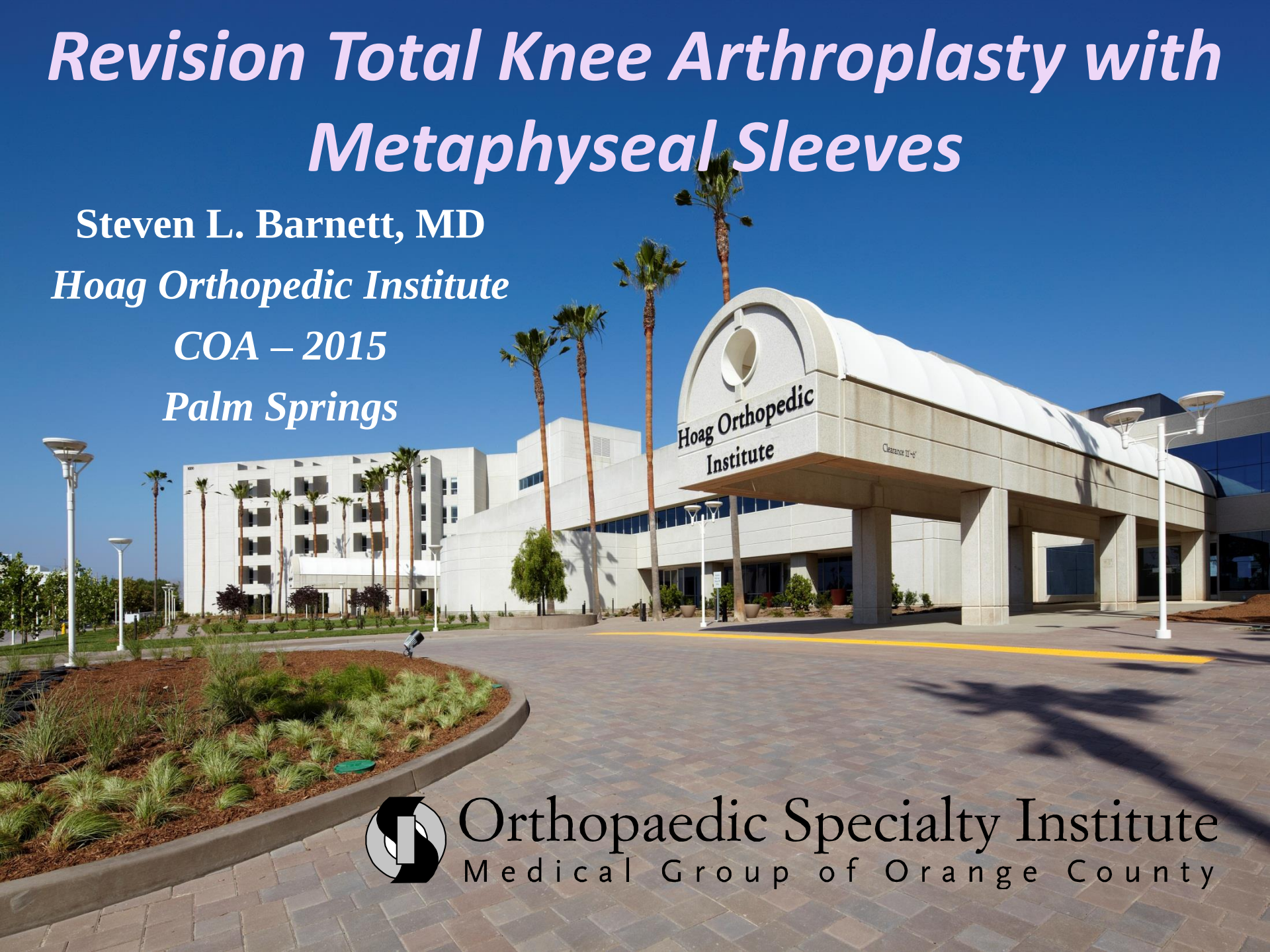
Revision Total Knee Arthroplasty with Metaphyseal Sleeves

Steven L. Barnett, MD

Hoag Orthopedic Institute

COA – 2015

Palm Springs



Orthopaedic Specialty Institute
Medical Group of Orange County

Disclosure

- **Consultant: DePuy, Zimmer**
- **Research Support: DePuy, Zimmer**

DISCUSSION OBJECTIVES

- ***TKA FAILURE MECHANISMS, SURGICAL PLANNING, AND METAPHYSEAL SLEEVE DESIGN***
- ***TECHINQUE***
- ***PUBLISHED RESULTS***

Why do TKA's Fail?

Contents lists available at ScienceDirect

The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org

Why are Total Knee Arthroplasties Being Revised?

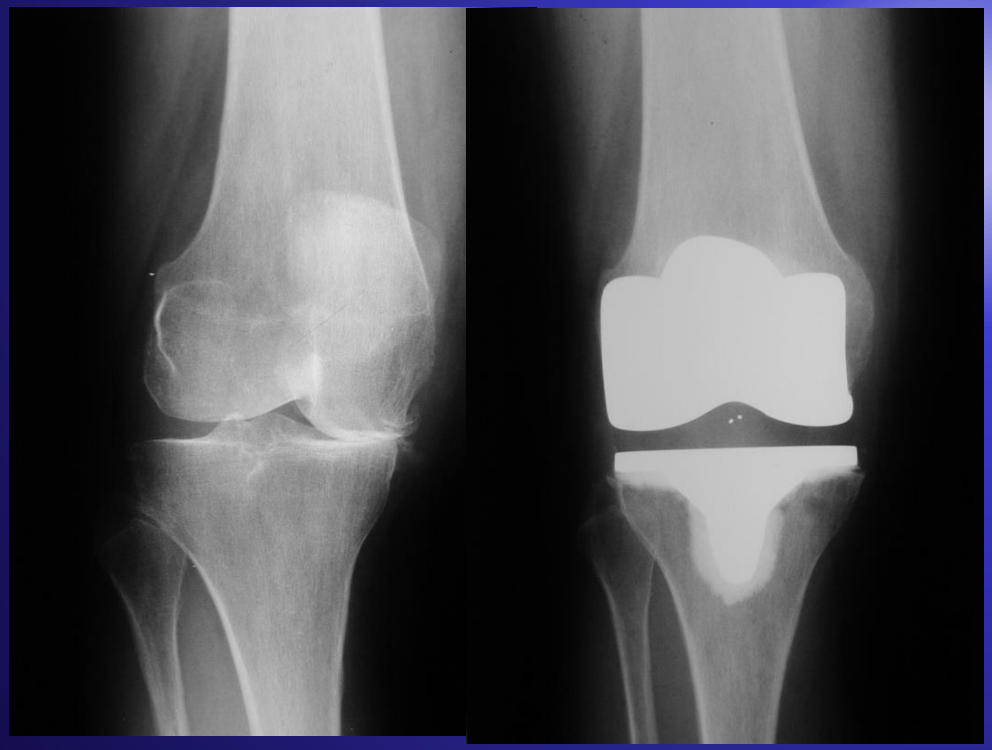
David F. Dalury, MD [a], Donald L. Pomeroy, MD [b], Robert S. Gorab, MD [c], Mary Jo Adams, BSN [a]

820 Revision TKA's

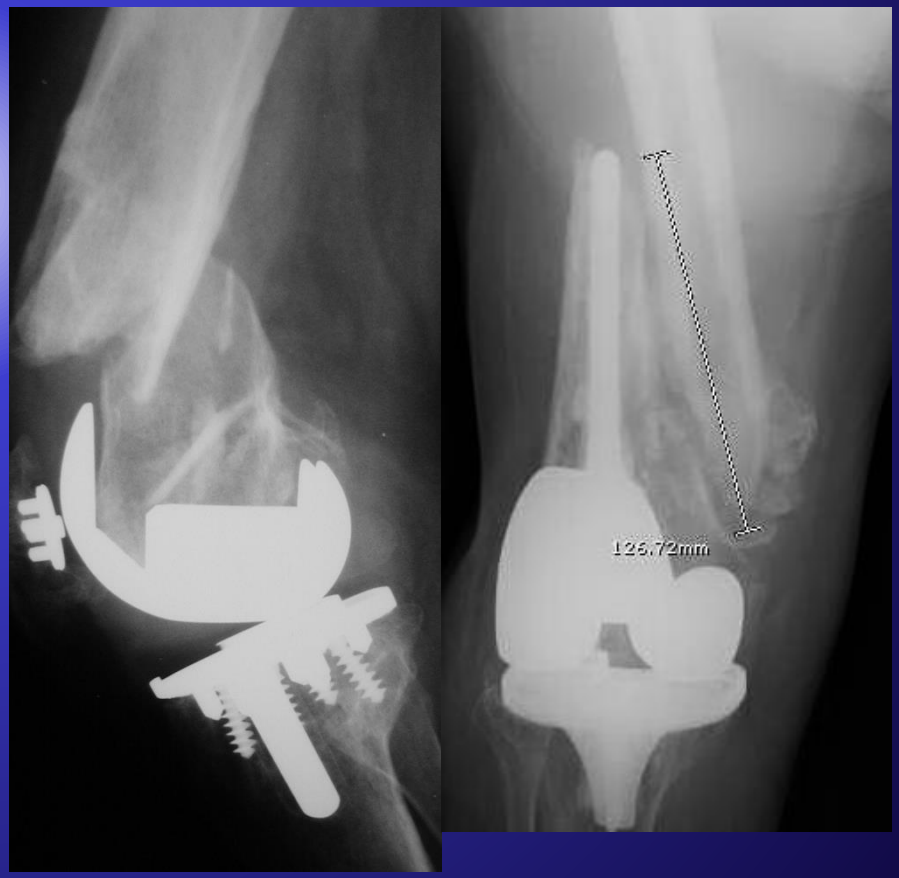
J. Arthroplasty, 9/2013

- **Instability (26%)**
  - Up to 70% in some series
- **Mechanical Wear (22%)**
- **Loosening (23%)**
- **Infection (18%)**
- **Malposition (3%)**

