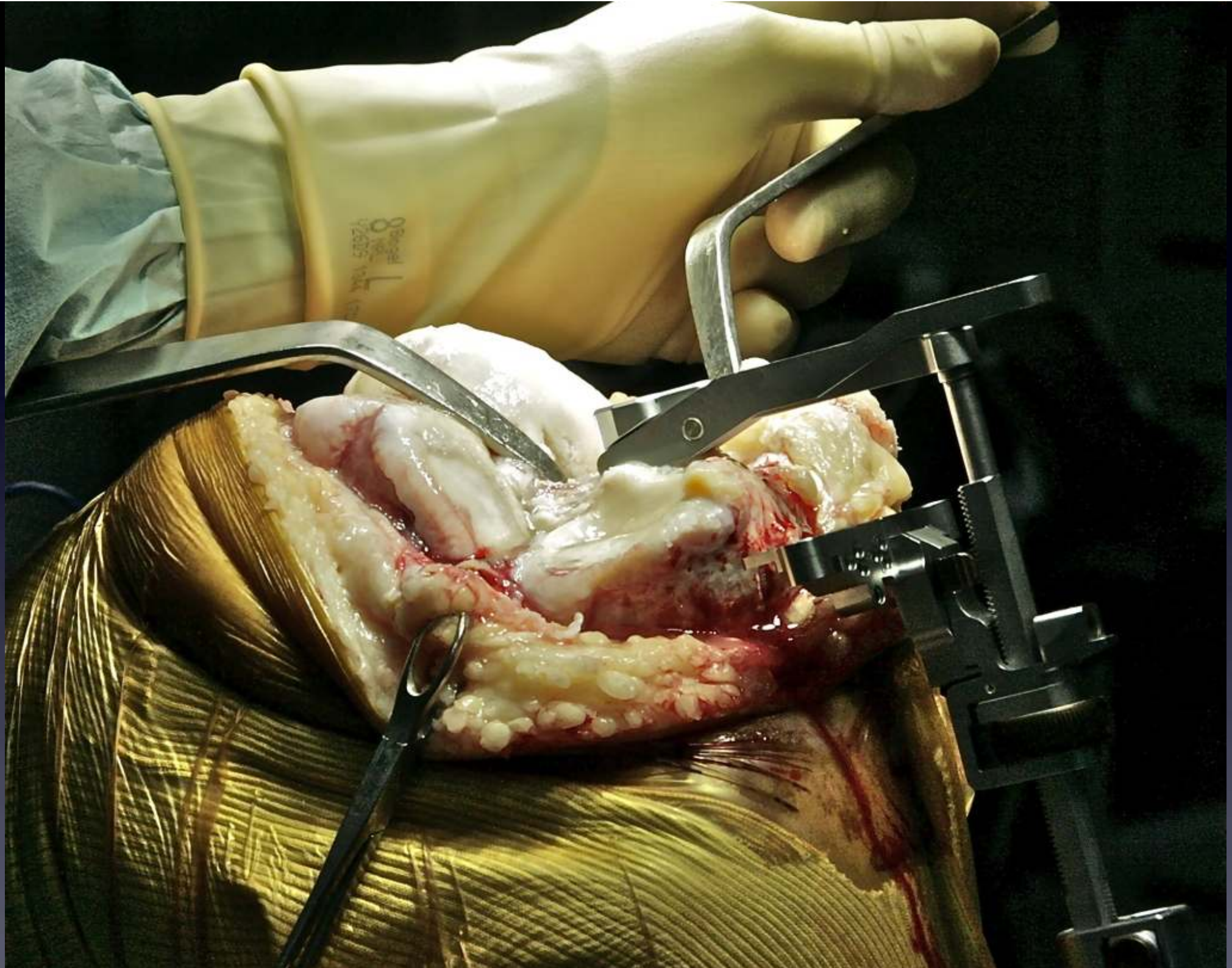
Surgical technique

- Midline incision
- Medial parapatella sweep

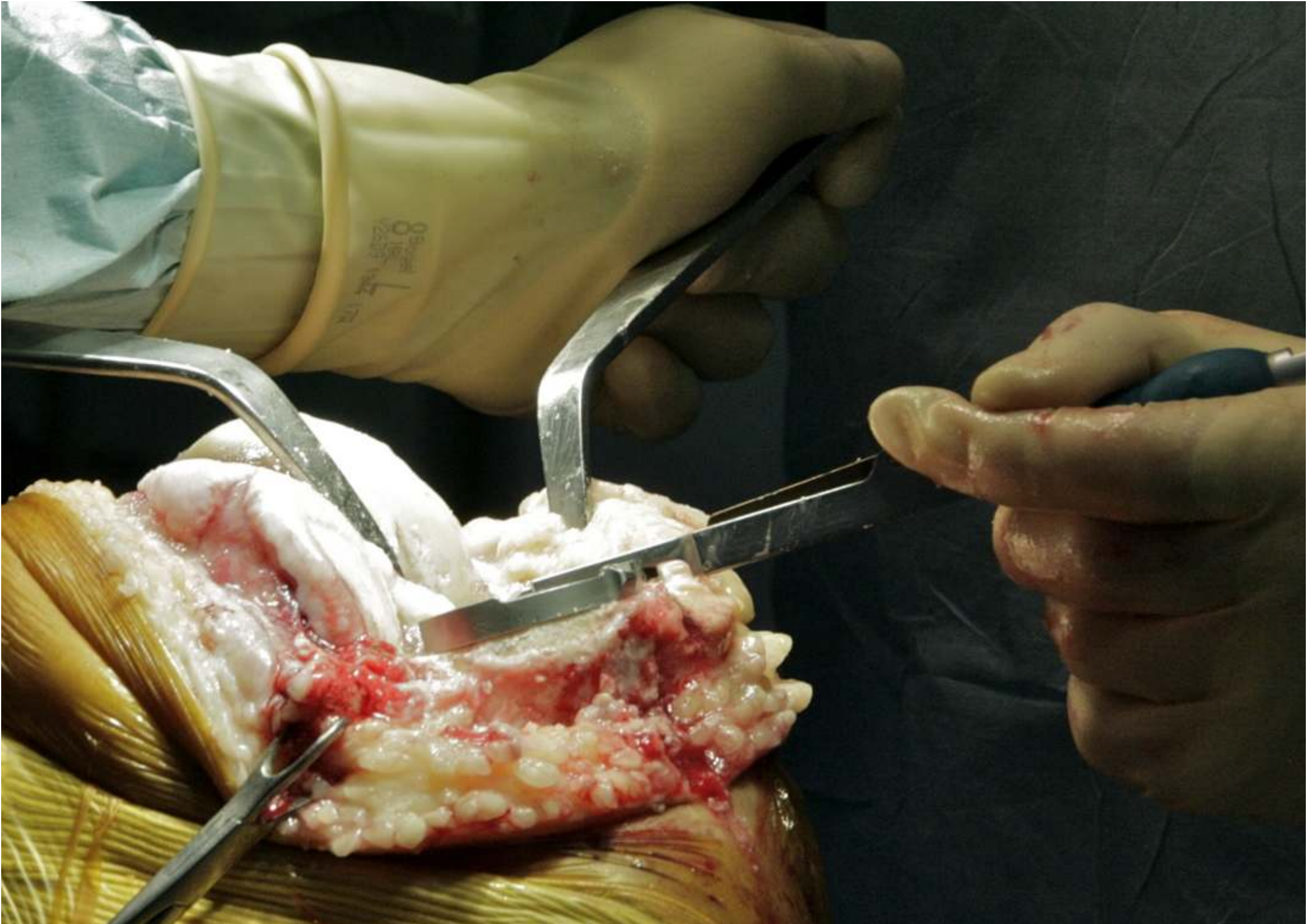
Surgical technique

