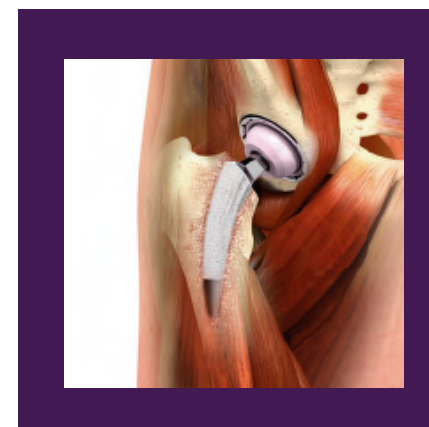




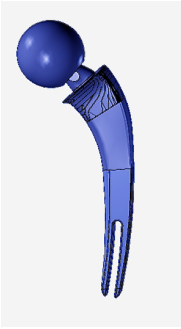
Short Stems for THA

Timothy McTighe, Dr. H.S. (hc), Executive Director
 Joint Implant Surgery & Research Foundation
 Chagrin Falls, Ohio www.jisrf.org



RLO/ Real Life Orthopaedics
 Charleston, S.C.
 May 19, 2011

•Acknowledge Members of the TSI™ Study Group
 For their continued support and contributions



Disclosure

- In accordance with Professional guidelines I acknowledge there is a financial relationship with the content of this paper
- Consultant to Omnilife science, Member of CDD,LLC
- JISRF Consults with industry in the form of speaker and research fees
- Intent is to make services available to all of orthopaedic industry
- Note: JISRF is dependent on funding from industry and many Members of JISRF have commercial relationships www.jisrf.org





JISRF Affiliations since 1971

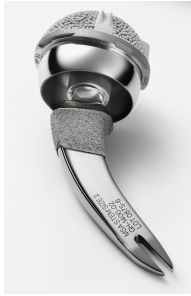
(In Part)

AAHKS
AAOS
Active Implants, LLC
Australian Orthopaedic Association
American Society of Biomechanics
American Society of Biomaterials
Apex Surgical
Bacterin International, Inc.
Biomet
Concept, Design & Development, LLC
DePuy
Dow Corning Wright
DARF
Encore Medical
E. M. Warburg, Pincus & Co.
Global Orthopaedic Technology
Harrington Arthritis Research Center
Howmedica
ISTA
Jackson Arthritis Center

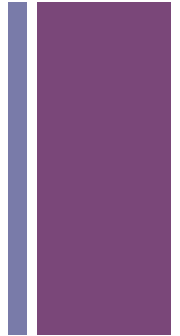
Johnson & Johnson orthopaedics
Joint Medical Products Corp.
Keggi Orthopaedic Foundation
Kenesis Medical, Inc.
LLUM
Montreal General Hospital (orthopaedic research lab)
NASA
Omnilife science™
OREF
ORS
Orthopaedic Development Corp.
Orthomet
OTI
Richards Manufacturing Co.
The Shepherd Centre
Signature Orthopaedics
Smith & Nephew, Inc
Zimmer

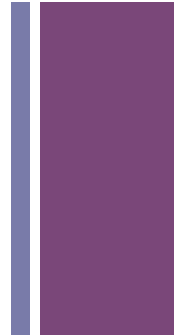
Note: includes non-profit & for profit organizations
(partial list)

www.jisrf.org



Variety of Short Stems

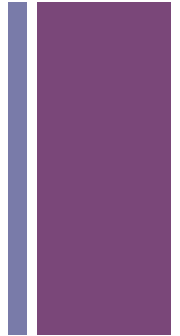




The past few years has seen an influx of so-called short stems with very little clarification as to design features, required surgical technique and clinical outcomes.



- Most devices, meet with some level of learning curve and most systems do little in the way of warning new surgeons as to the pearls and pitfalls during the initial surgical phase.



Note: Not all short stems are equal in design and or function



As we have seen with modular junctions we need to differentiate short stem designs.



Design Consideration for Modular Stems

By

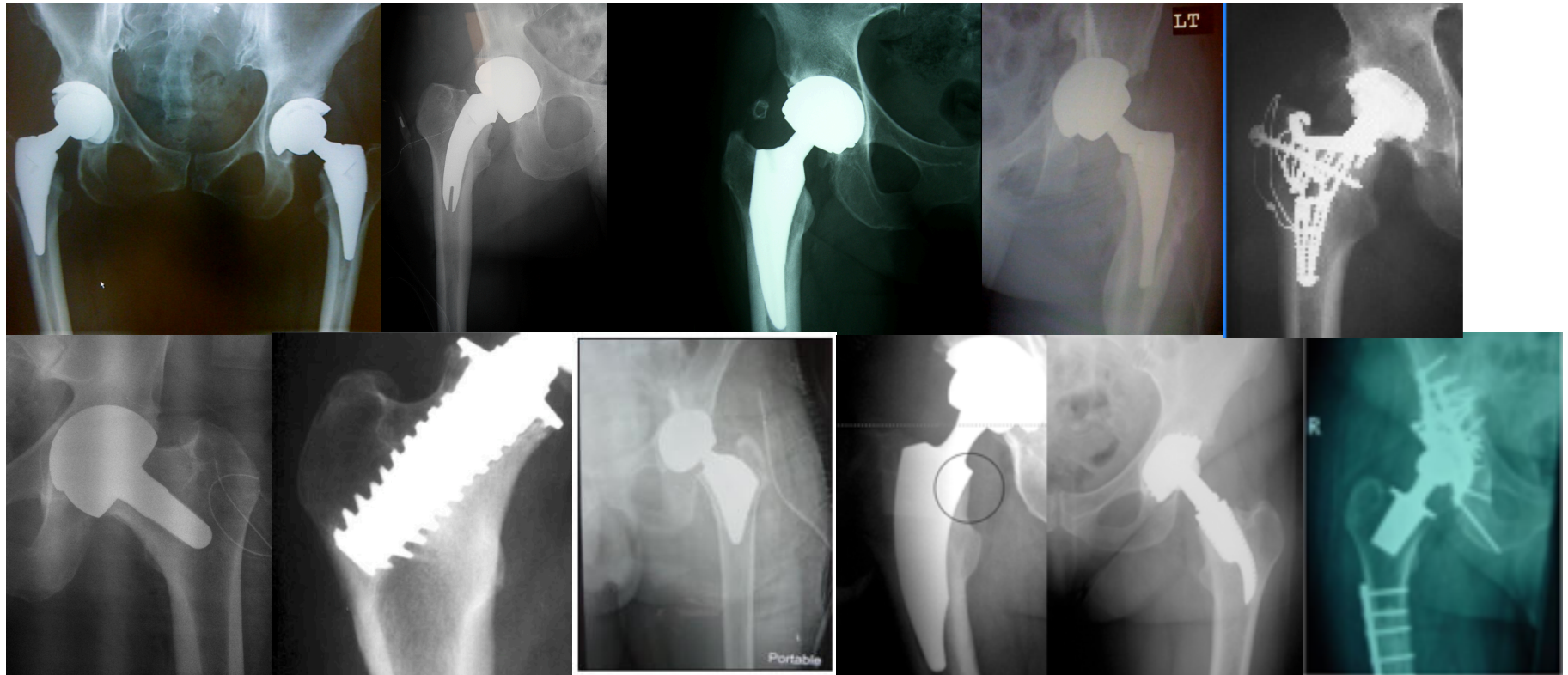
Timothy McTighe, Dr. H.S. (hc)
Joint Implant Surgery & Research Foundation
Chagrin falls, Ohio

RLO*: Charleston
Joint replacement Surgery 2010, May 6-7, 2010
Charleston, South Carolina
*** Real Life Orthopaedics**



Short Stems

Need to have a classification system





“JISRF Stem Classification System”

Stems come in a variety of sizes and shapes

- **Conventional Stabilized Stems**

- Straight

- Anatomical

- Curved

- **Neck Sparing Stabilized**

- Conventional Neck Sparing straight

- Short Curved Neck Sparing

- **Metaphyseal Stabilized**

- **Head Stabilized**

- HR

- Mid-Head





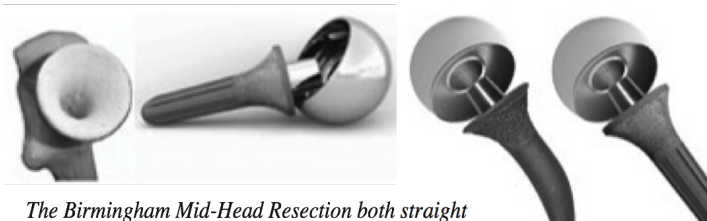
Short Stems

Classify by Stabilization point

■ Head Stabilized



The **Birmingham Mid Head Resection Prosthesis** is a device which, in terms of the bone resected, lies between the Birmingham Hip Resurfacing and a more standard total hip replacement. It can be used when it is possible to preserve part, but not all, of the femoral head.