Good Day



Bad Day

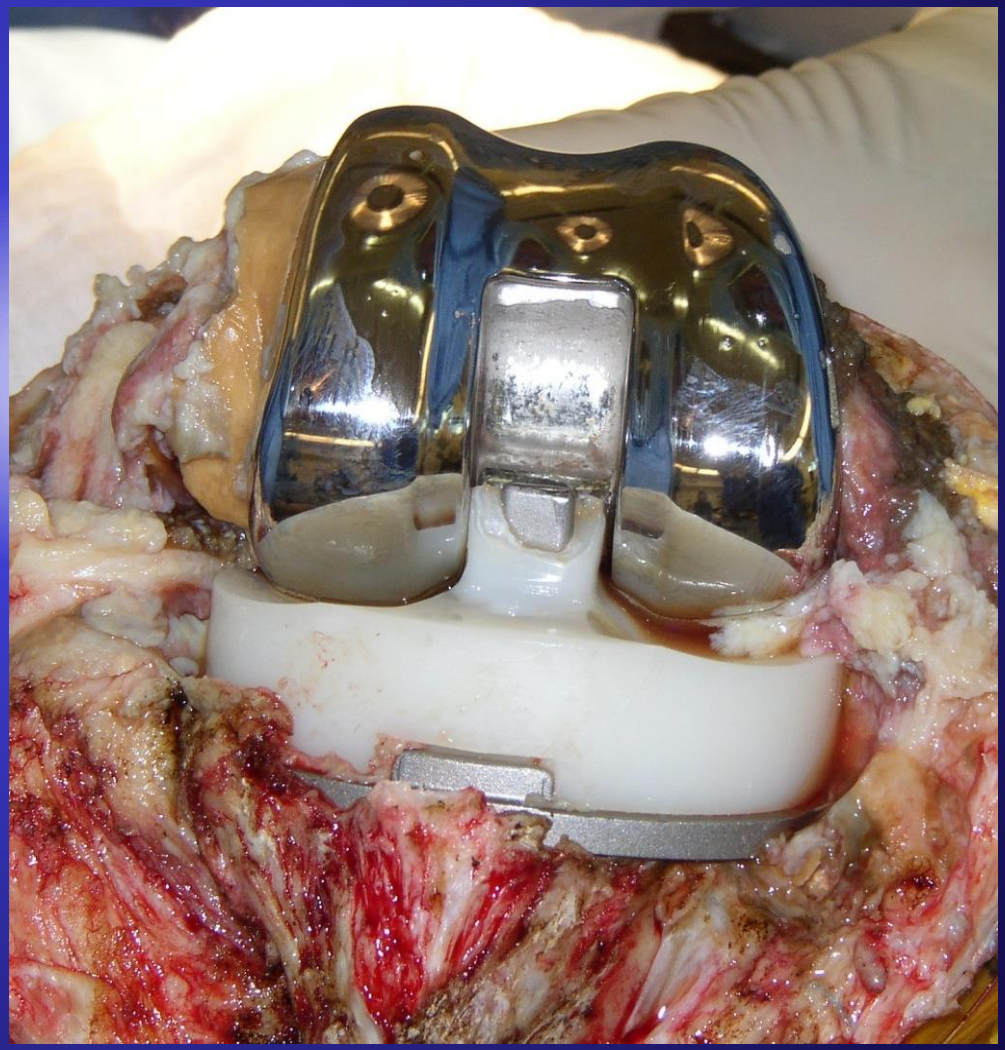


INSTABILITY

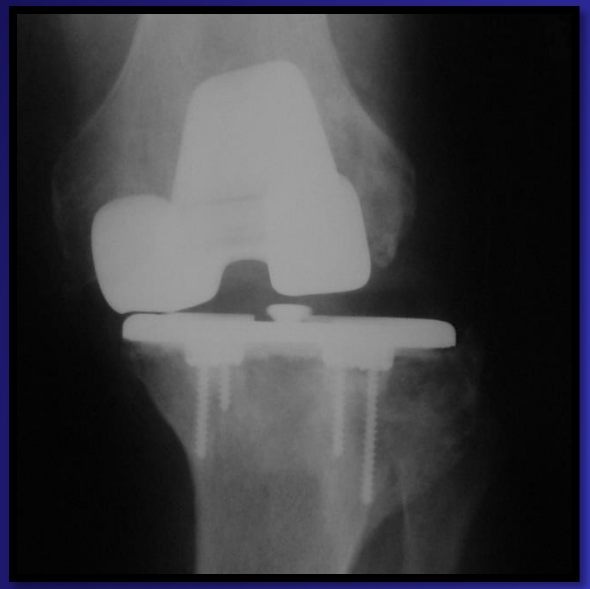
LOOSENING

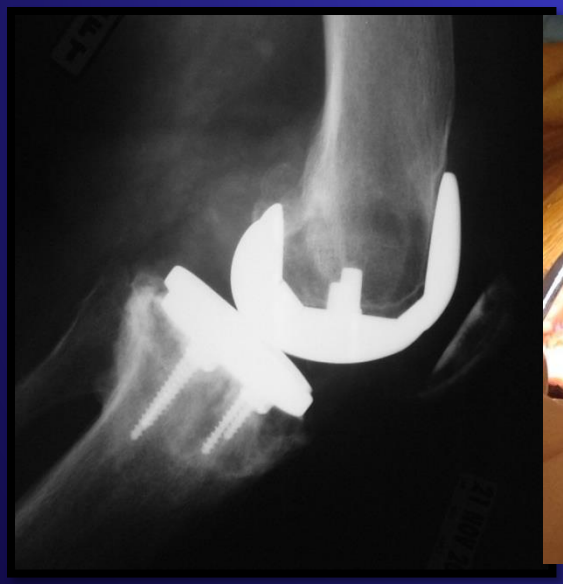
Implant Failure

Infection

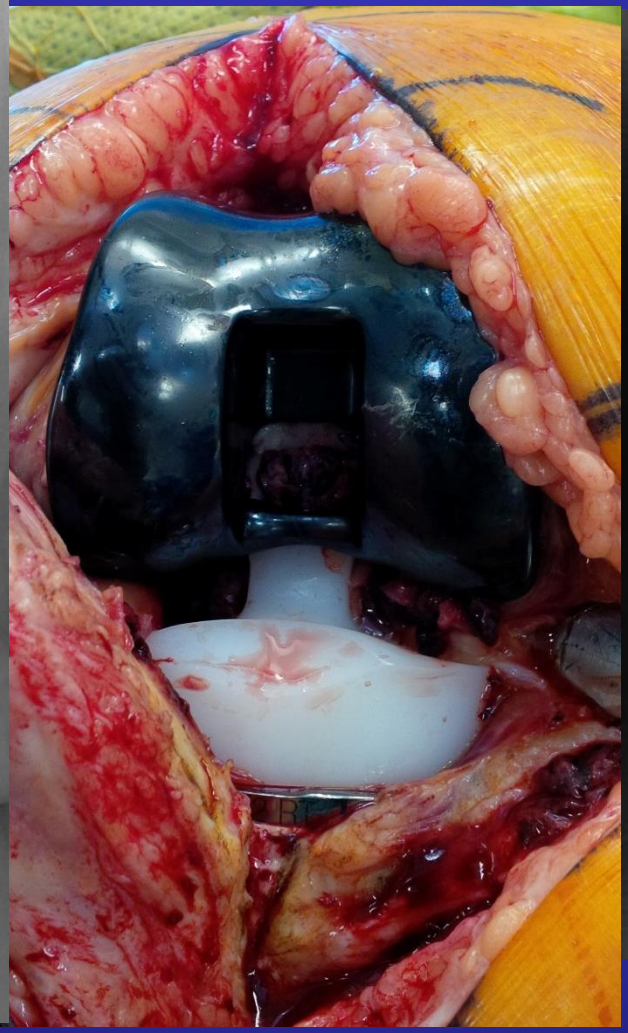


WEAR





Dislocation



Revision TKA Goals:

- Obtain Stable, Long-Term Fixation
- Balance Flexion/Extension Gaps
- Correct Mal-alignment
- Restore Mechanics
  - Joint line
  - Patellofemoral relationship
- Minimize Constraint

Hoag Orthopedic Institute

Pre-op Planning

- What's in there?
- Why are we doing this?
- Game Plan
  - Equipment
  - Bone Graft
- Treat Bone Loss and Soft Tissue Defects separately

Expect The Worst!

Avoid "Columbus Procedures"

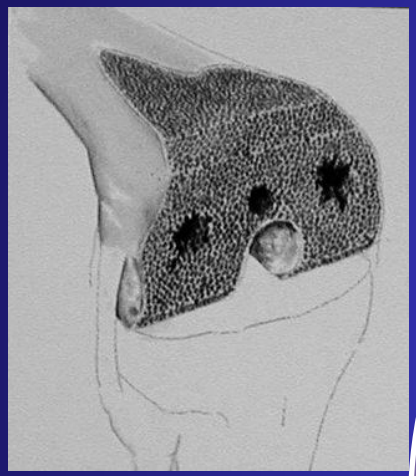
Match Implant System Surgical Need

- Bone loss
- Ligament deficiency/constraint

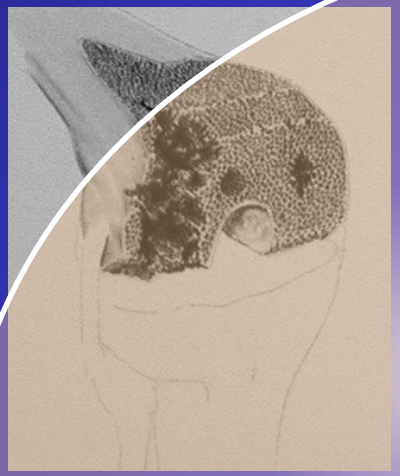
Bone Defects

Soft Tissue Concerns

AORI Classification System

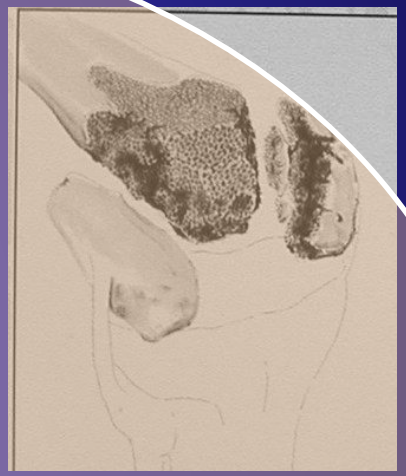


F/T 1

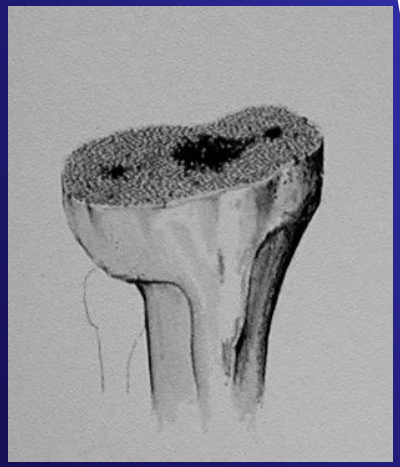


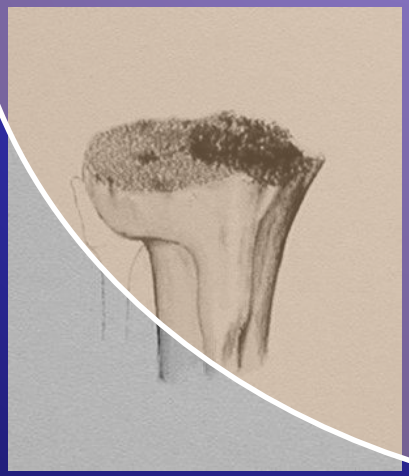
F/T 2A

F/T 2B



F/T 3

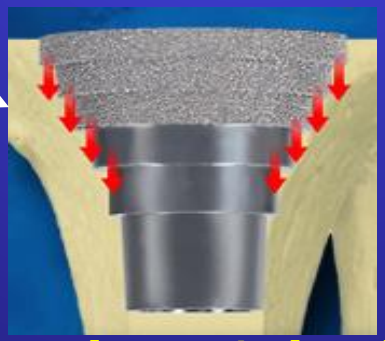




Revision TKA

Metaphyseal Sleeves

- **Tibial and femoral defects**
- **Stabilize implant nearer to joint line**
- **Proximal third or Fully porous coated**
- **Conical, Stepped design for progressive metaphyseal loading**



Sizes

29mm

37mm

45mm

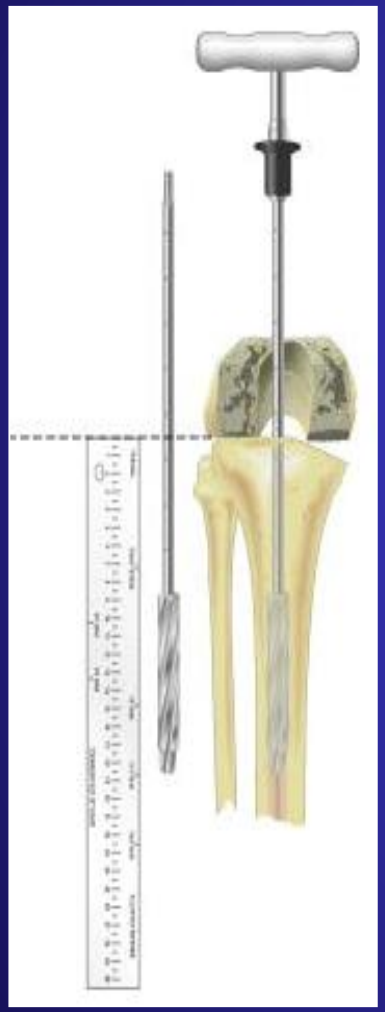
53mm

61mm

"Modular, Mobile-Bearing Hinge Total Knee Arthroplasty, Richard E. Jones, MD; CORR, November 2001.*

MBT Revision/Sleeve Surgical Technique:

Intra-medullary (IM) with tibial sleeve

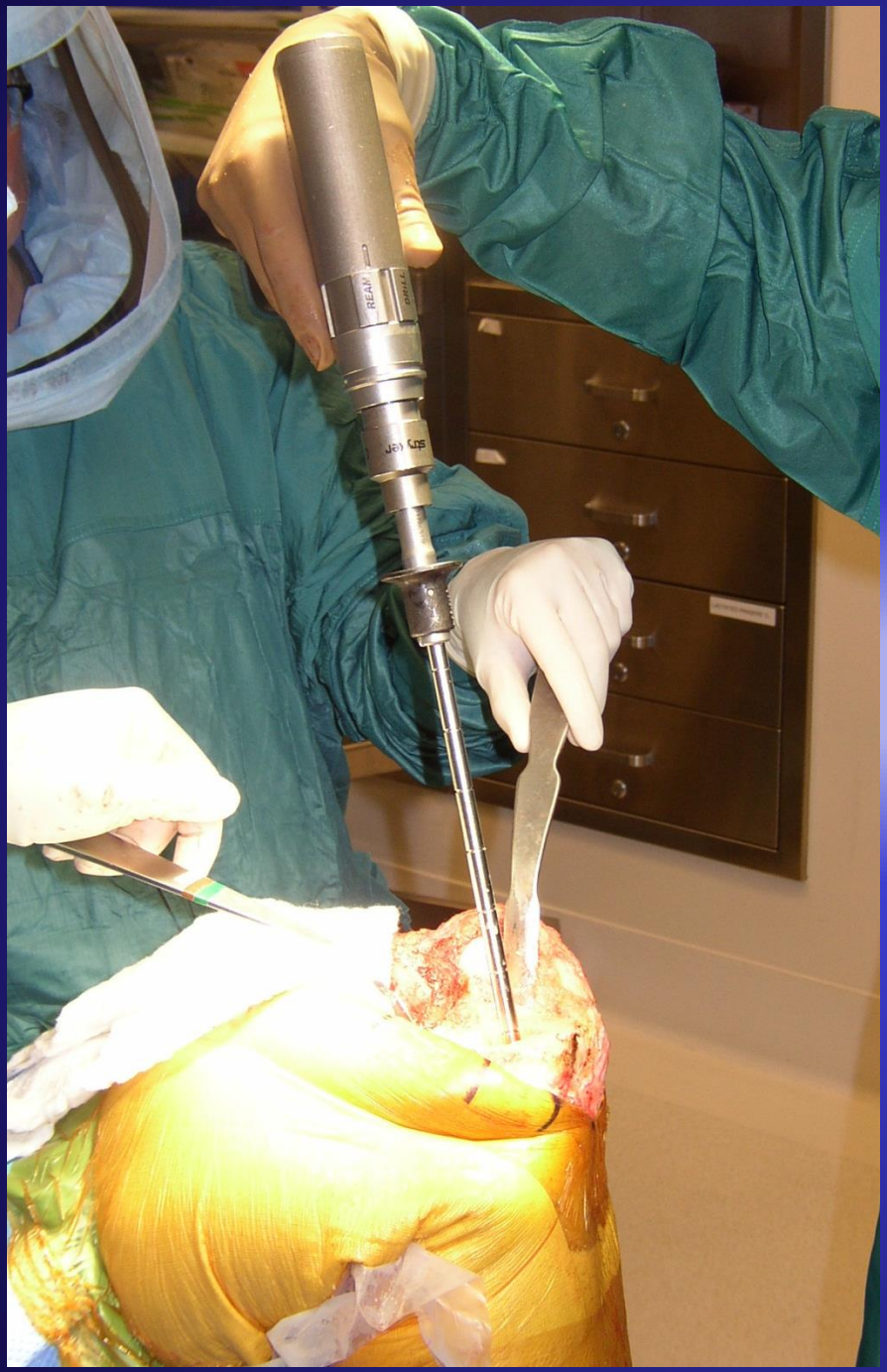


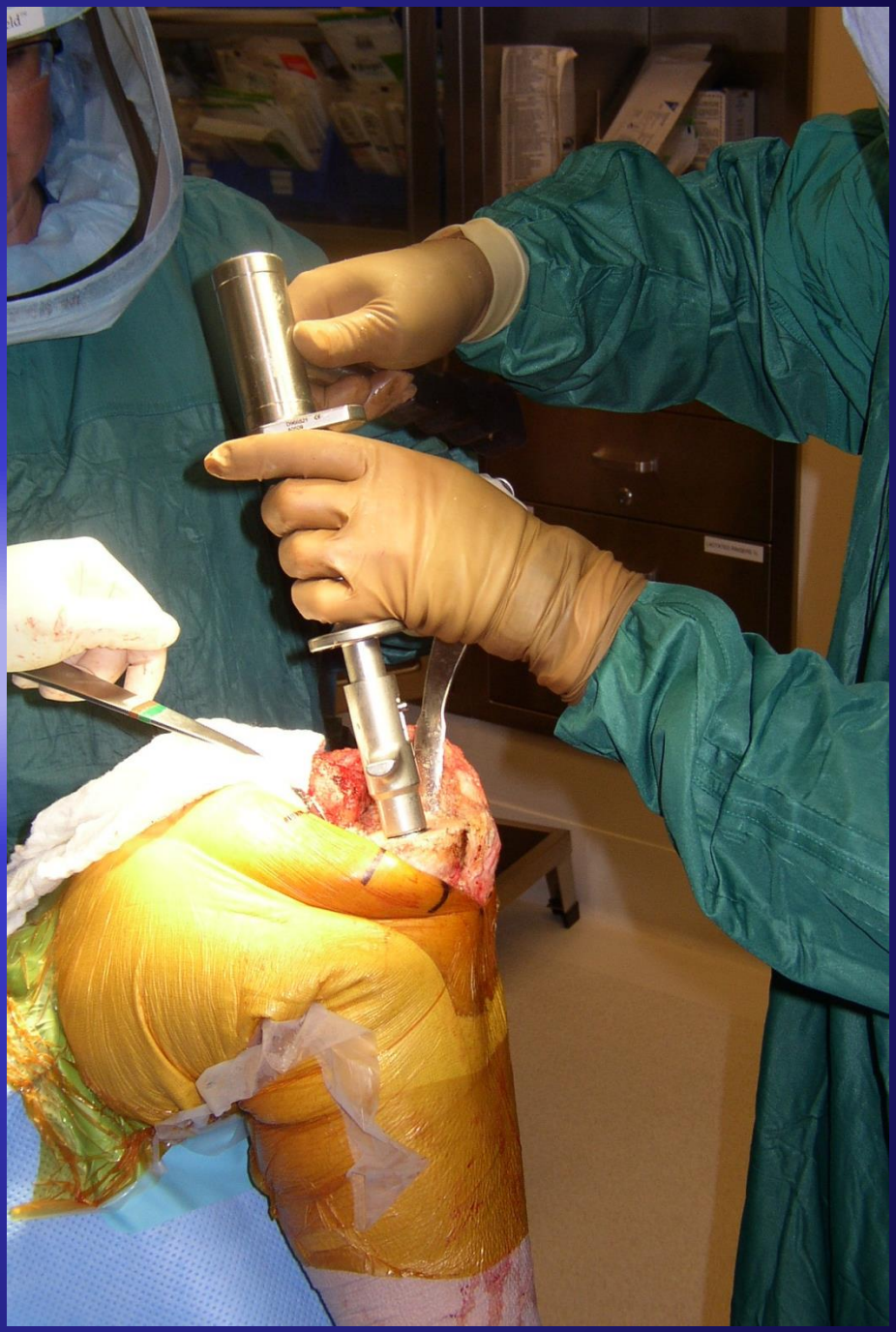
Straight Ream

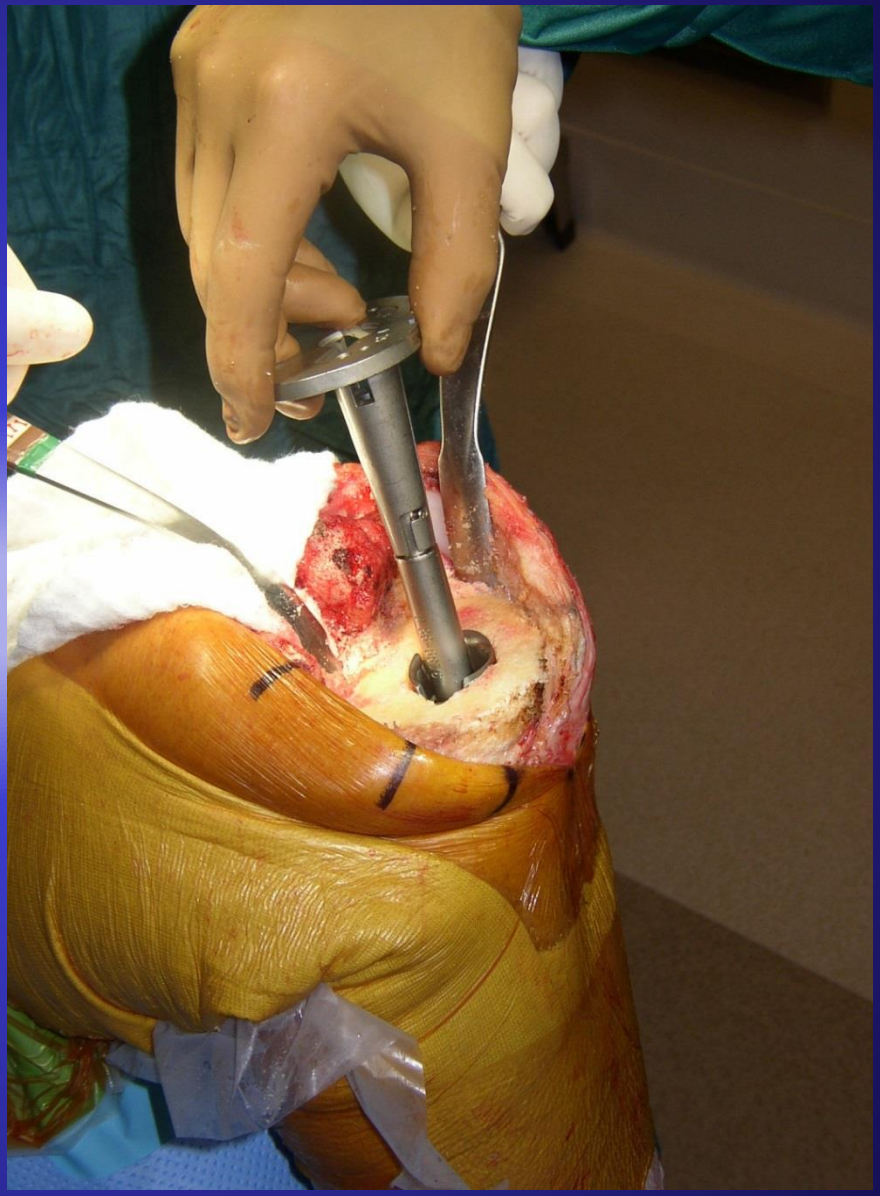
Broach

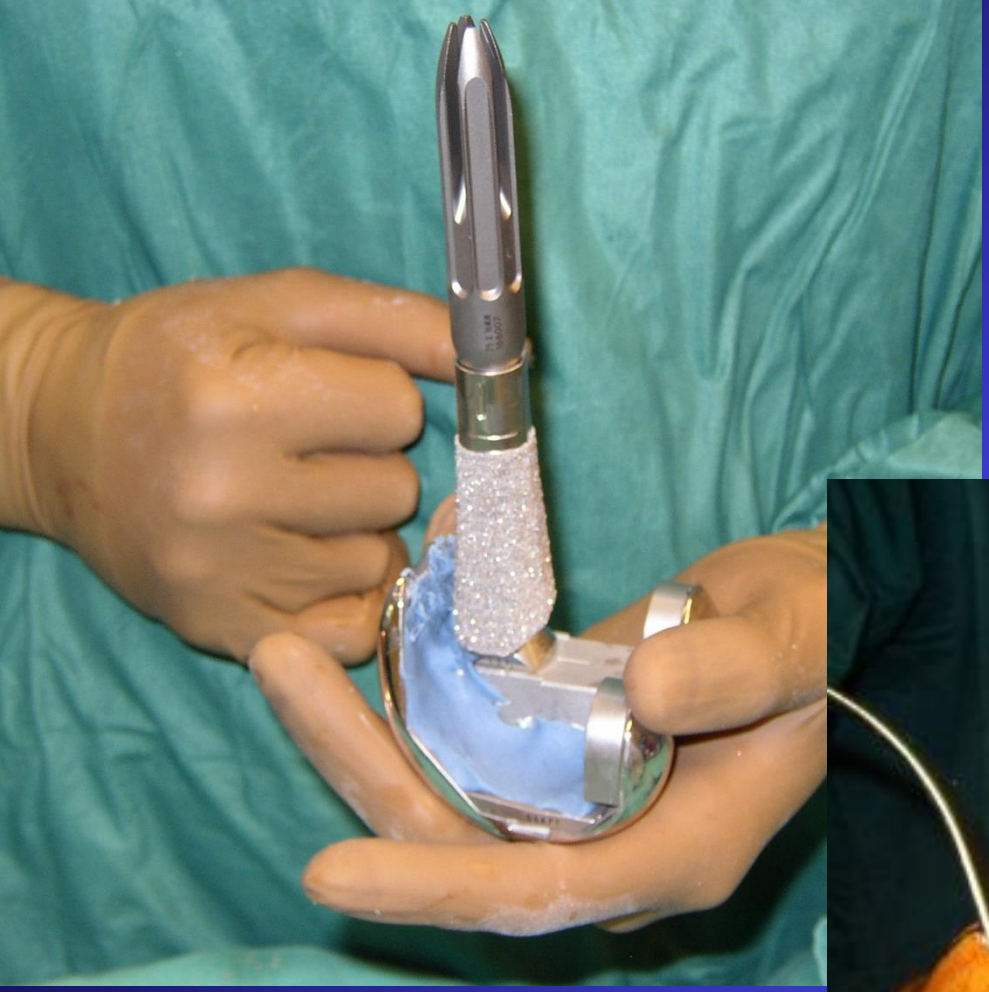
Cut Tibia

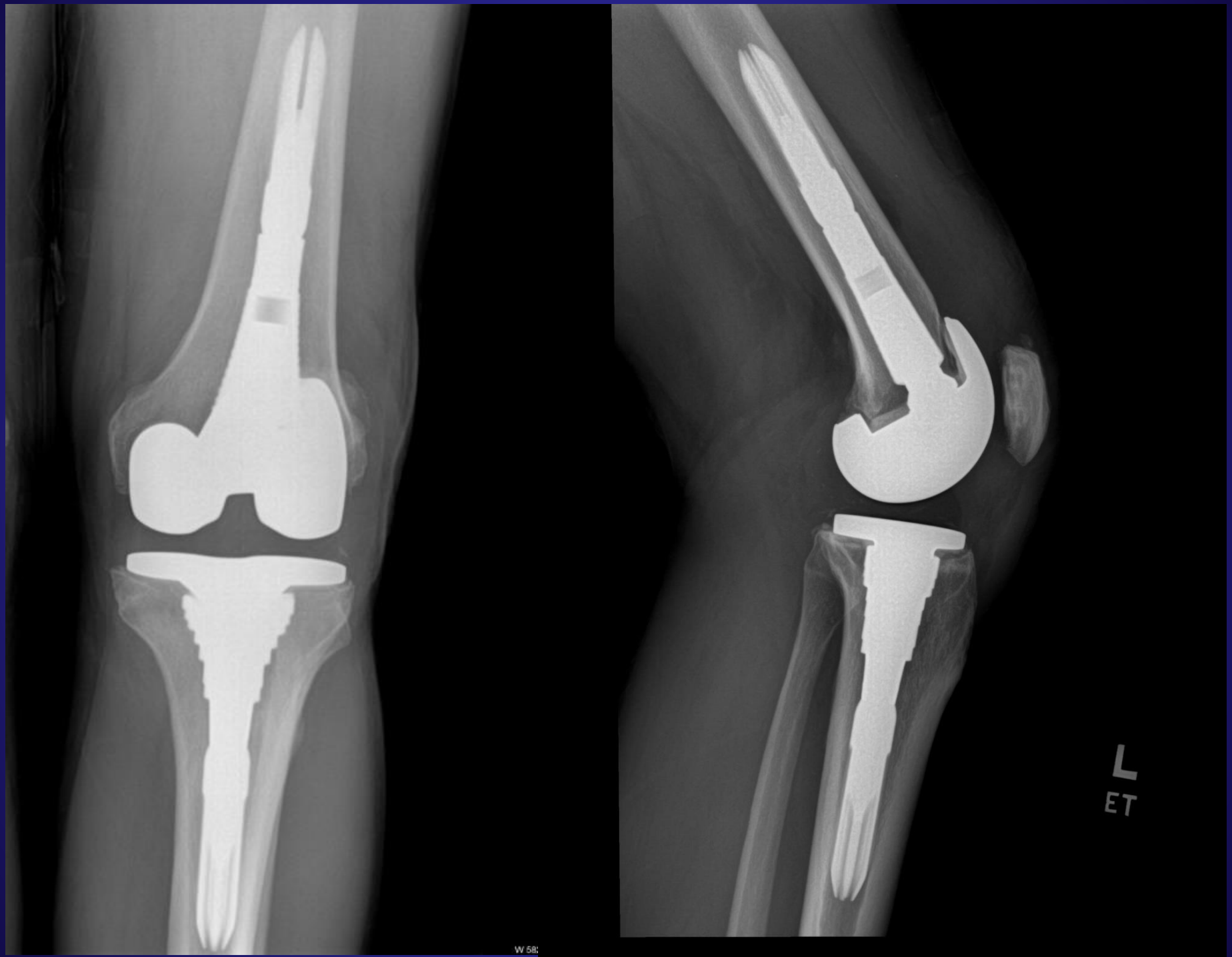
Trial










L
ET
W 58:

RESULTS

METAPHYSEAL SLEEVES FOR TIBIAL DEFECTS IN REVISION TKA

Barnett SL[1],, Gondusky JS[3], Patel JJ[1], Gorab RS[1].

Use of stepped porous titanium metaphyseal sleeves for tibial defects in revision total knee arthroplasty.

J. Arthroplasty, 2014 Jun;29(6):1219-24

The Journal of Arthroplasty 29 (2014) 1219–1224

Contents lists available at ScienceDirect

The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org

Use of Stepped Porous Titanium Metaphyseal Sleeves for Tibial Defects in Revision Total Knee Arthroplasty: Short Term Results

Steven L. Barnett, MD [a,b], Ryan R. Mayer, BS [b], Joseph S. Gondusky, MD [a], Leera Choi, BA [a], Jay J. Patel, MD [a,b], Robert S. Gorab, MD [a,b]

[a] Orthopaedic Specialty Institute of Orange, California
[b] Hoag Orthopedic Institute, Irvine, California

AAHKS, 11/13

Materials & Methods

Retrospective Review 6/07-6/11

51 Revision TKA with Porous Tibial Sleeves

<u>INCLUSION</u>

- **Minimum 2-year follow-up**
- **Uncemented**
- **AORI Defect Type II or III**

AAHKS, 11/13

Materials and Methods

SLEEVE AND STEM (29)