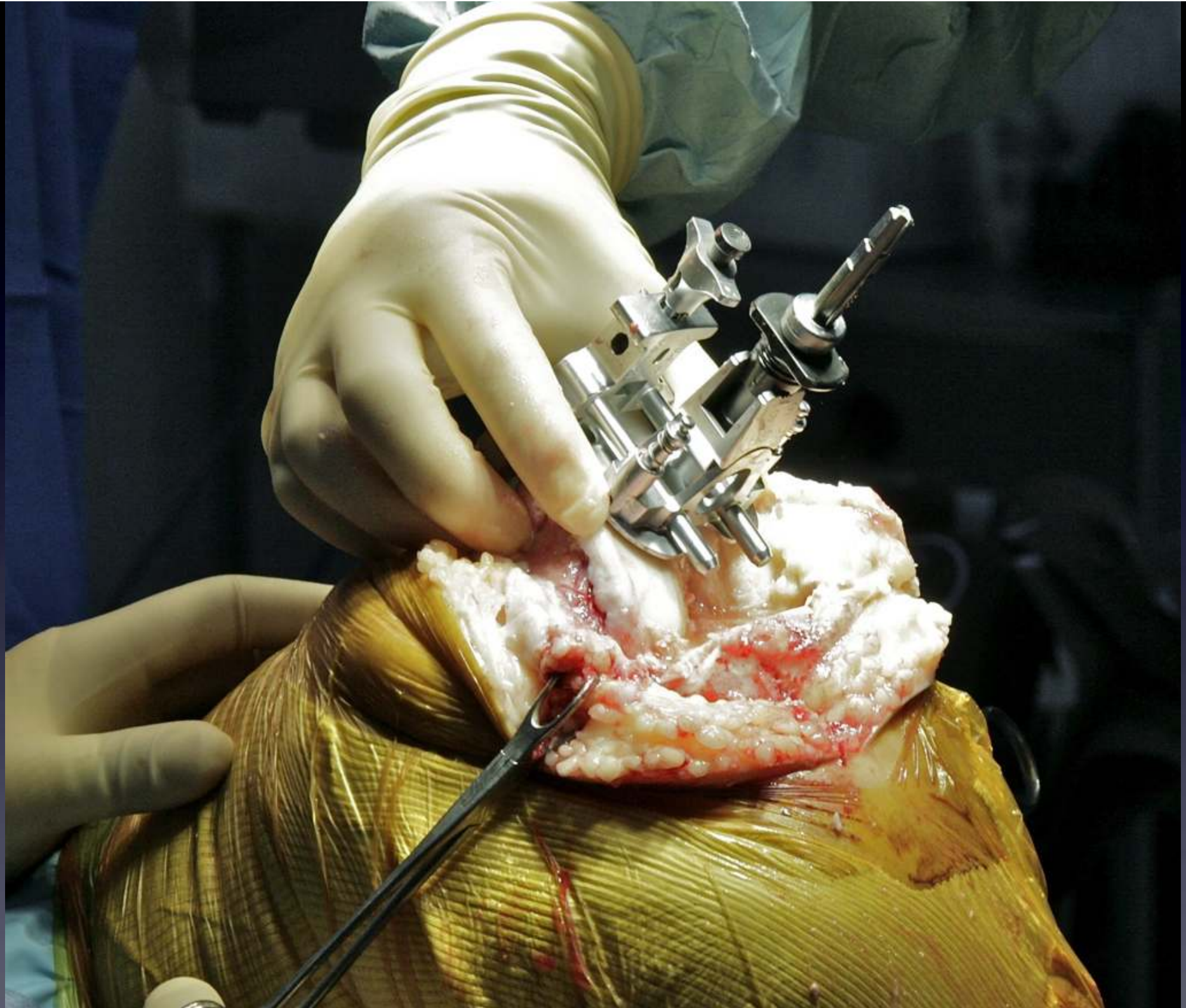
- Patella everted and knee dislocated

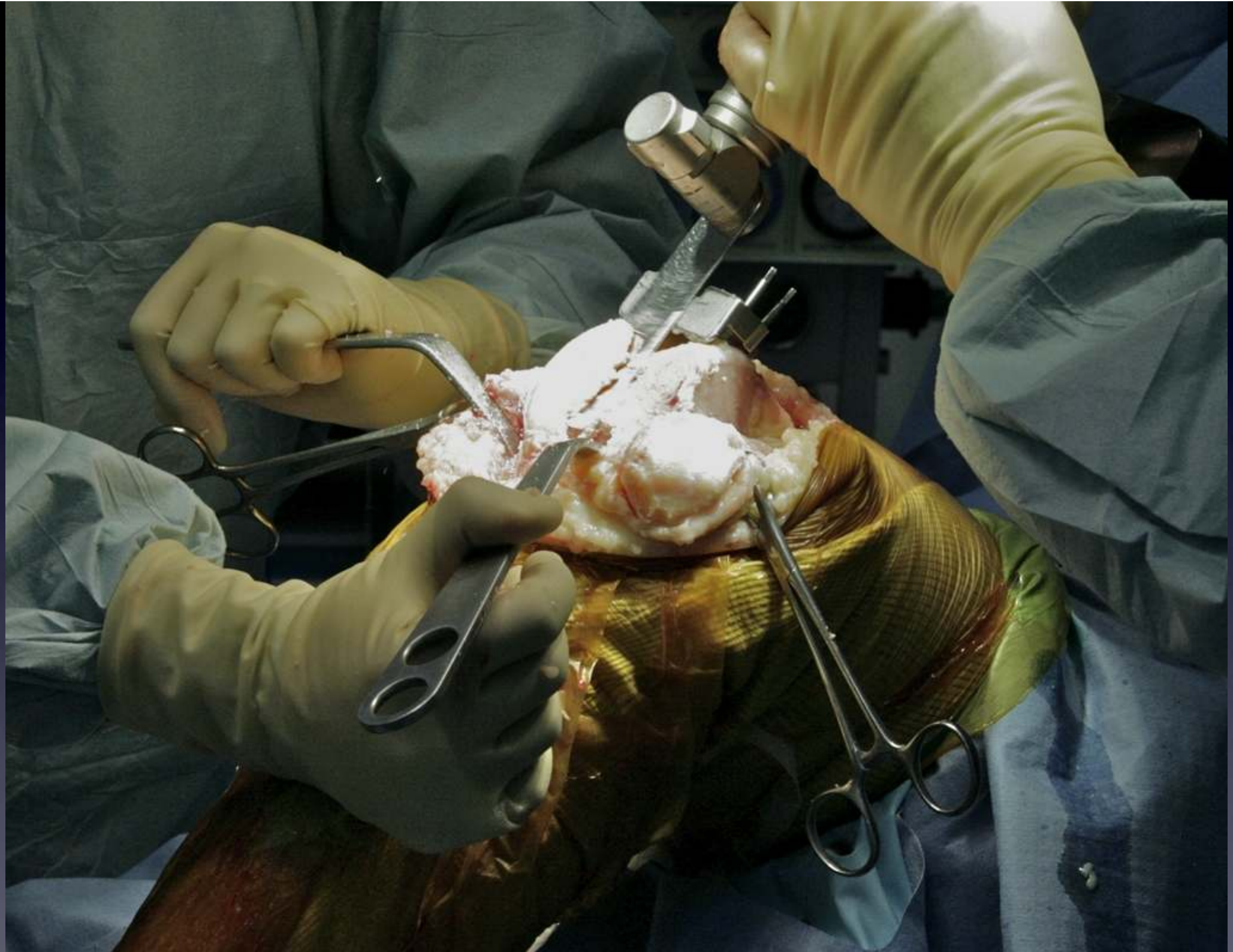


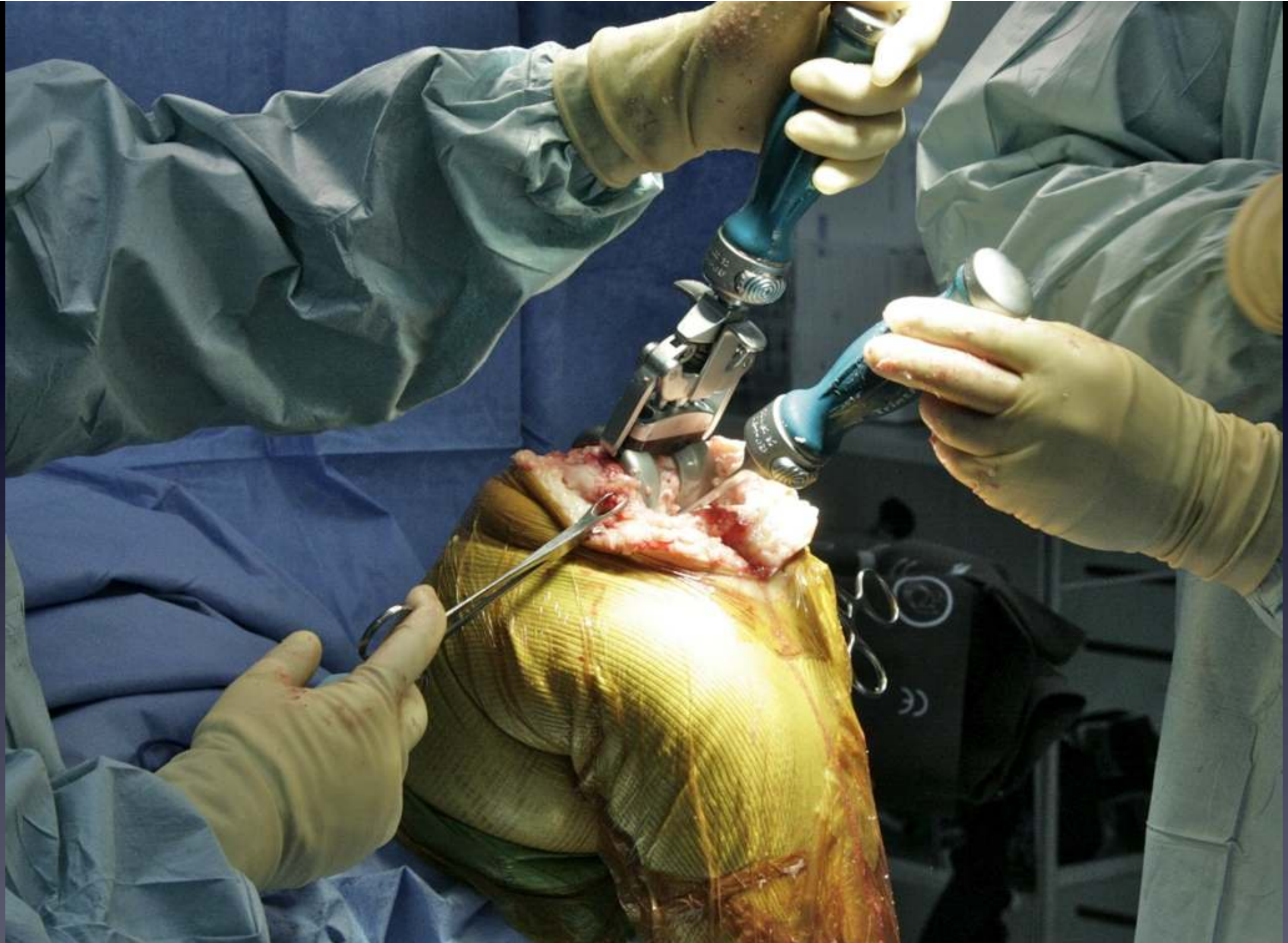