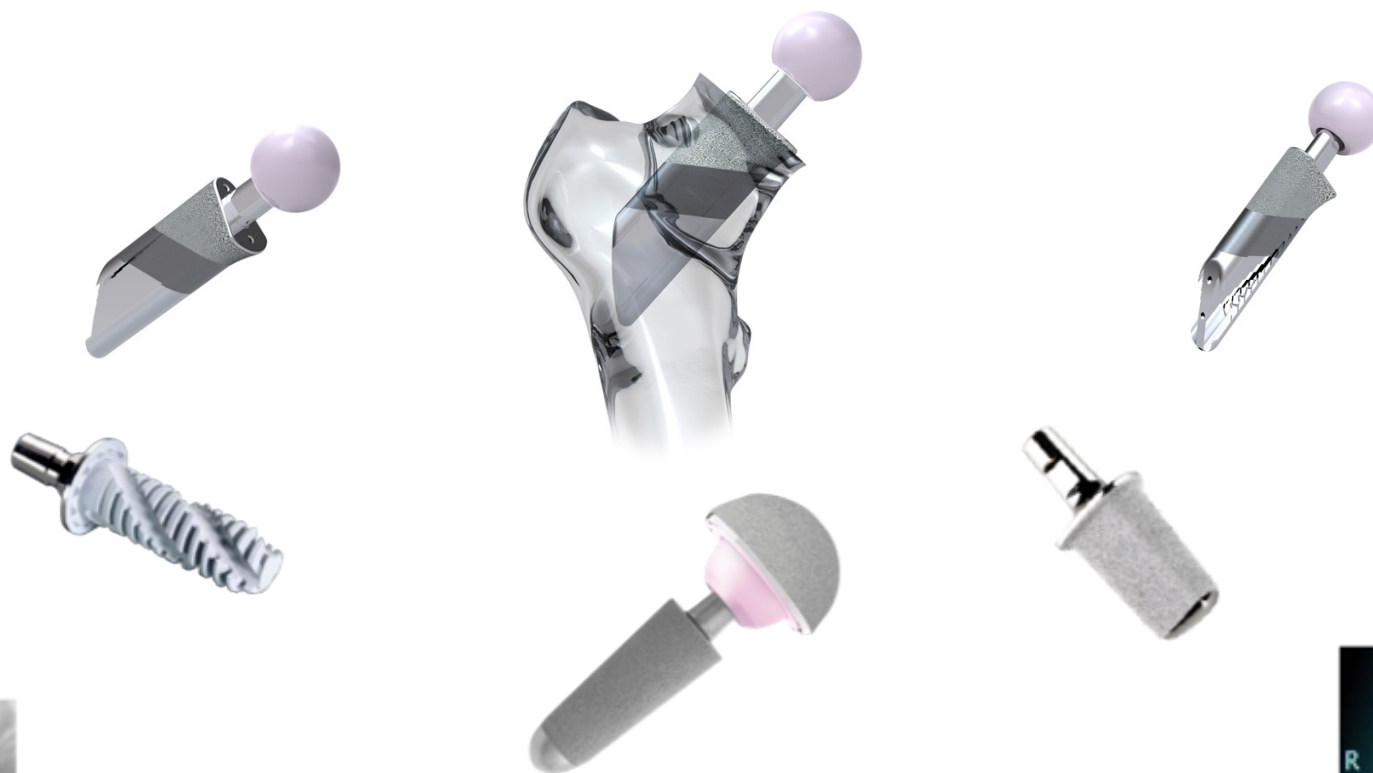
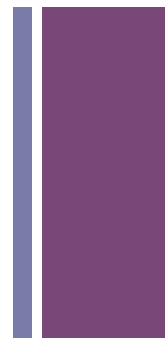


The Birmingham Mid-Head Resection both straight and curved stem designs





Neck Stabilized (neck plugs)



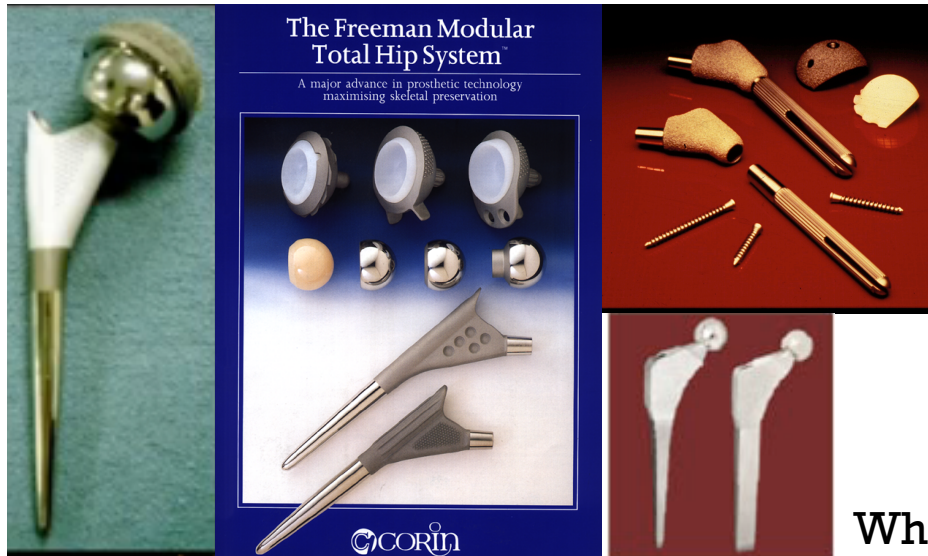
There is growing interest.



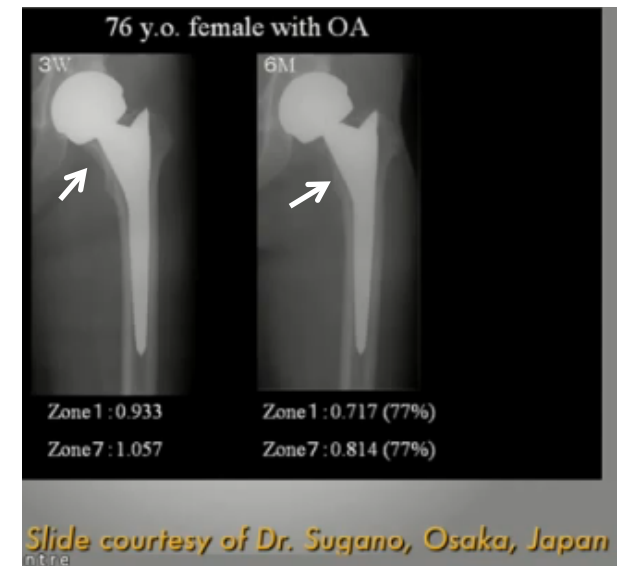


Townley
Platform

Traditional Neck Stabilized



Whiteside

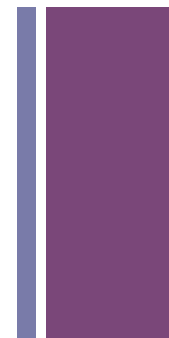


- Neck resorbs @ 6-12 months
- Also confirmed by Whiteside with his conventional neck retention stem.

➤ Historically traditional neck stabilized stems have had disappointing results with regard to bone remodeling “Stress Shielding” of the medial calcar



Neck Stabilized Short Curved Stems



Pipino



ARC™ & MSA™ Stems
Licensed TSI™ technology patents pending



Corin



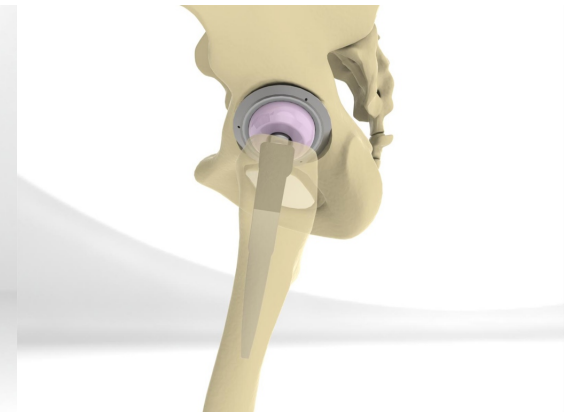
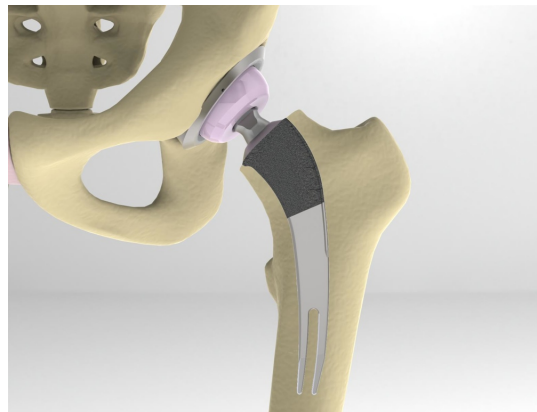
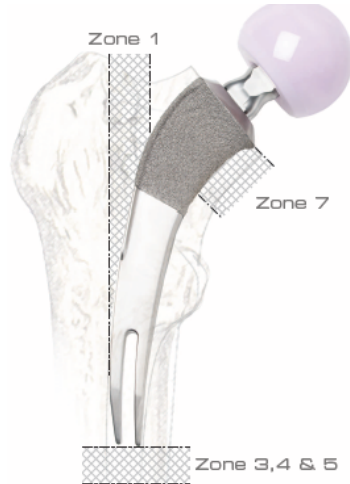