SLEEVE ONLY (11)

AAHKS, 11/13

Results: Demographics

	MEAN	RANGE
AGE (Y)	66	49-88
BMI (KG/M^2)	31	21-40
ASA CLASS	2.3	1-4
SEX	58% MALE	

AAHKS, 11/13

Results: Follow-Up

	MEAN	RANGE
FOLLOW-UP (MO)	38	24 - 62
PRIOR KNEE REVISIONS	0.22	0 - 2

AAHKS, 11/13

REASON FOR REVISION	PERCENTAGE
INSTABILITY	27.8
INFECTION	25.0
ASEPTIC LOOSENING	16.7
PAIN / STIFFNESS	8.3
FRACTURE	8.3
POLYETHYLENE WEAR	5.6
OSTEOLYSIS	5.6
MALALIGNMENT	2.8

AAHKS, 11/13

Results: AORI

TIBIAL DEFECT (AORI)	PERCENTAGE
2A	41
2B	44
3	15

2A

2B

3

AAHKS, 11/13

IMAGES: Haidukewych,JAAOS 2011; 19:311-318

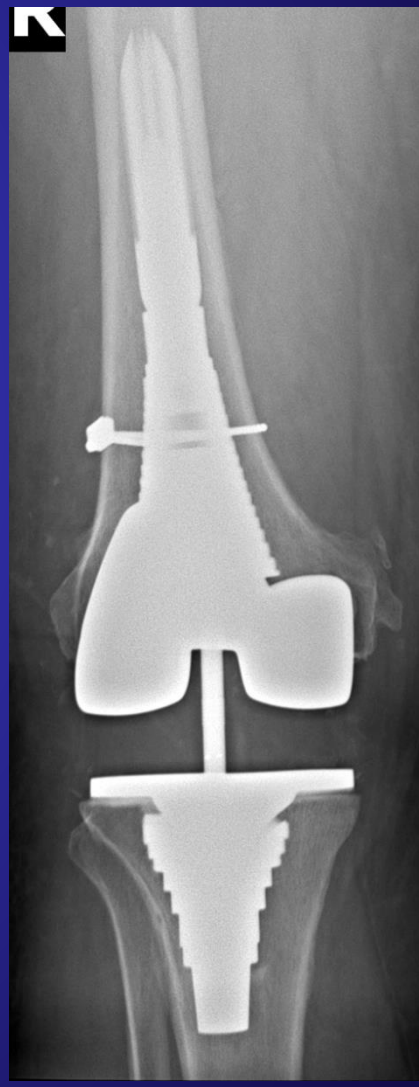
Results: Constraint

LEVEL OF CONSTRAINT	%
POSTERIOR STABILIZED	20%
V/V CONSTRAINED (VVC)	71%
HINGE	9%

AAHKS, 11/13

Results: Clinical

	PRE-OP AVERAGE	FINAL FOLLOW-UP AVERAGE	P-VALUE
EXTENSION	4.6	0.4	<0.001
FLEXION	98.9	112.1	<0.001
KNEE SOCIETY FUNCTIONAL SCORE	41.8	75.0	<0.001
KNEE SOCIETY KNEE SCORE	41.7	88.7	<0.001



AAHKS, 11/13

Results: Radiographic

AP WB and Lateral X-rays

6 Weeks and Final Follow-Up (N=34)

AAHKS, 11/13

Results: Radiographic

	VARUS (>90) / VALGUS (<90) ALIGNMENT	SLOPE (DEG)
AVERAGE	90.2	3.3
RANGE	87.2 -- 93.4	0.1 -- 6.0

Results: Radiographic

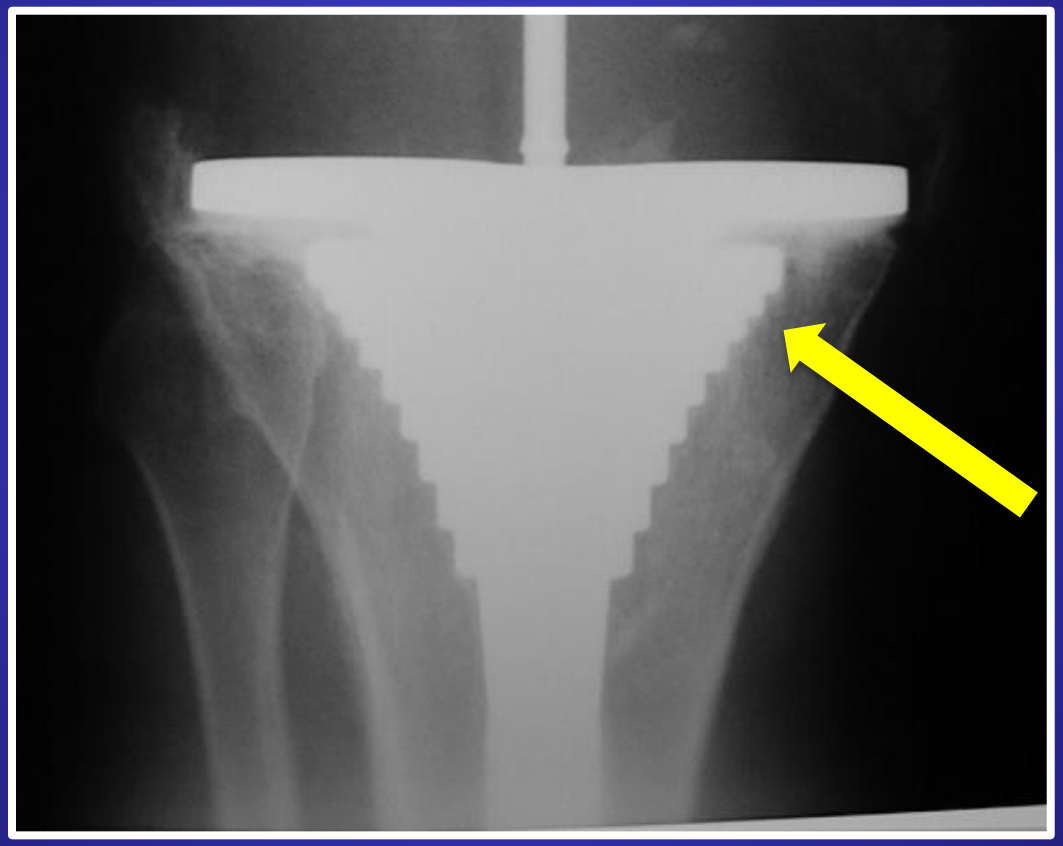
OSTEOINTEGRATION DEFINITION:

- **Bony apposition or spot welds ≥ 2 surfaces**
- **No reactive lines, progressive lucency, component migration**