Medialise



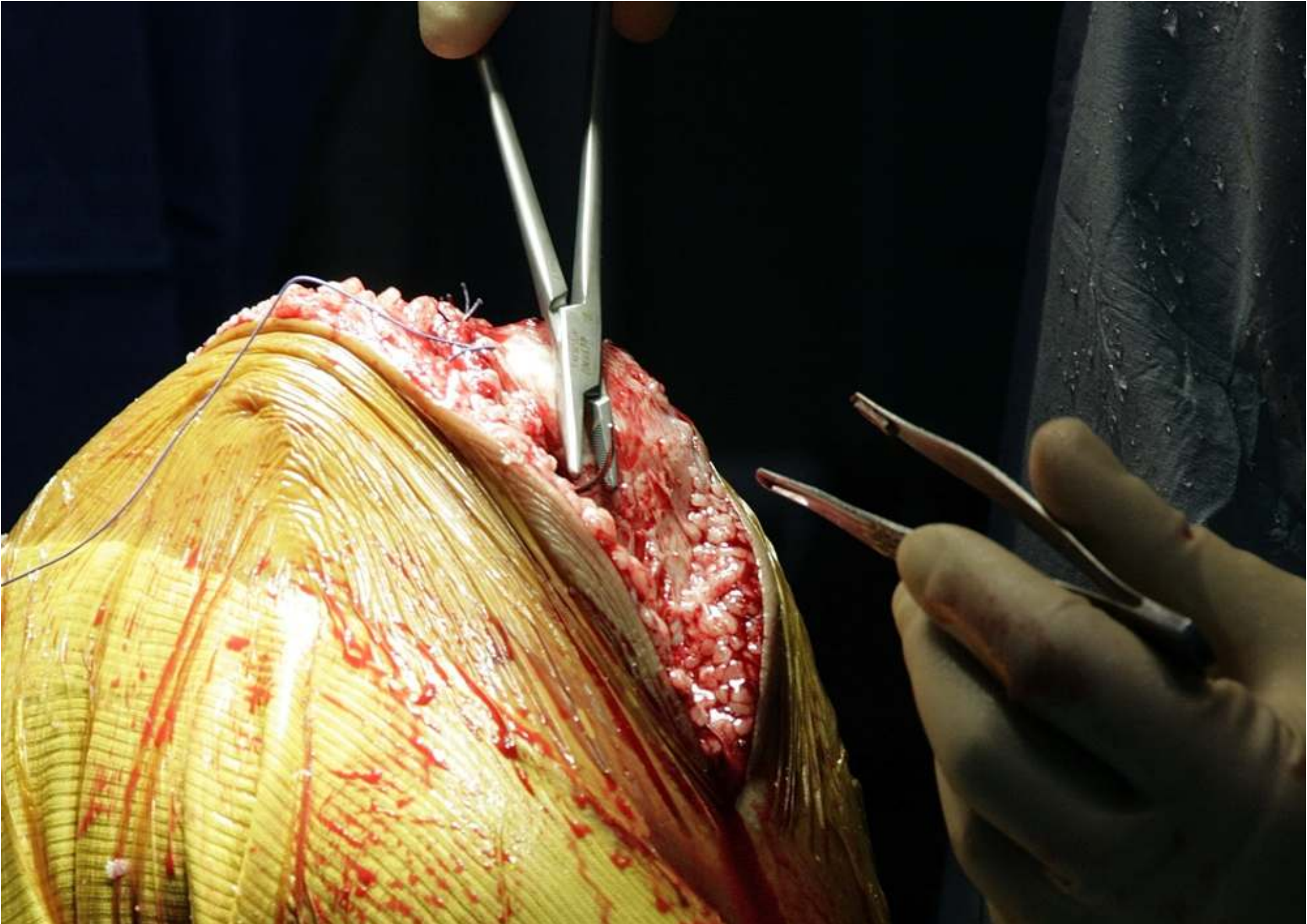






Total Knee Replacement

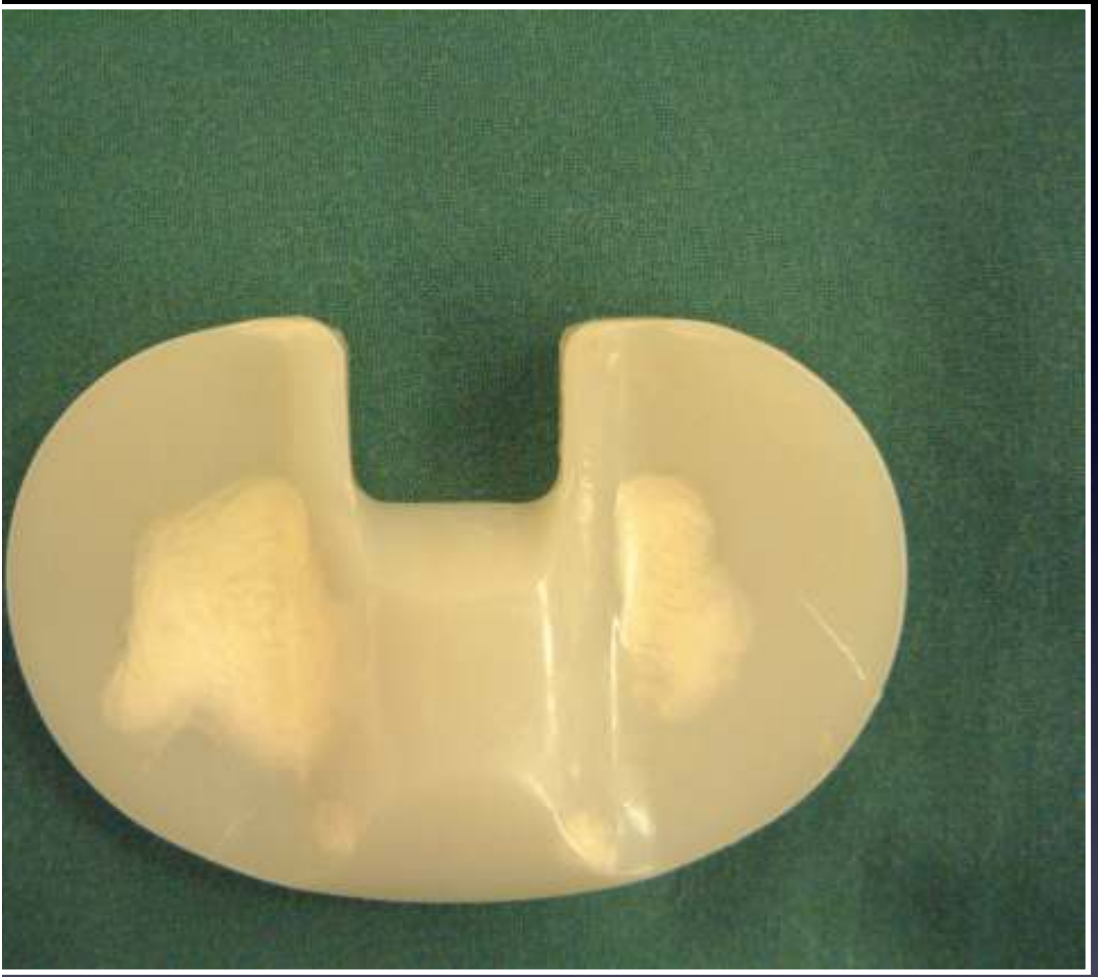
- Soft tissue balance