Short Metaphyseal Stabilized Stems

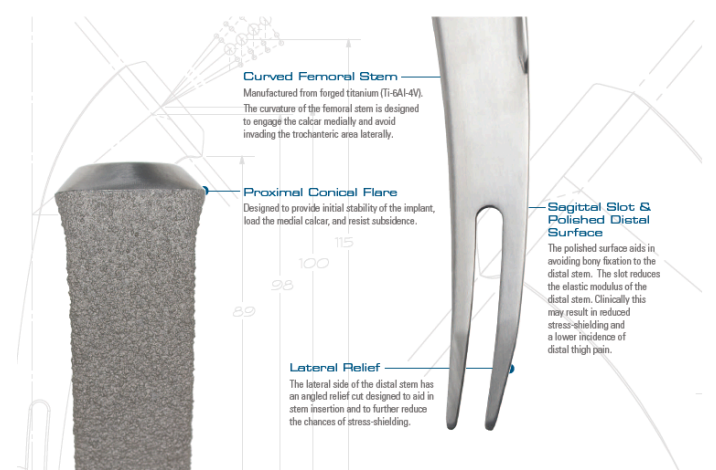
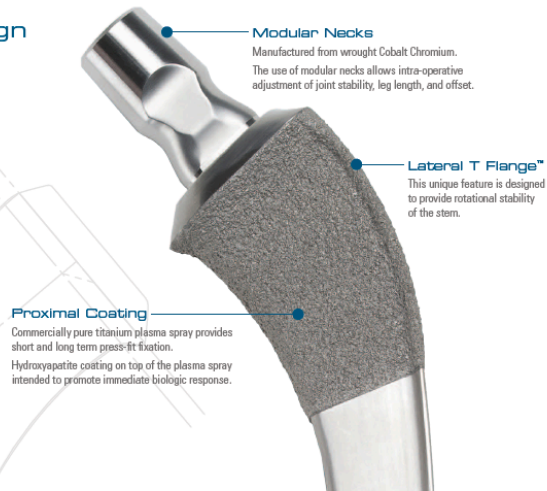




Design Features for a Short Curved Neck Stabilized “ARC™” Stem



Key Design Features





Why Save the Neck?

➤ Neck Resection generates significant increase in torsional and bending moment at the stem/bone interface



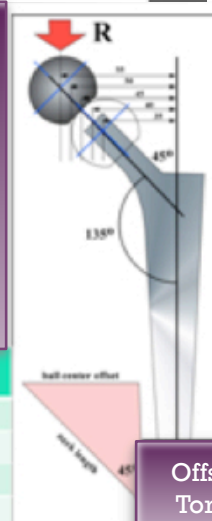
Neck retention reduces both torsional & bending moments



8° increase in torque per 1mm increase in true lateral ball-center offset

6° increase in torque per 1 mm increase with the ball's neck-length size adjustment

offset	Neck-length	Nm
35 mm	49.50	84
40 mm	56.58	96
45 mm	63.65	108
50 mm	70.72	120
55	77.79	132

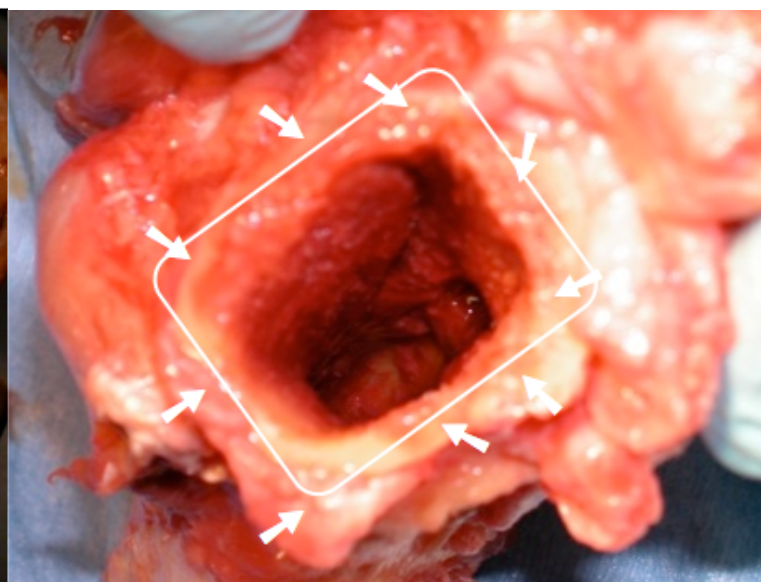
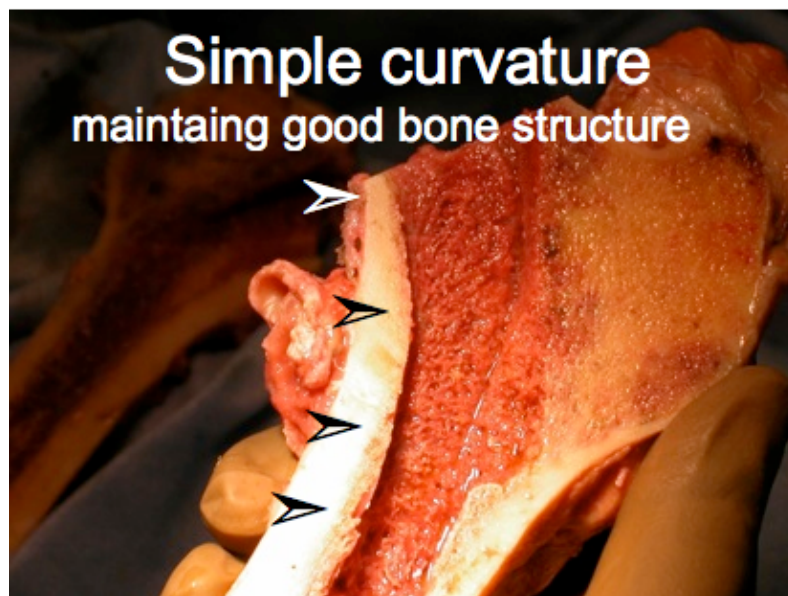
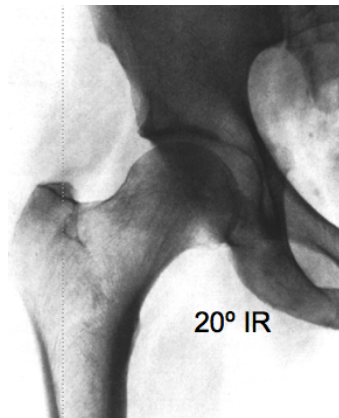


Offset increases Torsional loads





The Medial Curve





Curved stem feature

Comes from the pioneering work of
Thompson and Muller



Long history of curved devices

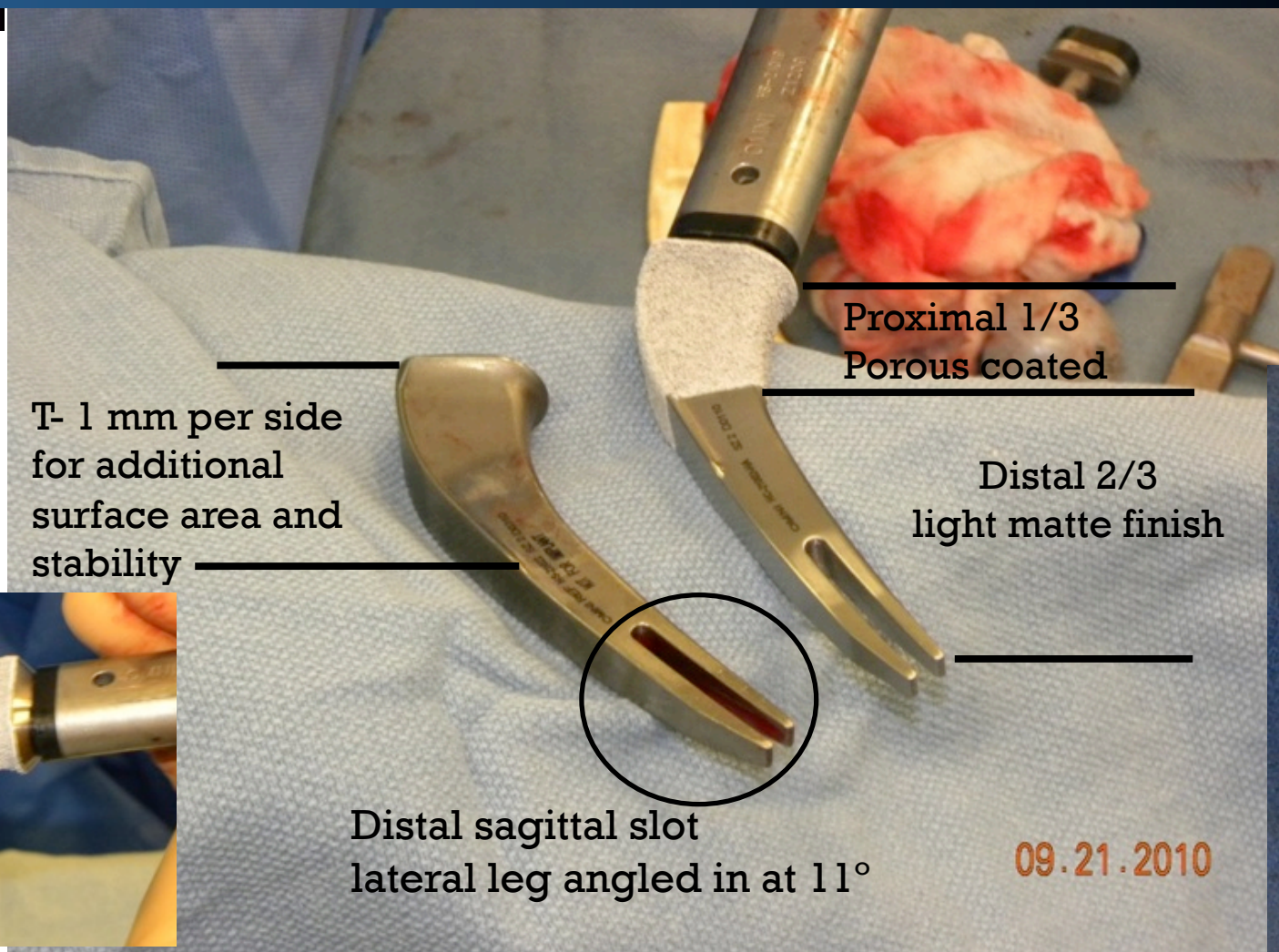
➤ Often the stem style and application of use was wrong
but the shape of the curve was and is anatomy friendly.