Results: Radiographic

	PATIENTS
OSTEOINTEGRATION	34
OSTEOLYSIS	2
LUCENCY	4
PROGRESSIVE LUCENCY	0
FRACTURE / PERFORATION	0
COMPONENT MIGRATION	0

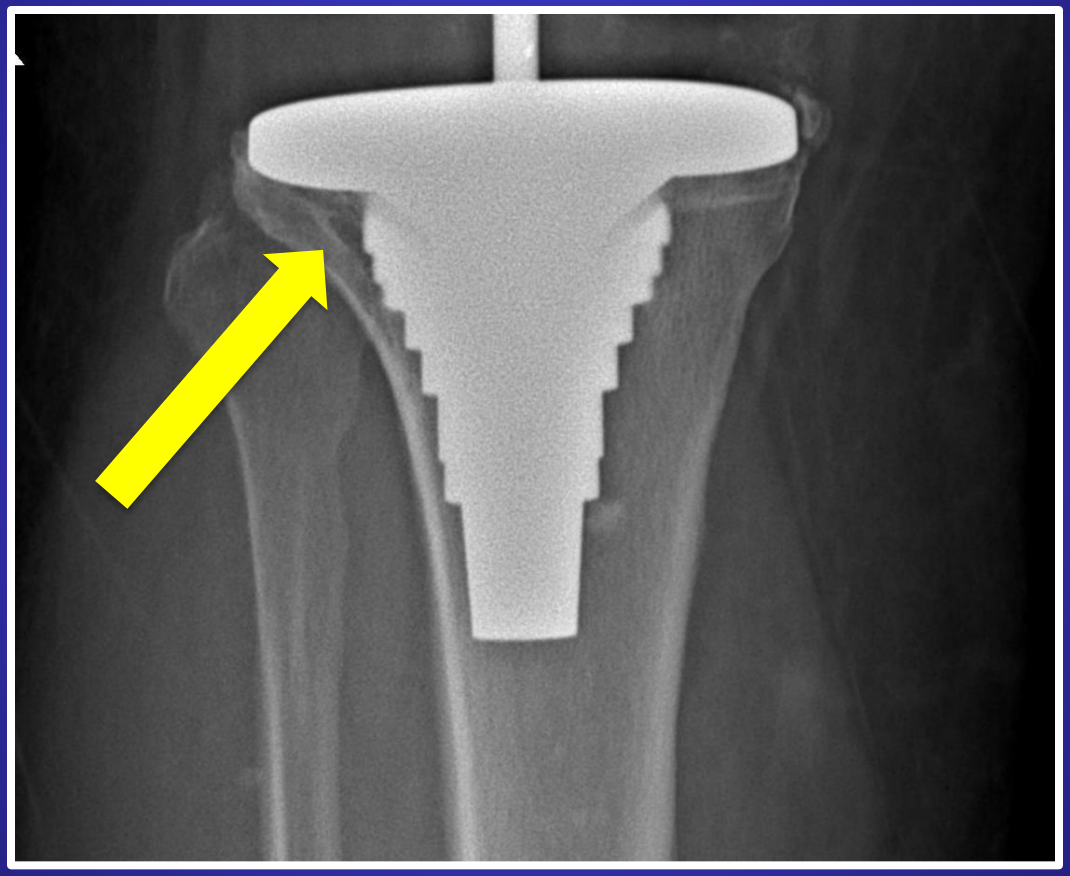
Results: Radiographic



WELL OSTEOINTEGRATED

AAHKS, 11/13

Results: Radiographic



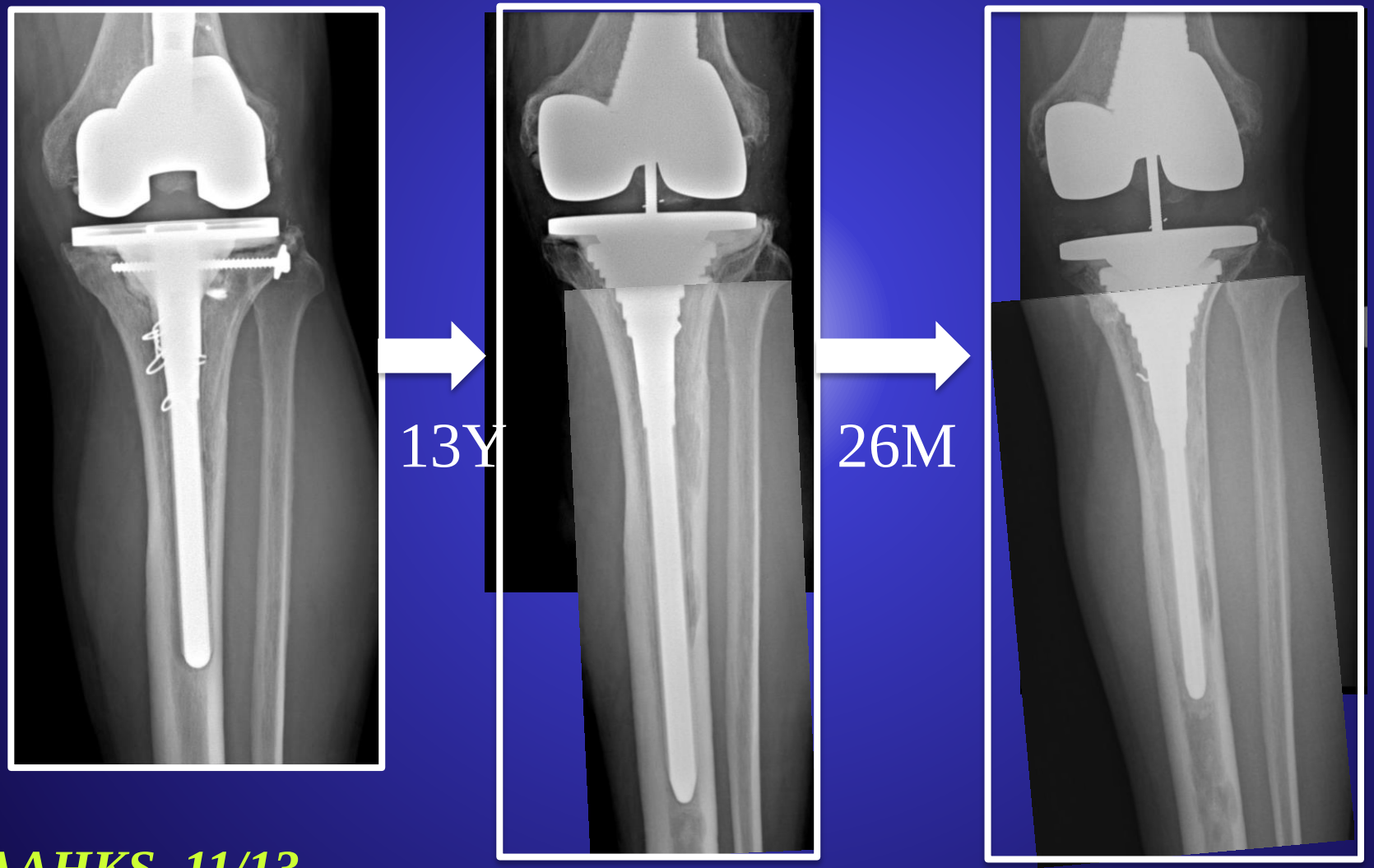
LATERAL LUCENCY

AAHKS, 11/13

Results: Complications

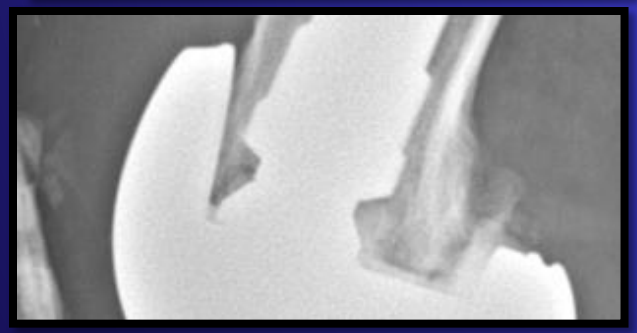
FRACTURE	PATELLA (1) DISTAL FEMUR (2)
INFECTION	RECURRENT (1)
ASEPTIC LOOSENING	FEMORAL (1)
MECHANICAL FAILURE	FEMORAL (1)
ASEPTIC TIBIAL FAILURE	END OF STEM PAIN (1)

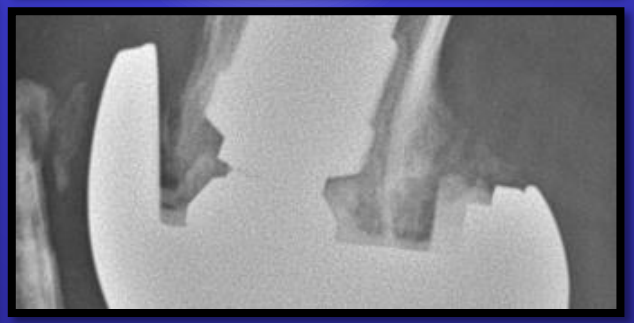
Results: Complications

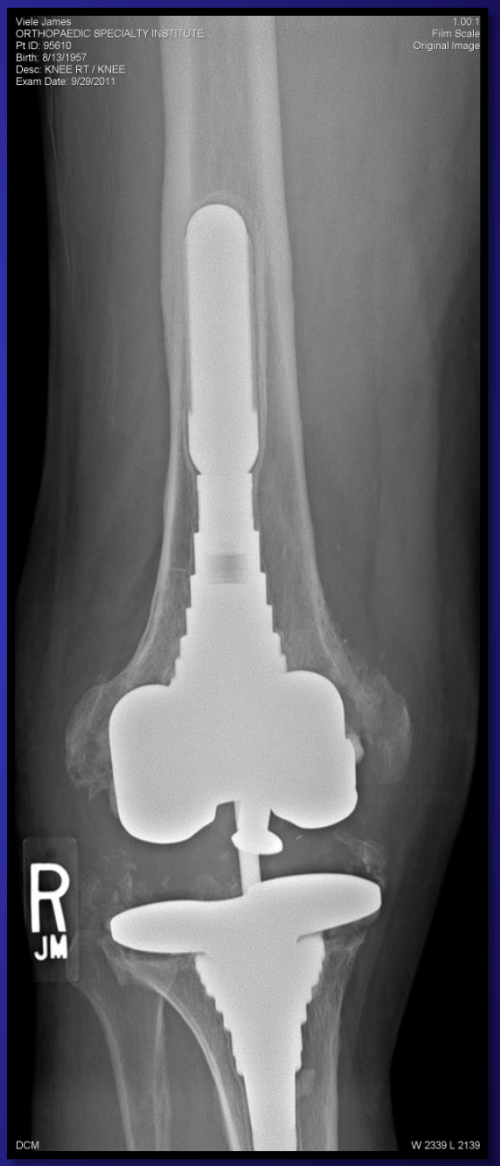


AAHKS, 11/13

IMPLANT FAILURE







AAHKS, 11/13

Study Conclusion

RETROSPECTIVE CASE SERIES

OUTCOMES SUPPORT SLEEVE USE FOR TIBIAL DEFECTS IN REVISION TKA

Hoag Orthopedic Institute

AAHKS, 11/13

Case Examples by AORI Classification System

Defect Classification

Type 1

- **Localized Defect, Normal Joint Line**
- **Much like a Primary TKA**

INTACT METAPHYSEAL BONE

Defect Classification

Type 2

- **Metaphyseal loss**
- **Cortical Rim Defects**
  - *Rim is Supportive*

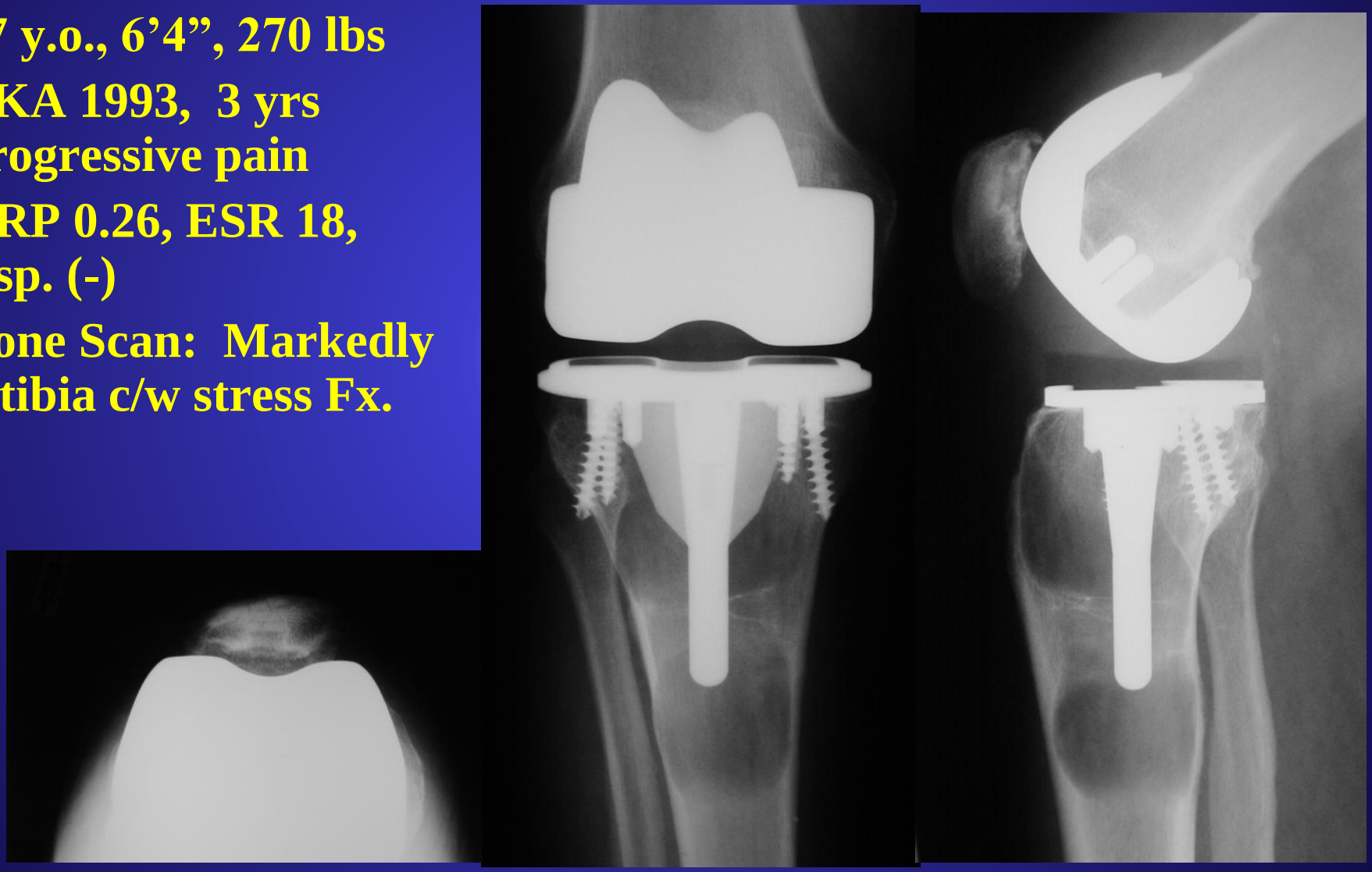
Implant Considerations:

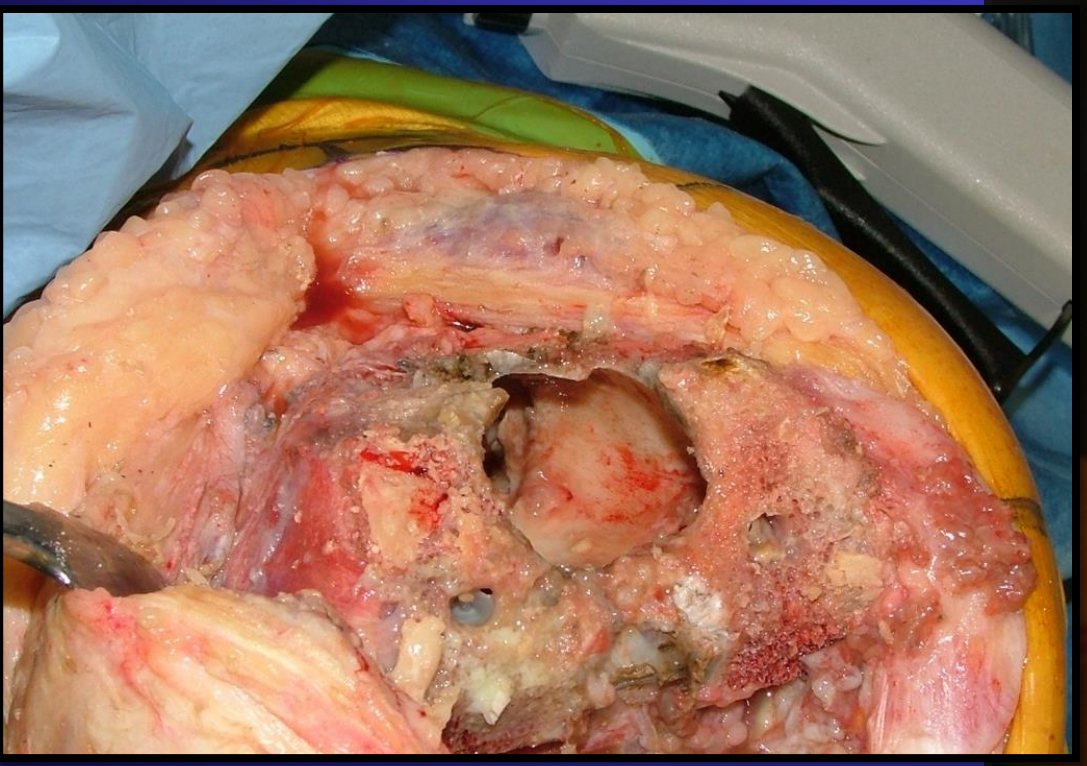
- *Sleeve*
- *Probable Stem*

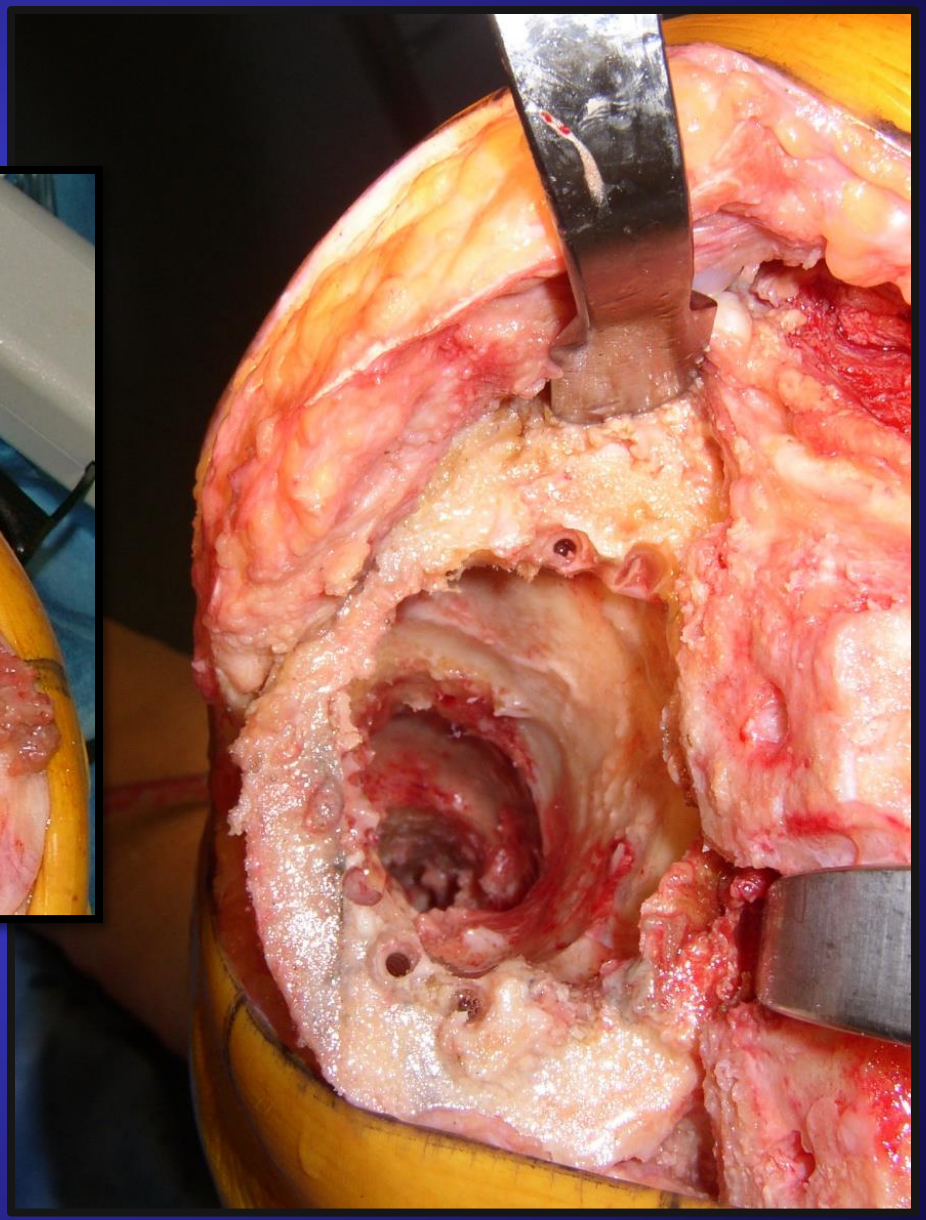
DAMAGED METAPHYSEAL BONE

Case: Type 2A FEMORAL & Type 2B TIBIAL DEFECTS

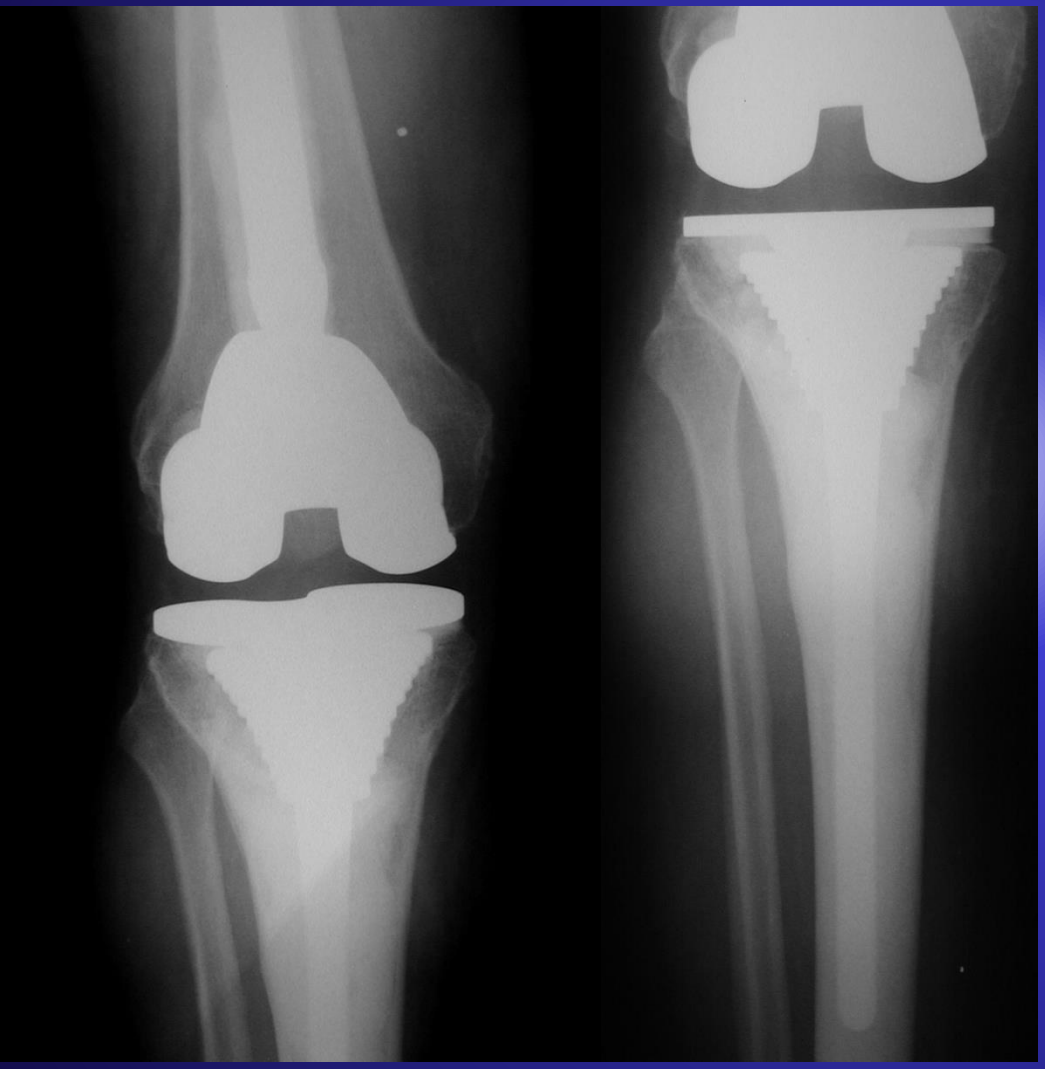
- 77 y.o., 6’4”, 270 lbs
- TKA 1993, 3 yrs progressive pain
- CRP 0.26, ESR 18, Asp. (-)
- Bone Scan: Markedly + tibia c/w stress Fx.