- Post op alignment

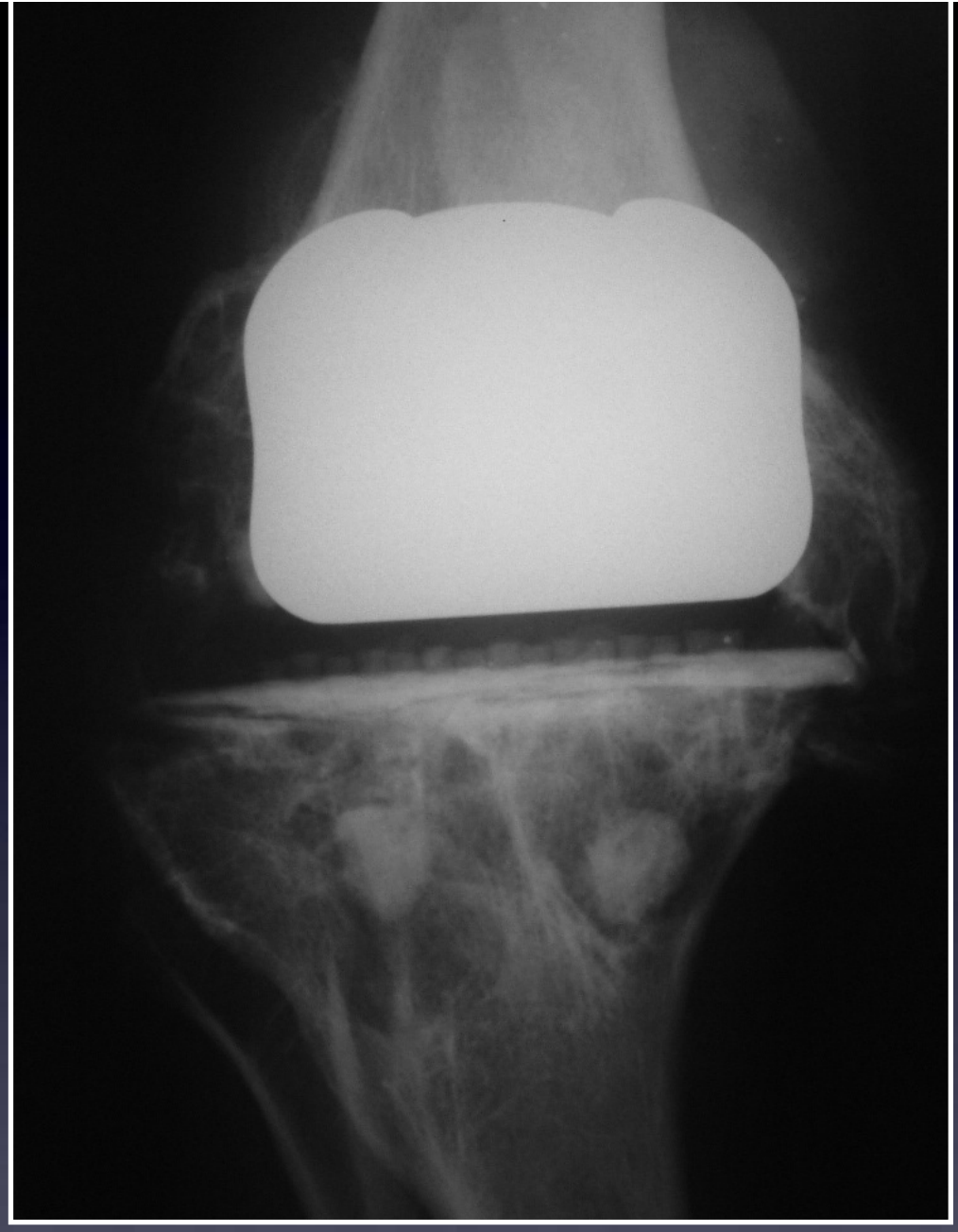
Consistency

Consistency

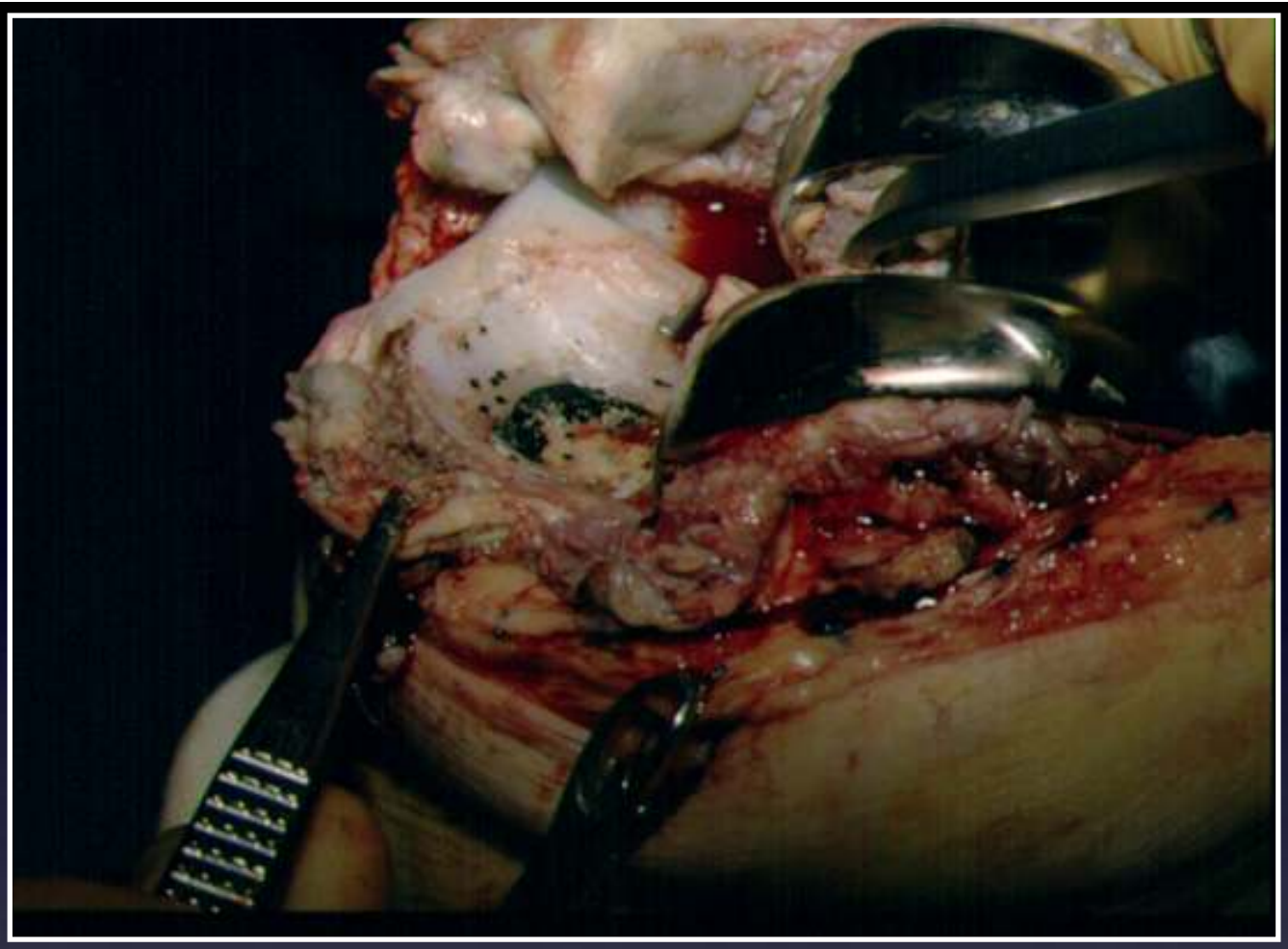


All implants wear

and Fail