Porous Surface

**Pure Titanium Plasma Spray Coating (0.5 mm per side)
95% Pure HA (approximately 50 micros)
applied in secondary application**



T- 1 mm per side
for additional
surface area and
stability

Proximal 1/3
Porous coated

Distal 2/3
light matte finish

Distal sagittal slot
lateral leg angled in at 11°

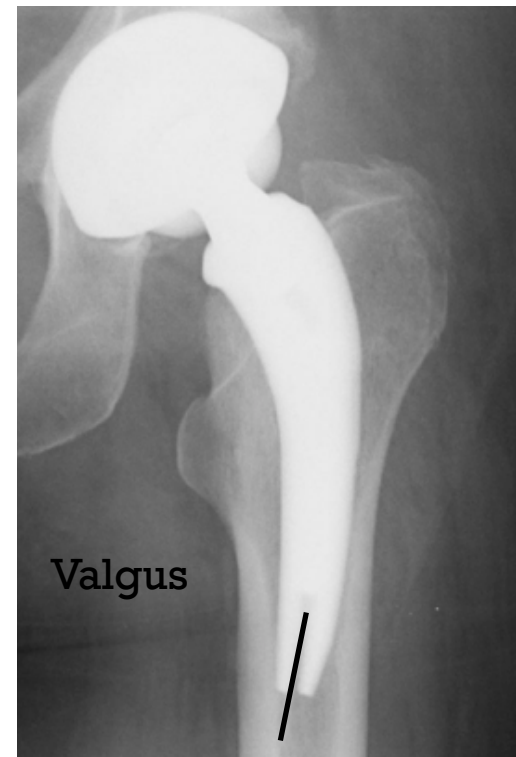
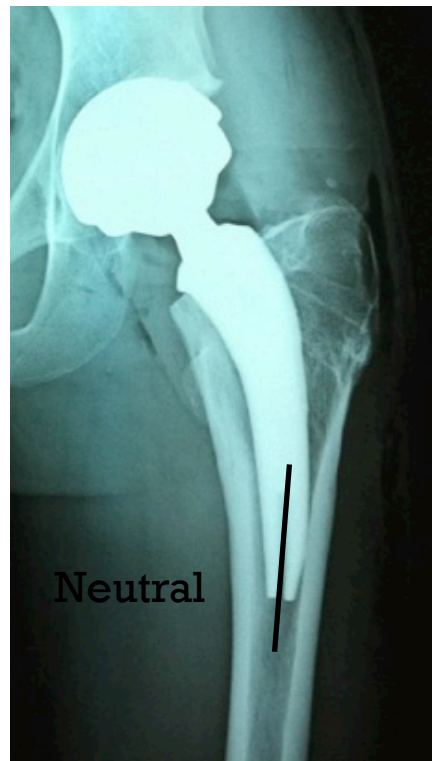
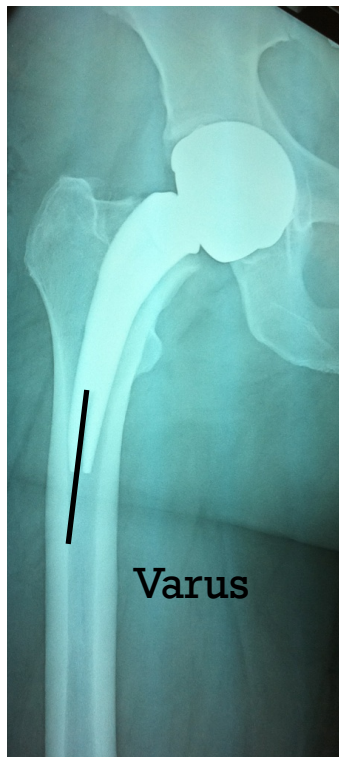
09.21.2010





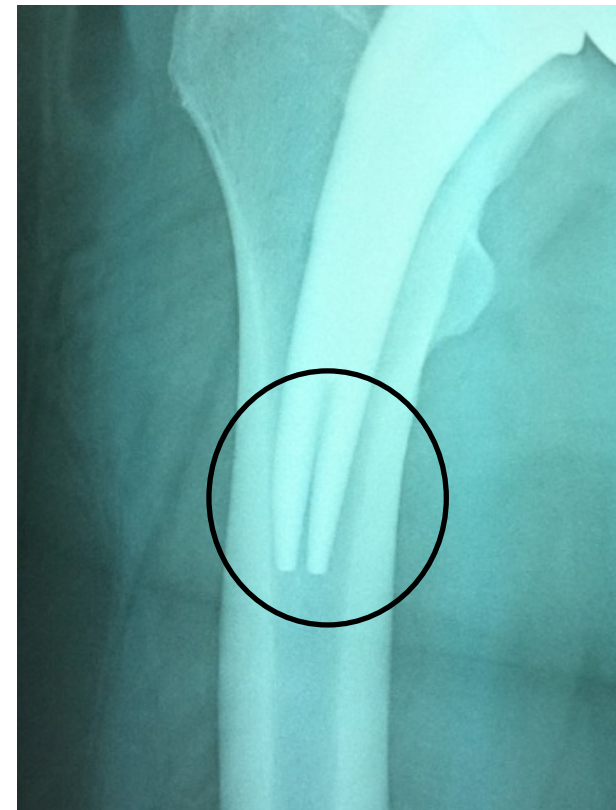
Distal Stem Features

➤ Short curved stems don't seem as sensitive to stem position as standard cementless or cemented stems