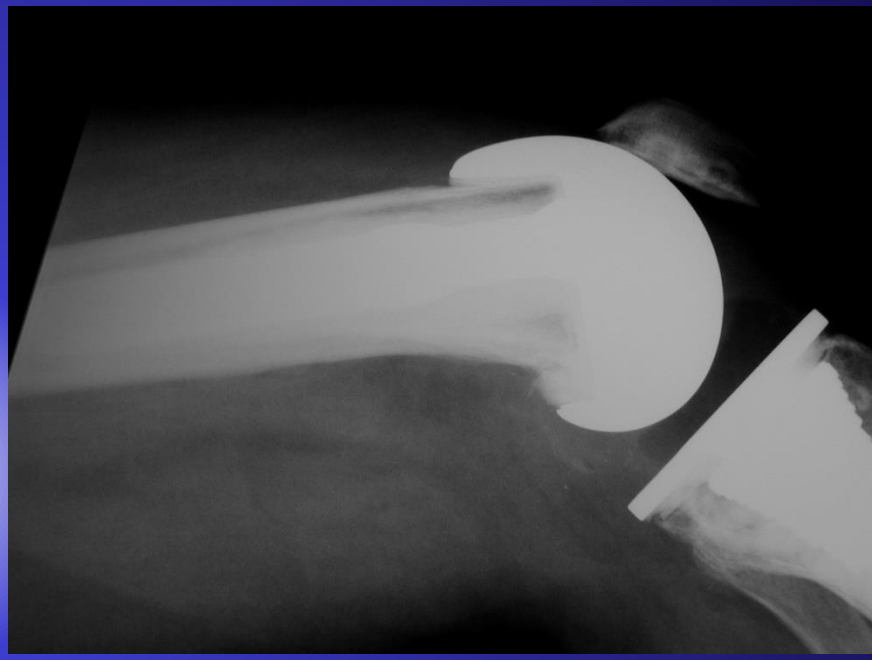


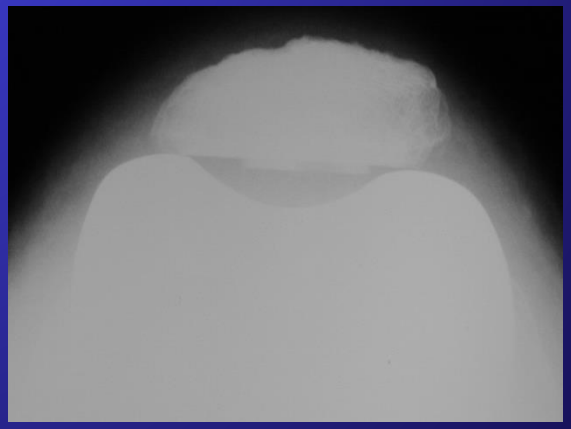




Severe Lysis, Intact Collaterals







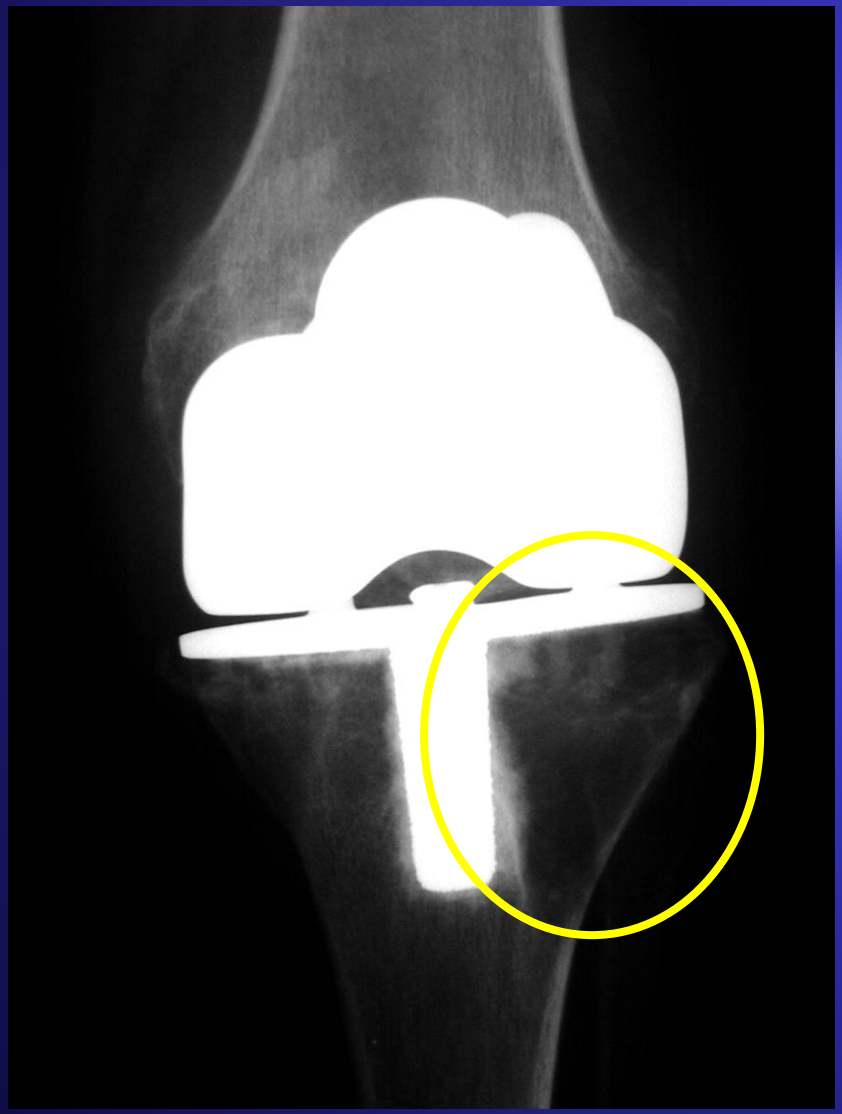
Defect Classification

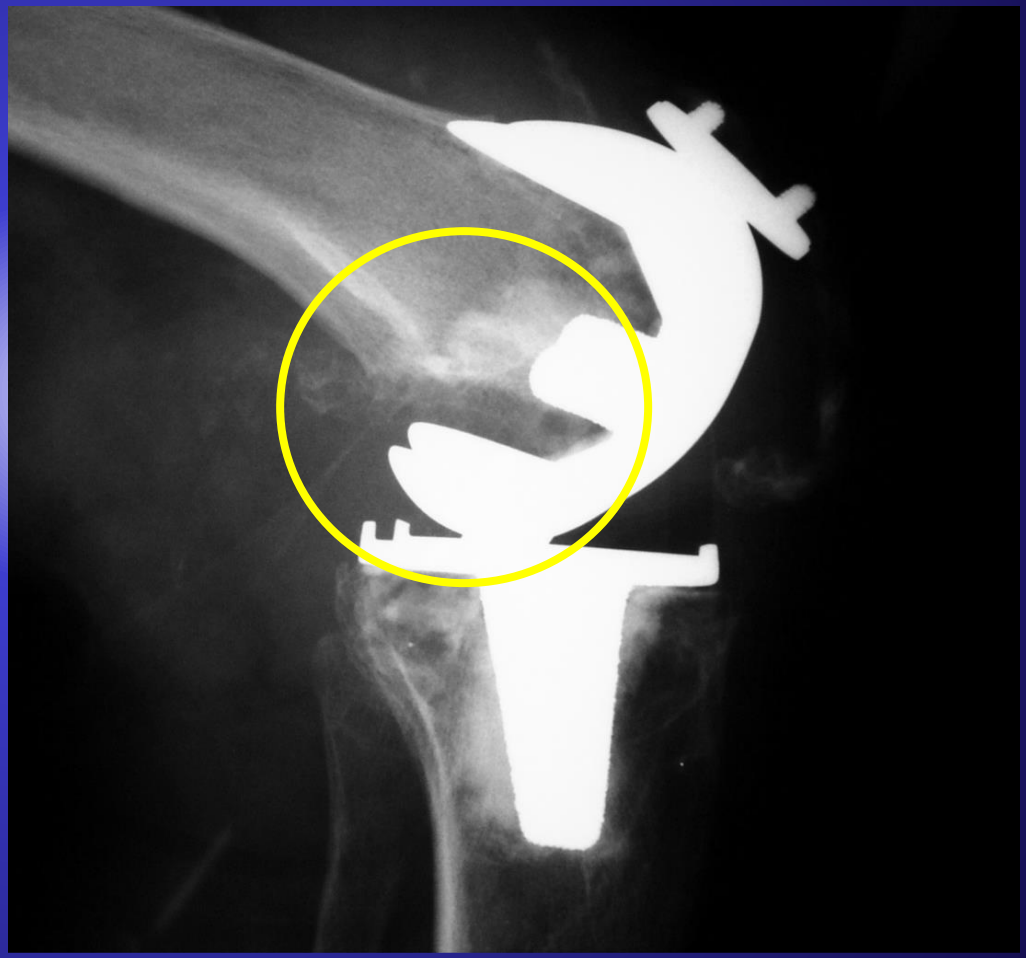
Type 3

- **Loss Entire Metaphysis with Cortex**
- **Stemmed Implant**
- **Metal Augments**
- **Modular Sleeves**
- **Structural Bone**
- **Usu. Hinge/ Tumor Prosthesis**

SEVERELY DEFICIENT METAPHYSEAL BONE

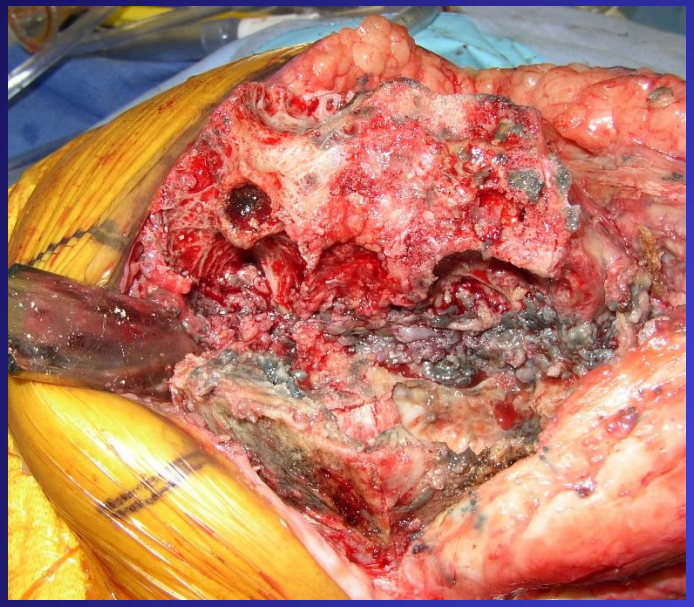
Case: Type 3B Femoral/ 3A Tibial Defects/Structural Allograft