Osteolysis



Polyethylene wear debris

Outcomes

What do we measure

- Comorbid conditions
- BMI
- WOMAC (Western Ontario and McMaster University)
- SF 36 (short form 36)

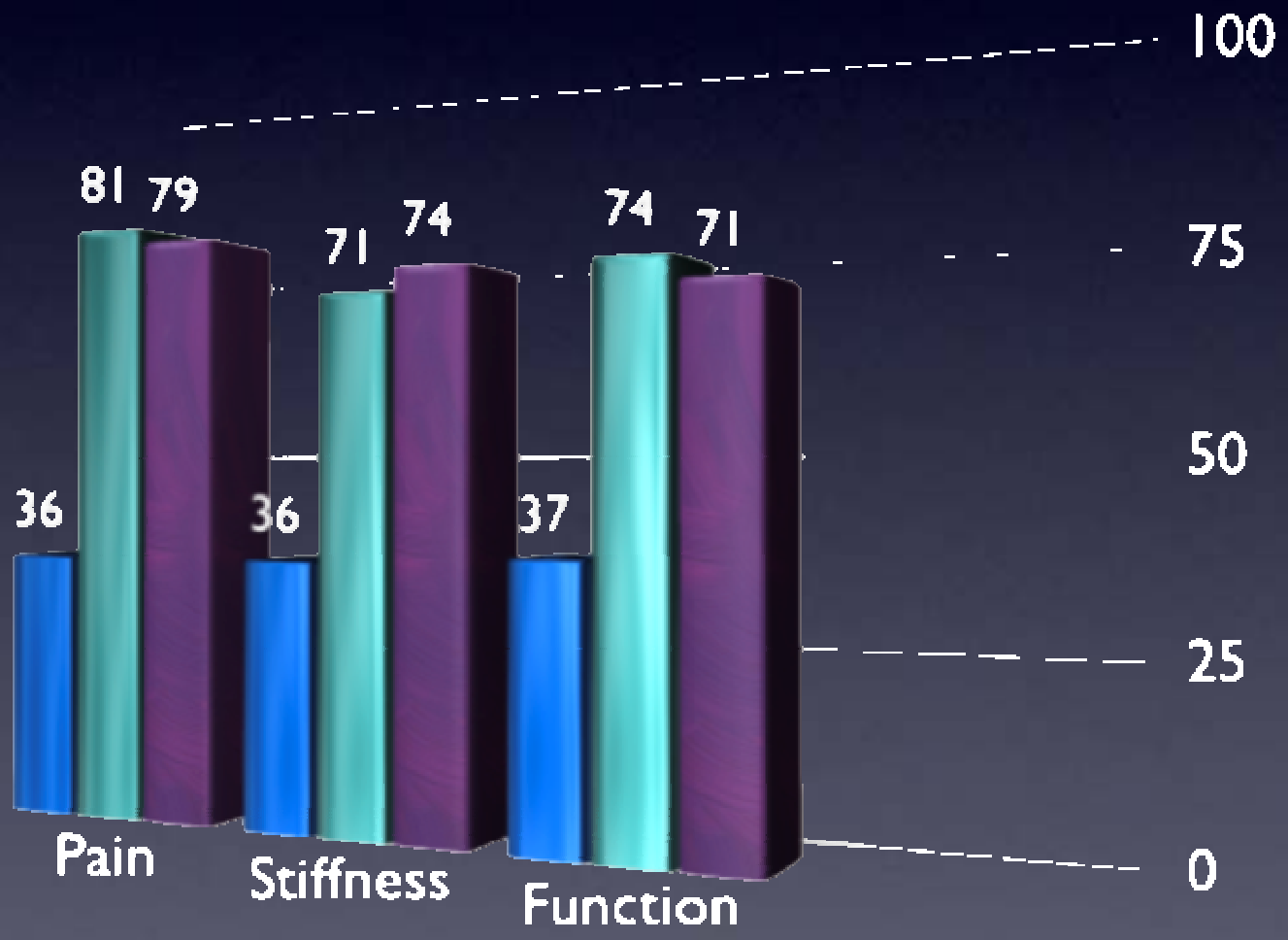
WOMAC

- Self administered (assessing pain, disability and joint stiffness)
- validated
- accurate
- responsive