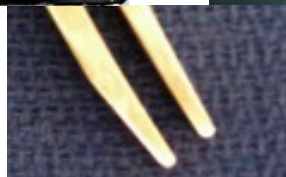




Distal tip angle reduces edge contact



➤ Distal slot reduces stem stiffness
and reduces potential distal load
transfer

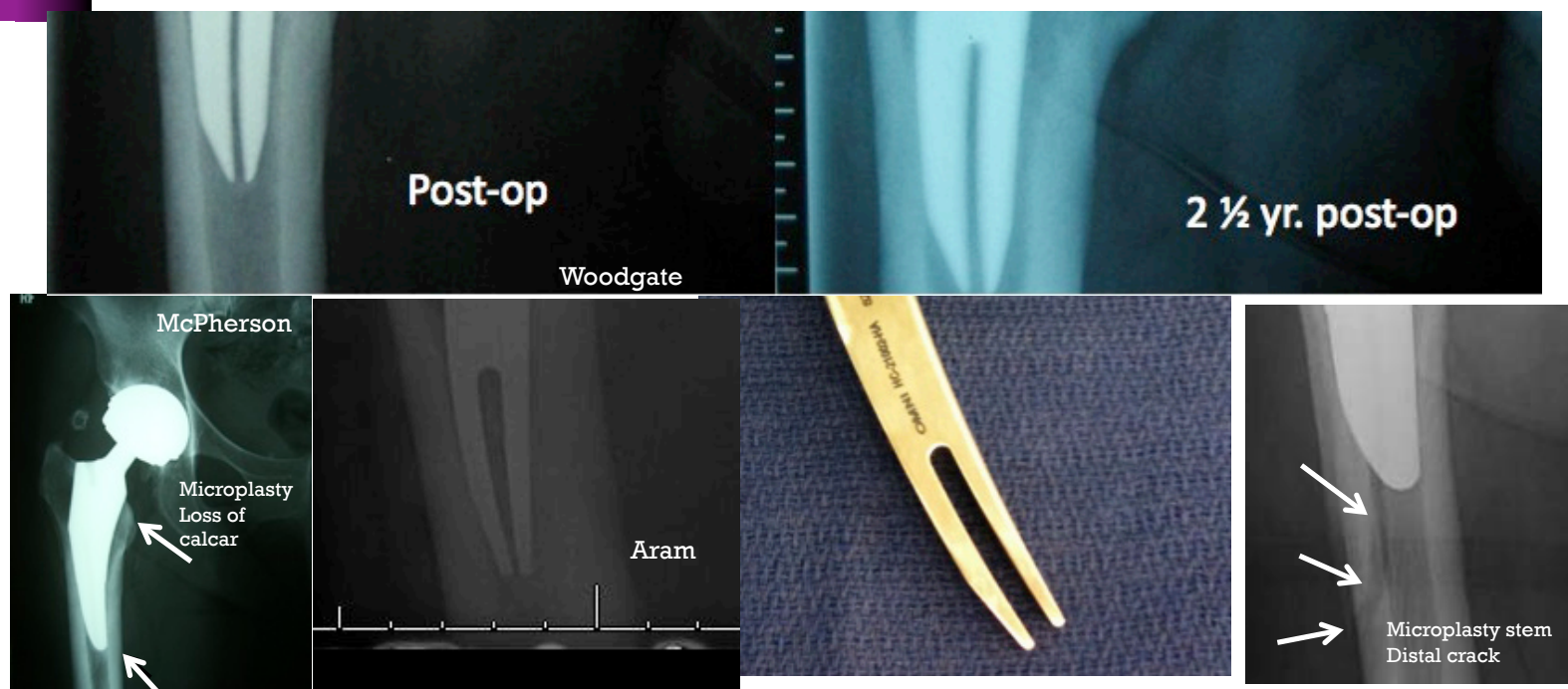


11° angle





Sagittal Distal Slot



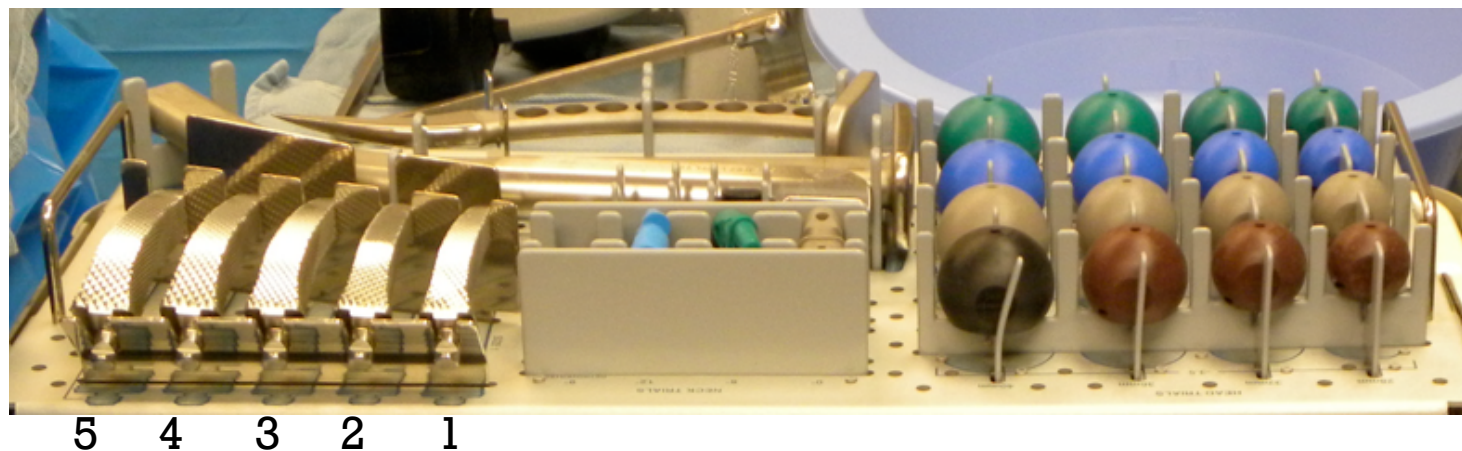
Reduces bending stiffness reducing distal load transfer
and reduces hoop tension reducing potential distal fx.



Stem Sizes

Addresses +90% of Patients

- Five stem sizes presently



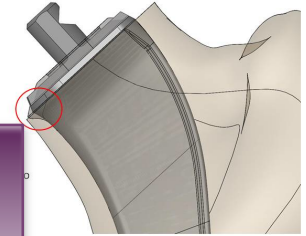
- Definitely add one size down & possible one size up to seven stems
- One tray of instruments



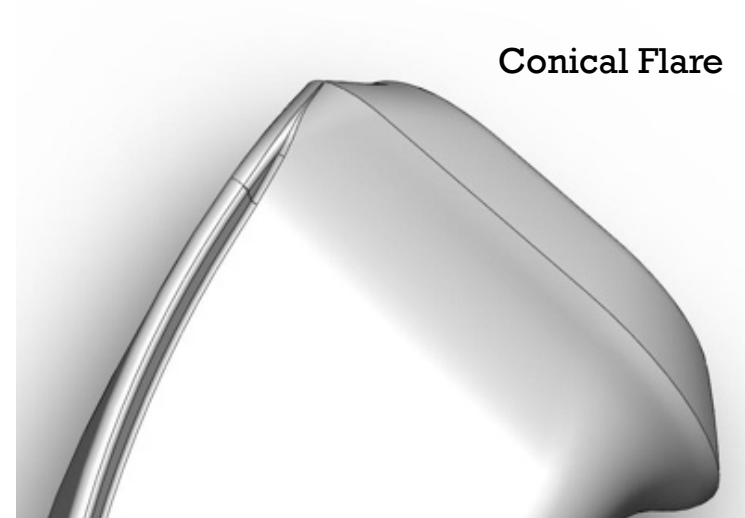
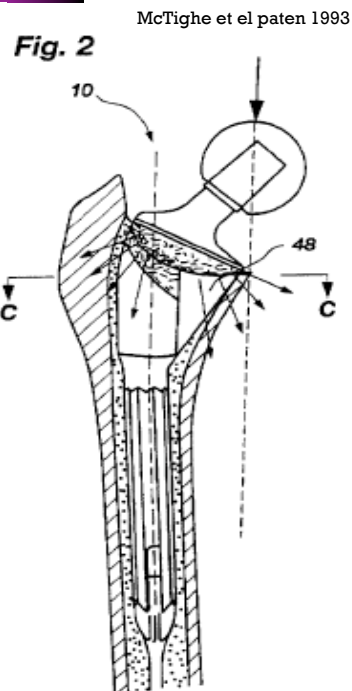


Conical Flare

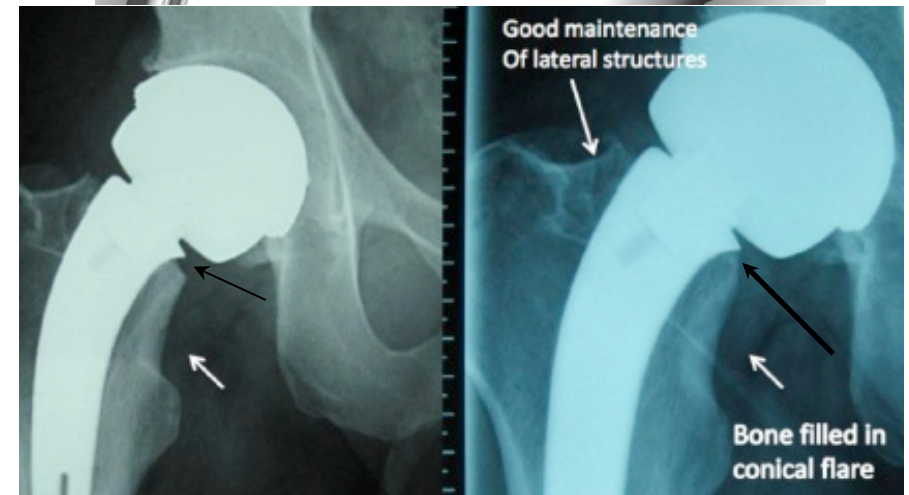
Designed off Conical Collar of 1993 design