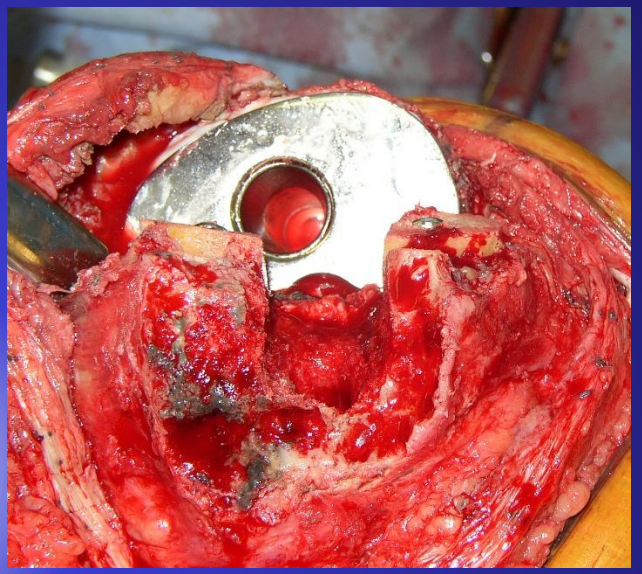


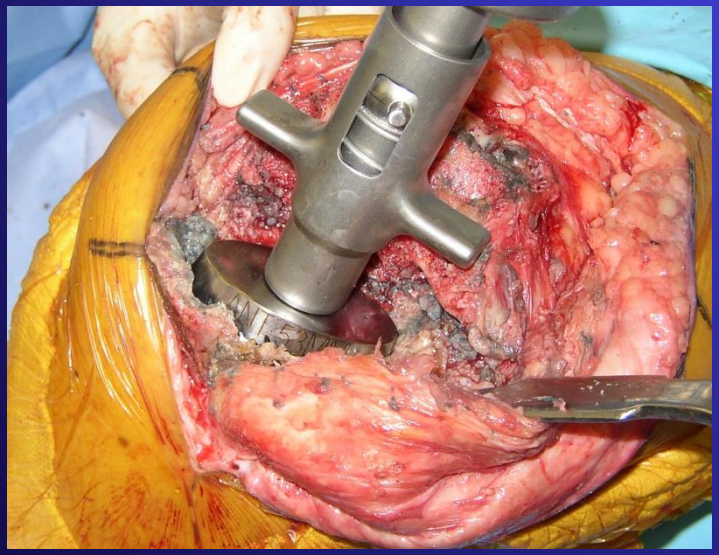


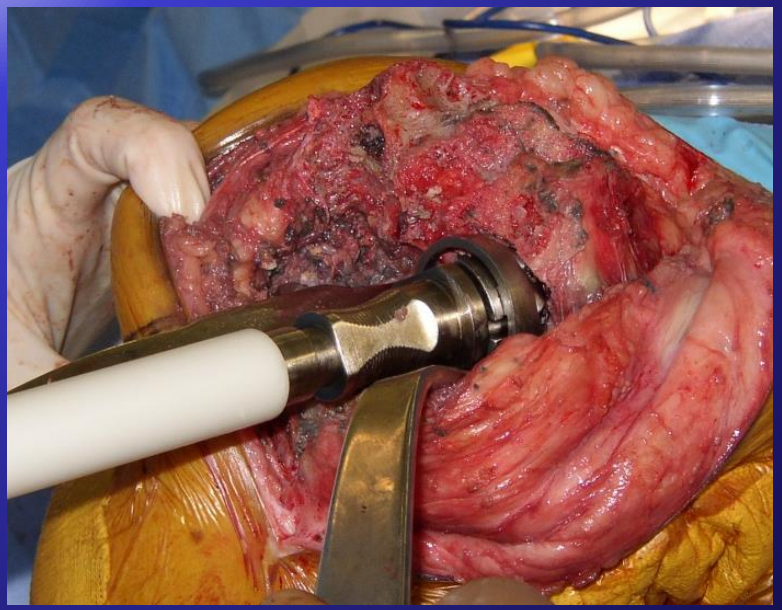
68 Year old, RA, TKA 1989

Defect Management



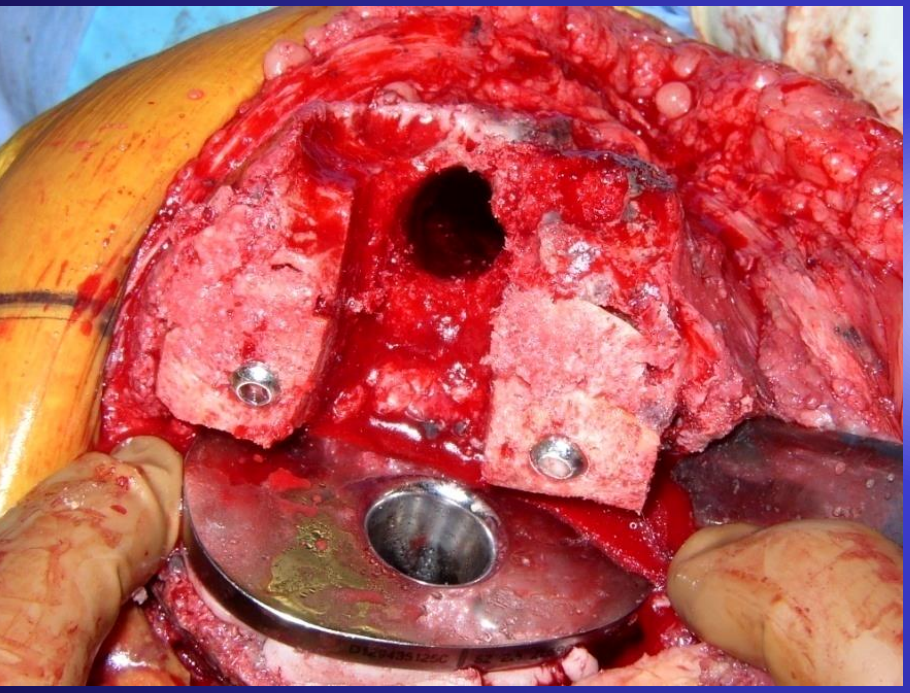


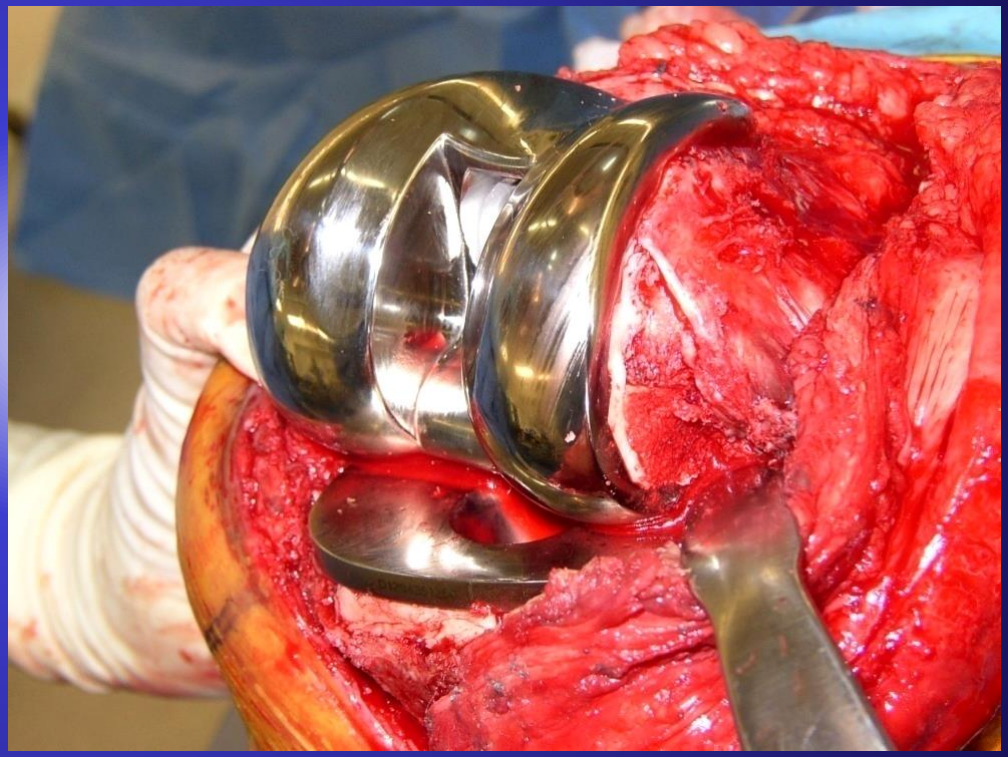


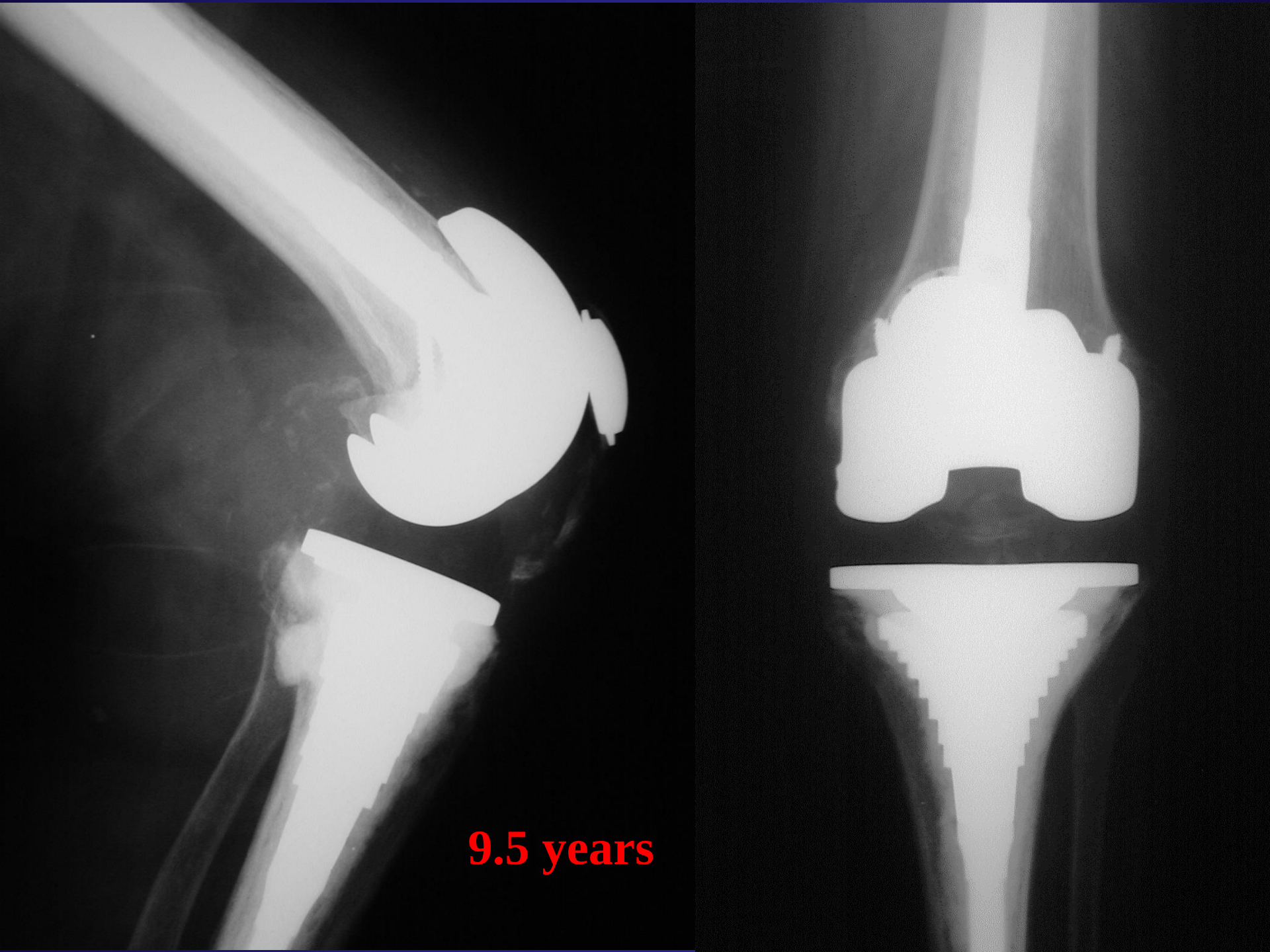


Severe Defects > 1.5cm:

Structural Grafts

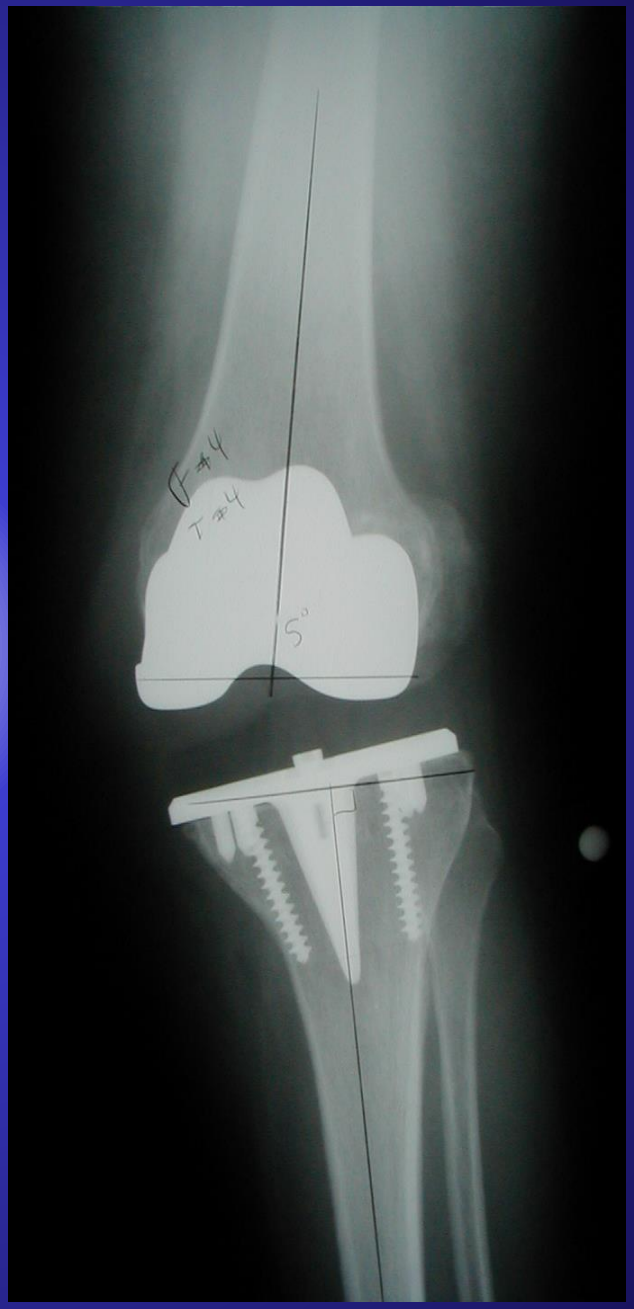





9.5 years

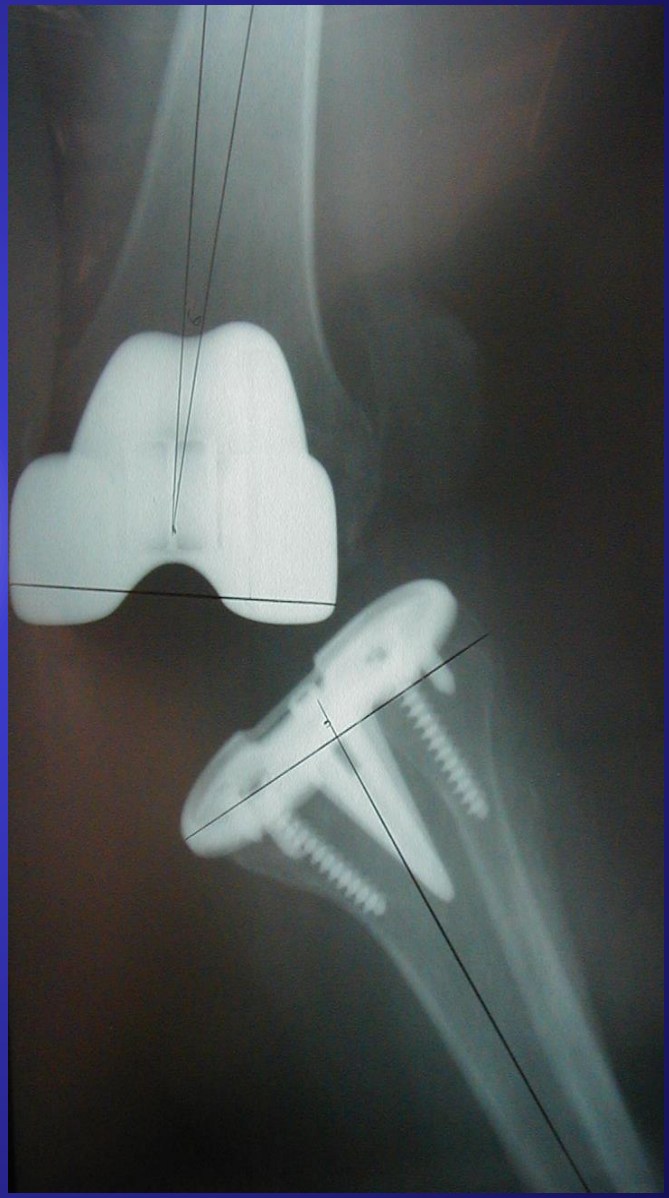
Case: Significant Instability

- 57 yo obese female
- 6 mos post-op
- Knee “gives way”

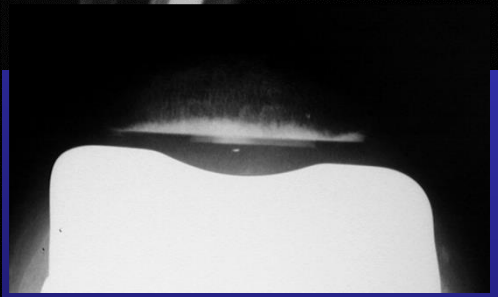


Valgus Stress

Stress View



Rotating Hinge



SUMMARY: REVISION TKA with METAPHYSEAL SLEEVES

- ***Revision TKA can be challenging***
  - **Bone Loss**
  - **Instability**
- ***Treat Bone Loss and Soft Tissue Defects Individually***
- ***Combination metaphyseal sleeve augmentation with stems when needed provides stable mid-term fixation***