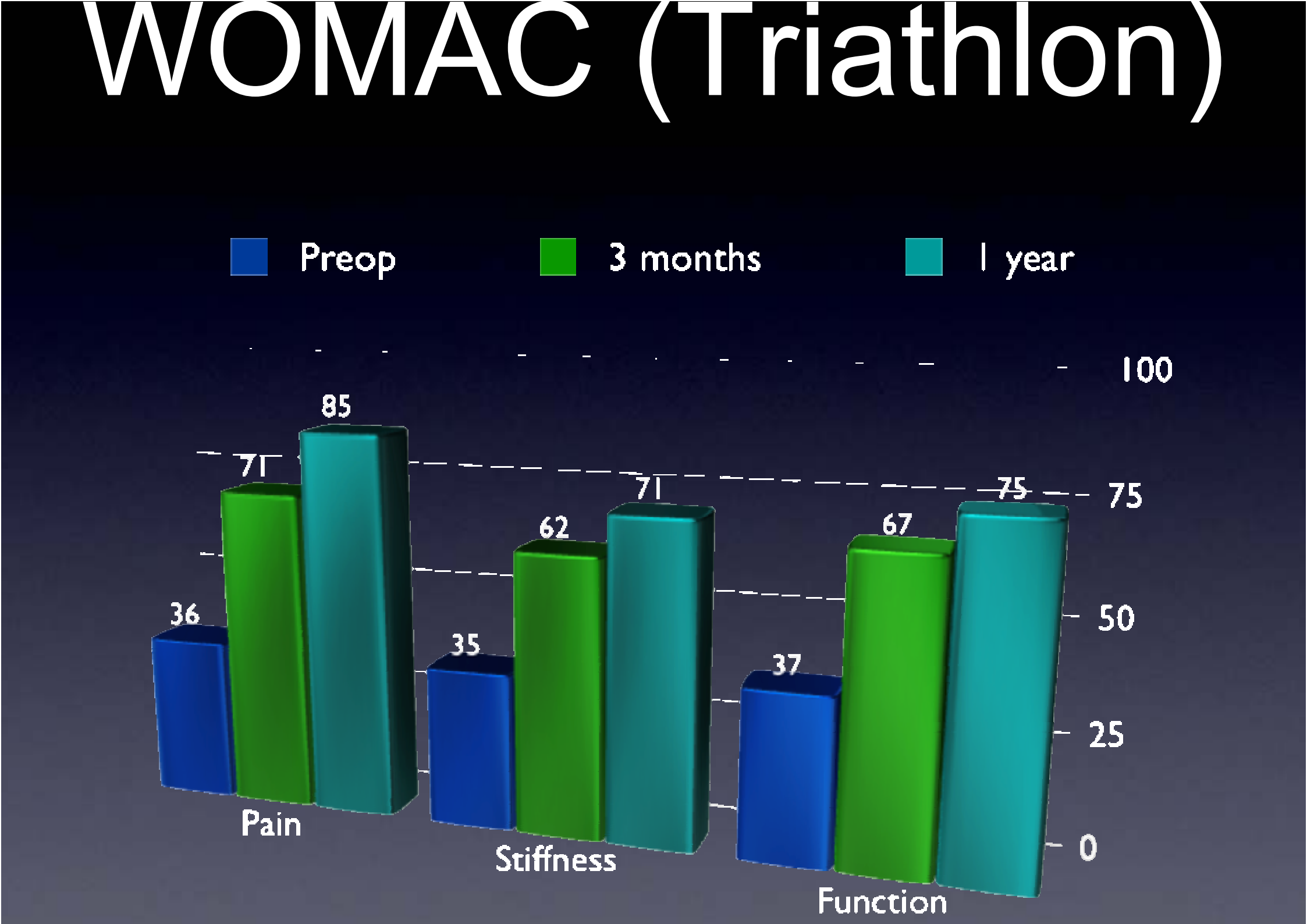
Comorbid conditions

- Hypertension 52%
- Back pain 50%
- Heart Disease 17%
- Lung disease 16%
- Depression 14%
- Upper GI 13%

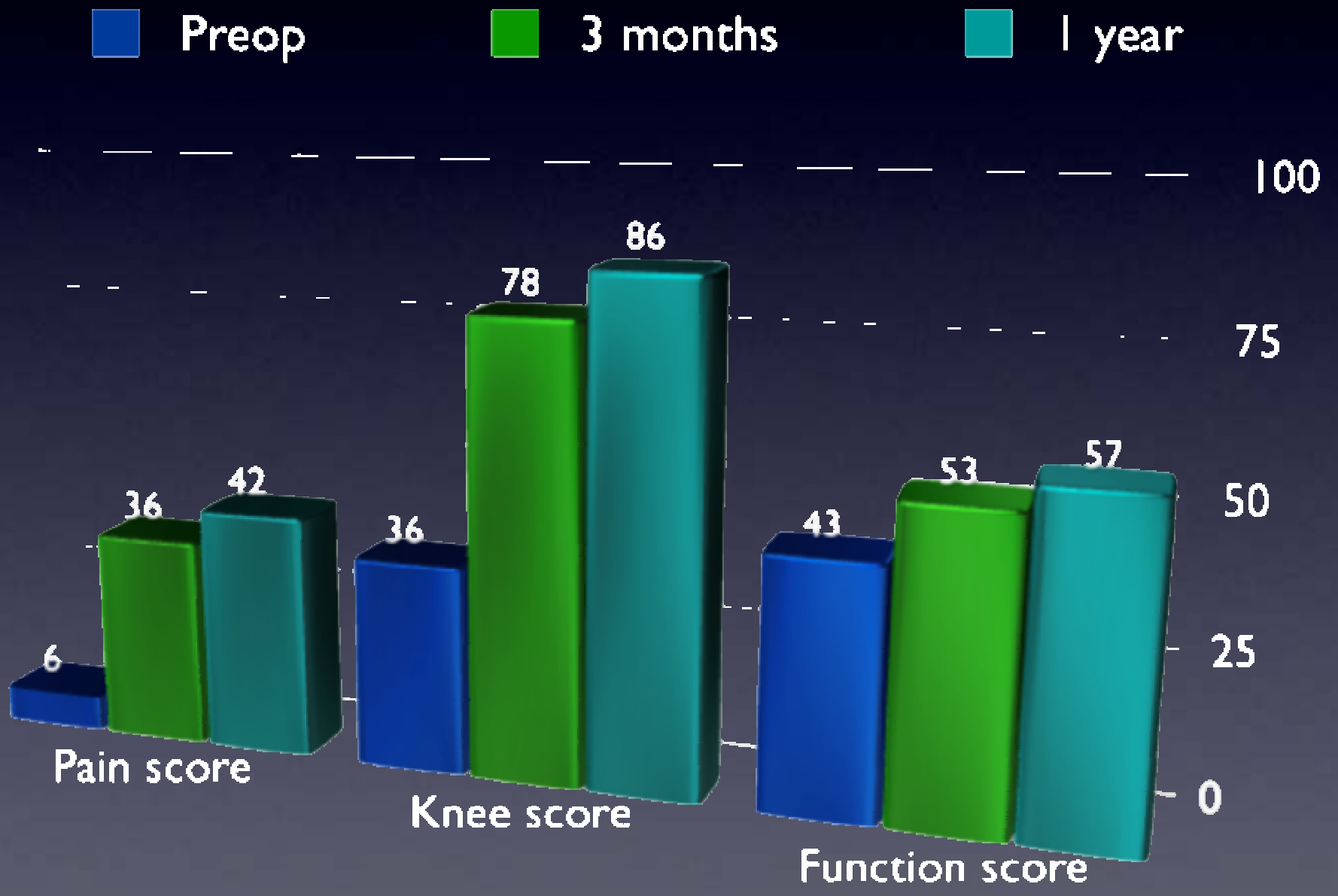
WOMAC (TKR)