This is the
key design
feature for
load transfer

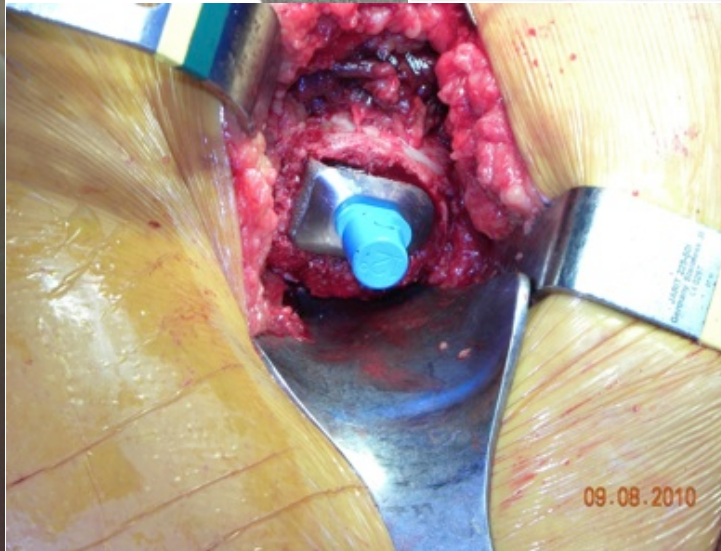
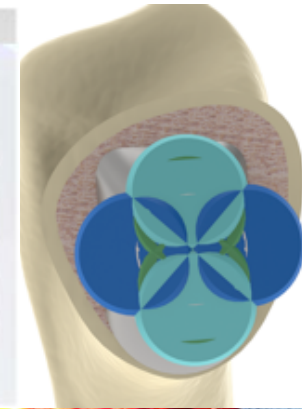
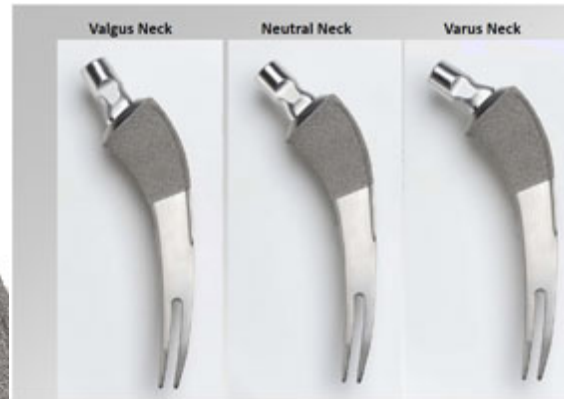


➤ Transfer of hoop tension into
compressive loads





Modular Neck (c.c.) allows for fine-tuning joint mechanics





Surgeon Decides Bearing Material





Joint Implant Surgery & Research Foundation

■ FEA Analysis of TSI™ Neck Stabilization Stem



Declan Brazil, Ph.D., Sydney, AU
Co-Director of Research JISRF

&

Timothy McTighe, Dr. H.S. (hc)
Executive Director
Chagrin Falls, Ohio

www.jisrf.org



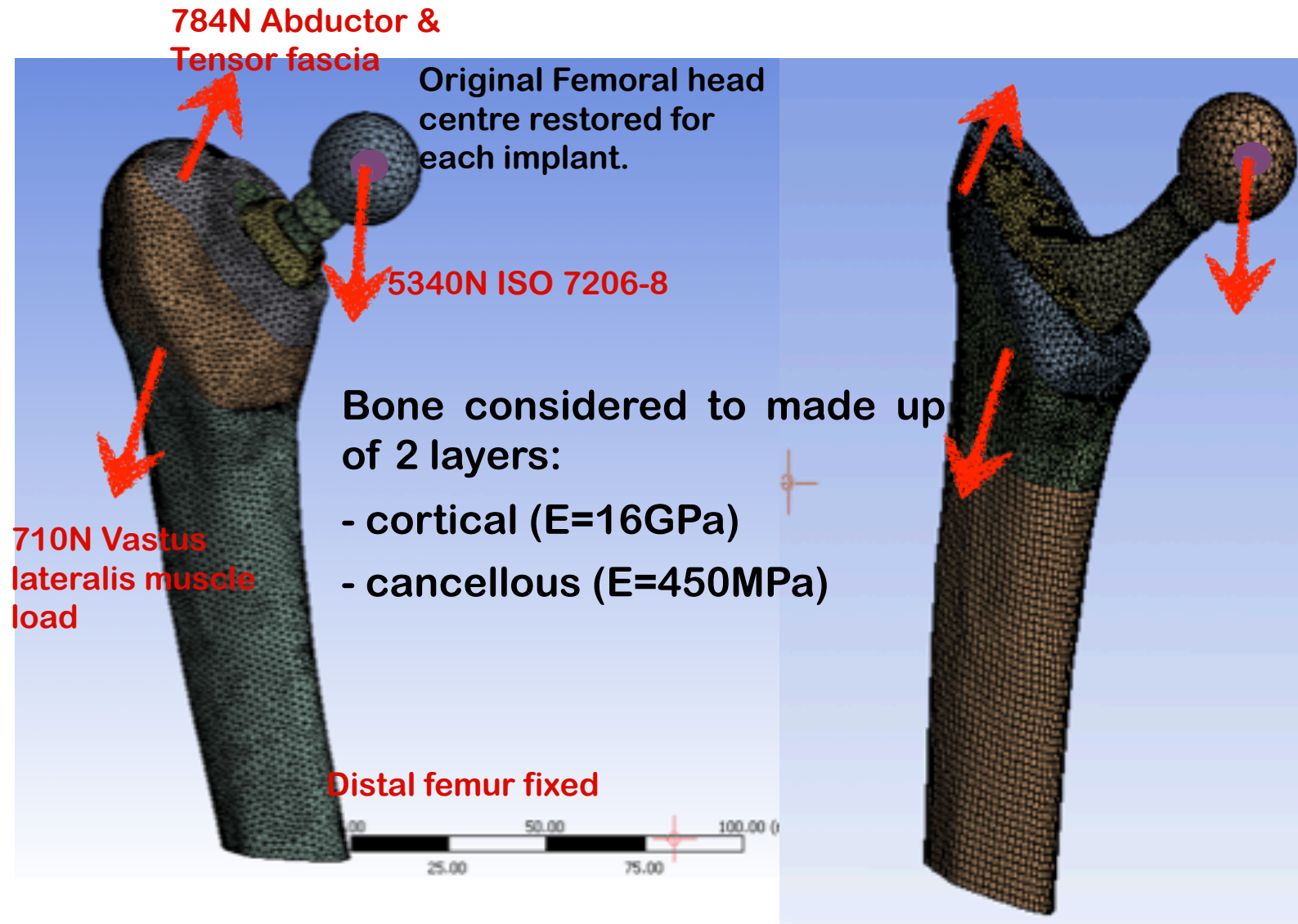
Objectives

- Compare stresses generated in conventional stem compared to neck stabilization stem when restoring same head centre.
- Compare strain in bone.
- Consider the effect of varus / valgus tilting both stem designs.



Model Setup

FEA Model





Components

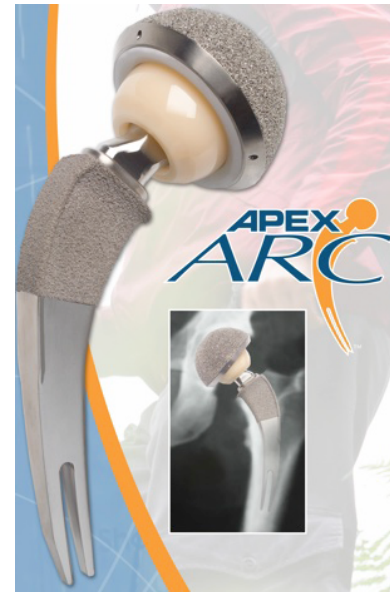
Components used to restore head centre

- TSI implant size 1 (range supplied is 1 through to 5),
- 22mm neck with +8mm head.
- Taperloc Stem Size 3, high offset with +8mm head.

Both Stems have Plasma coated proximal bodies and uncoated distally. Both implants were bonded to bone in coated region and frictionless conditions of remaining part of stem.

Implant Materials:

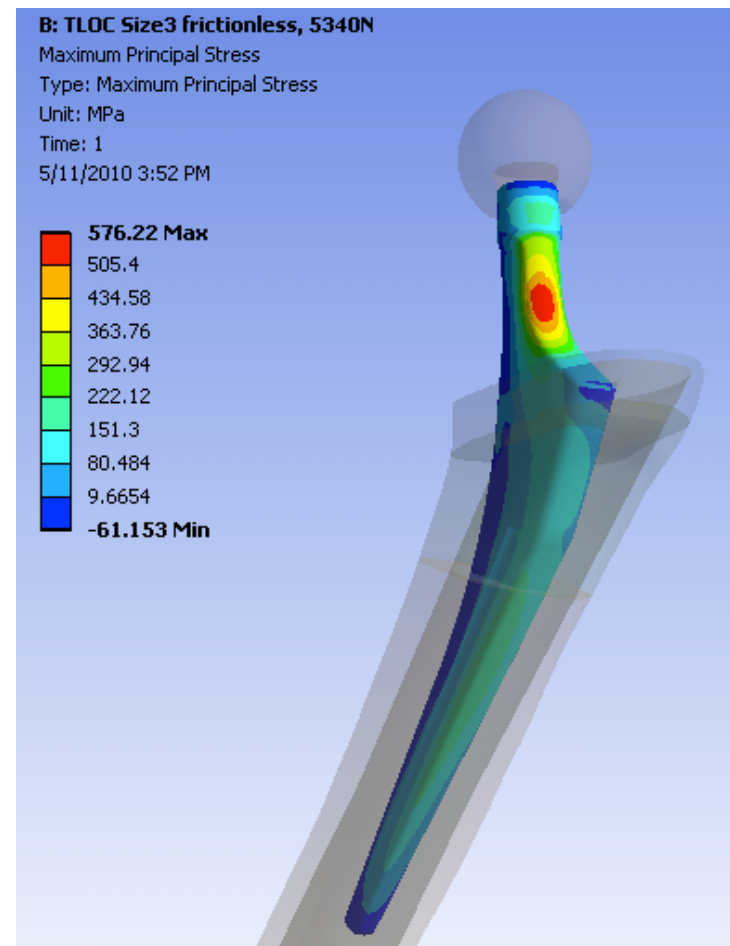
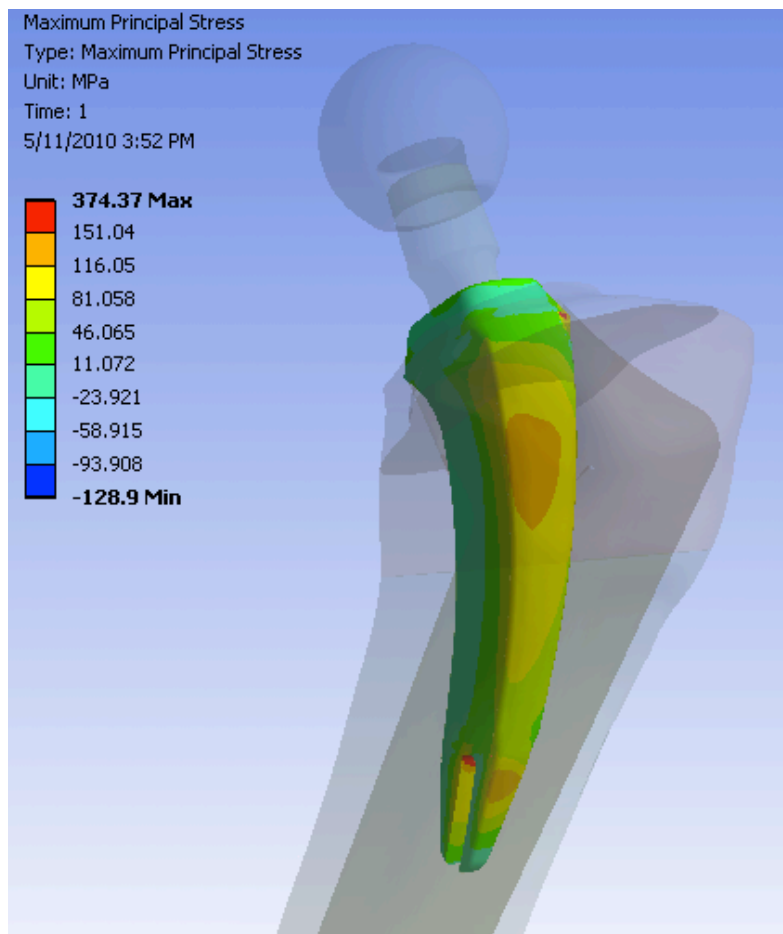
- Neck Stabilization implant
Titanium Stem, CoCr Neck.
- Conventional Stem,
Monoblock Titanium





Stress in Stem

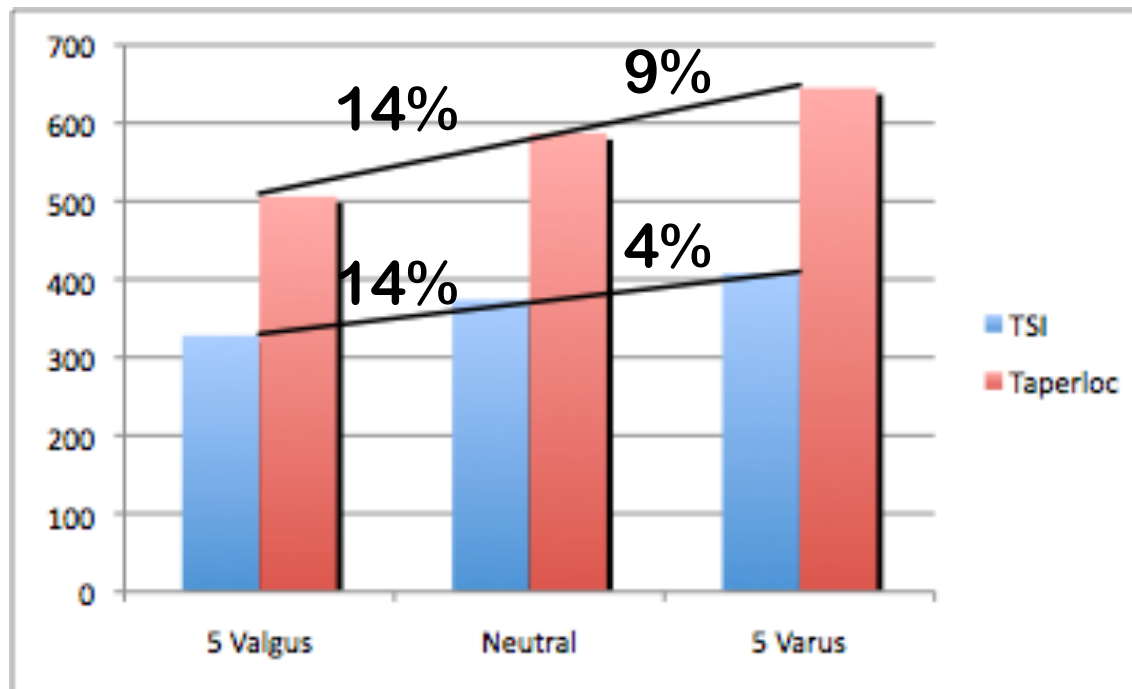
 The maximum principal tensile stress in the neck stabilization stem was 35% less than that of the monoblock design.





Stress in Stem

- The effect of Varus tilting Stem was much less for the neck stabilization stem compared to the monoblock design.





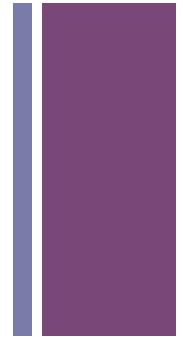
Head Center



**5 tilt shifts head
centre 1.8mm**



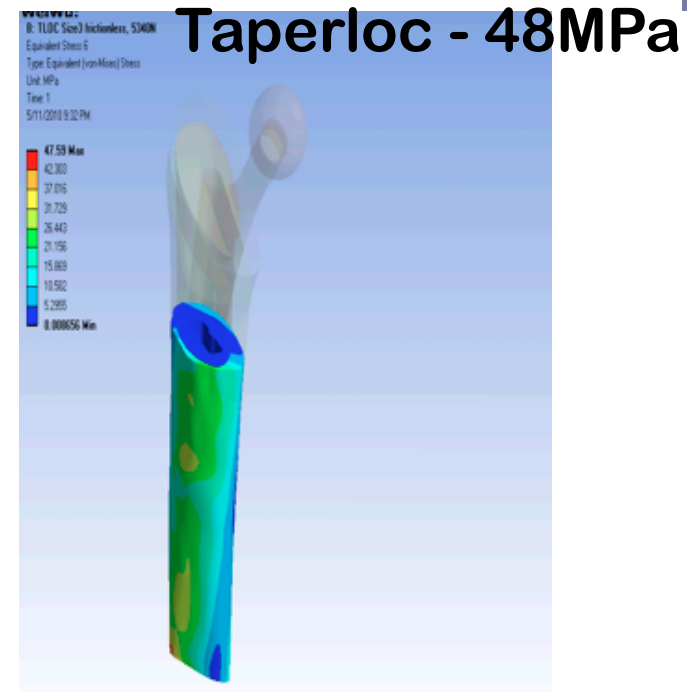
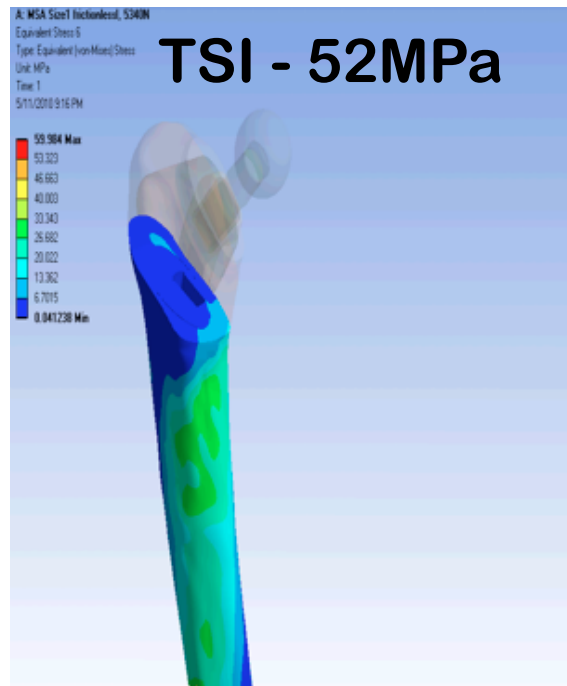
**5 tilt shifts head
centre 2.8mm**





Stress in Femur

- The equivalent stress in the distal femur was similar for both the neck stabilization and the monoblock stem.



Stiffening effect of long stem in femoral canal is equivalent to additional structural support achieved by neck stabilization.