WOMAC (Triathlon)

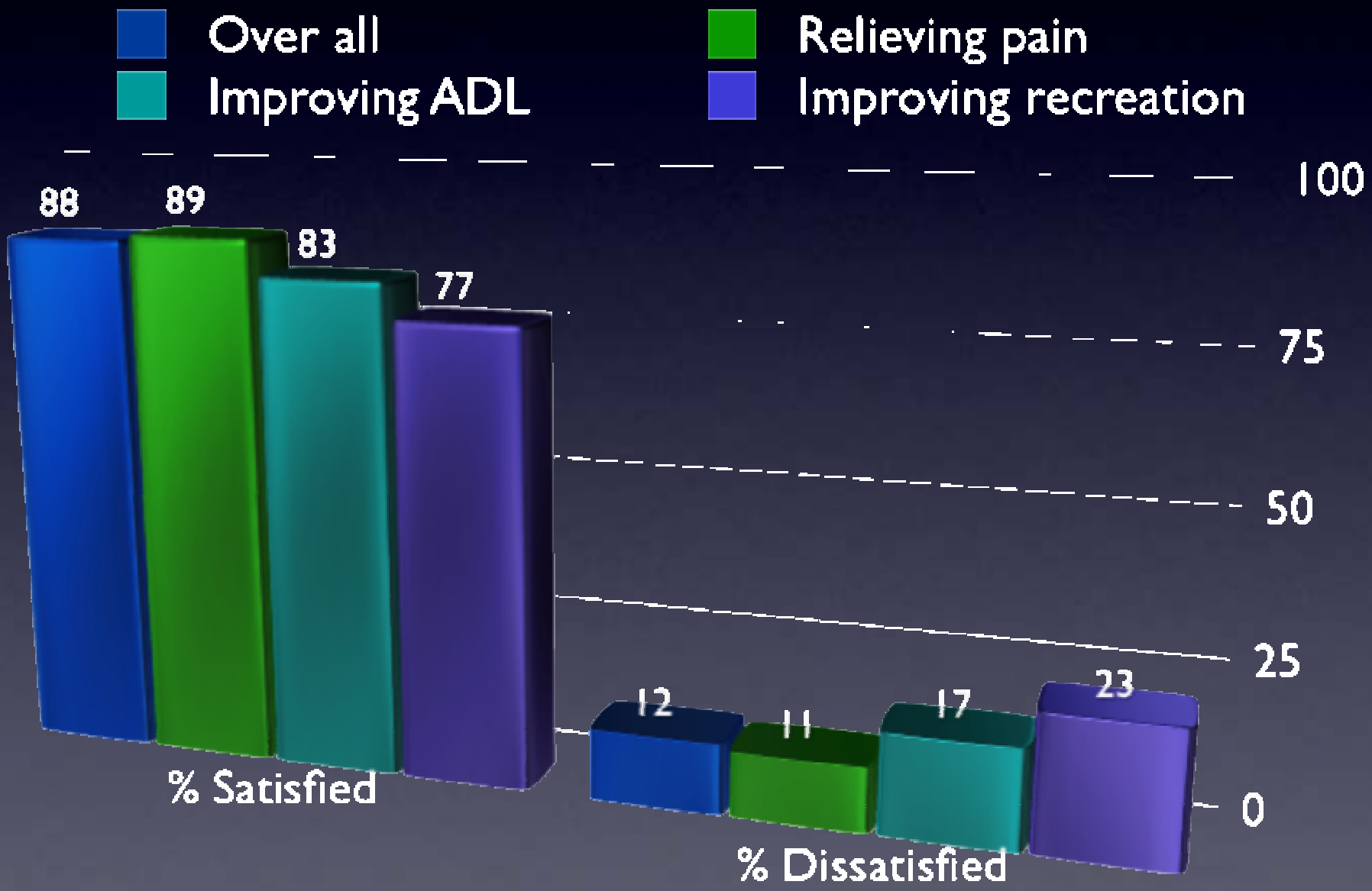


Knee Society Score (Triathlon)



SF 36

Satisfaction (TKR)



Total Knee Replacement

- Right operation for right patient at the right time
- Assess the clinical needs of the patient, the level of pain and functional disability.
- Hilton’s law; hip pain can be referred to knee joint and vice versa
- Correct diagnosis

Total Knee Replacement

- Relieve pain
- Improve quality of life
- Provide motion & stability
- Correct deformity

Total Knee Replacement

- Established treatment for knee arthritis
- Complex and highly demanding procedure for the surgeon, patient and for those looking after the patient in the perioperative period.

Total Knee Replacement

- Soft tissue operation

Thank you for your attention