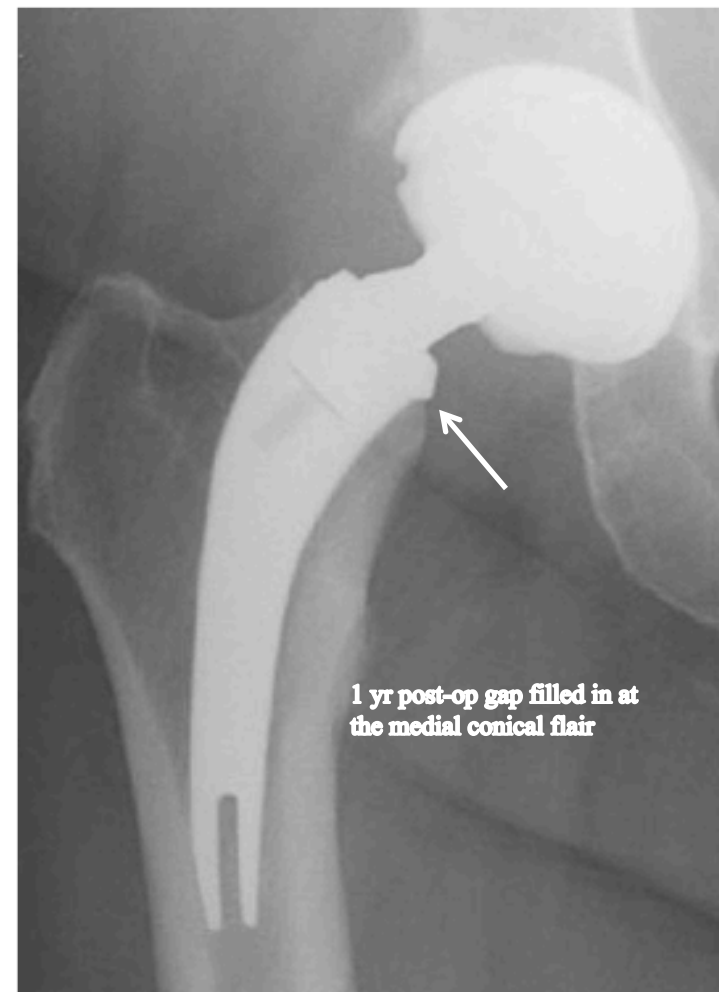
Conclusions

- Biomechanical advantage of neck stabilization stem produces lower stress in stem compared to monoblock equivalent.
- Stress in bone is comparable for both neck stabilization and monoblock design.
- Effect of varus tilting on monoblock design has more than double effect on stem stress.



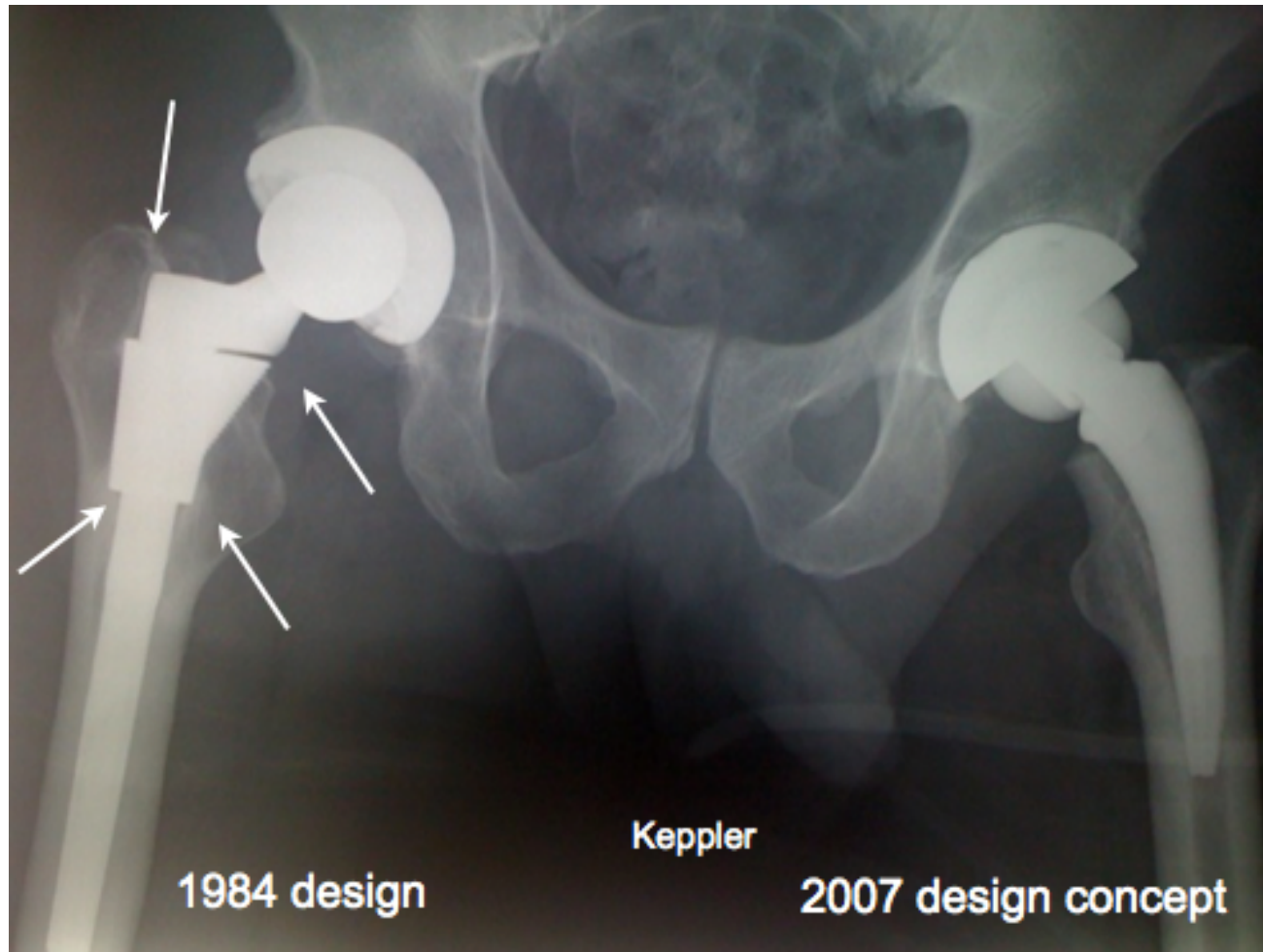
Case Examples

One year post-op John Keggi, MD



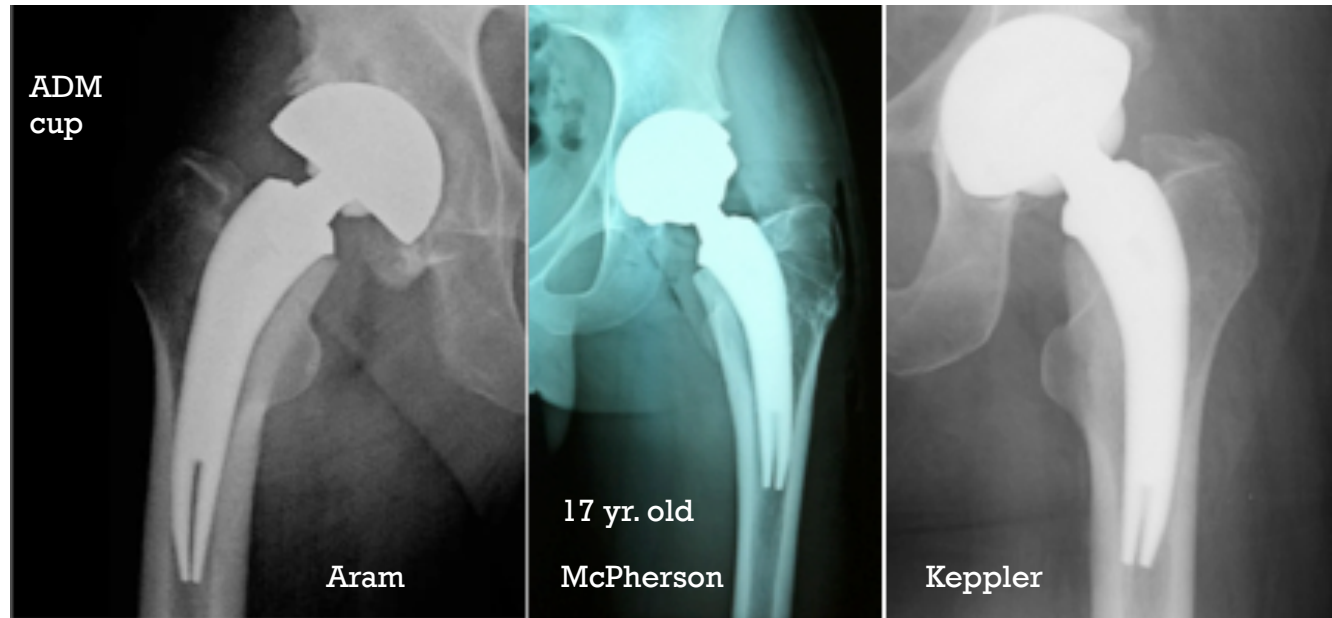


From Fit & Fill to a more conservative approach





Broader Application as compared to head stabilized devices



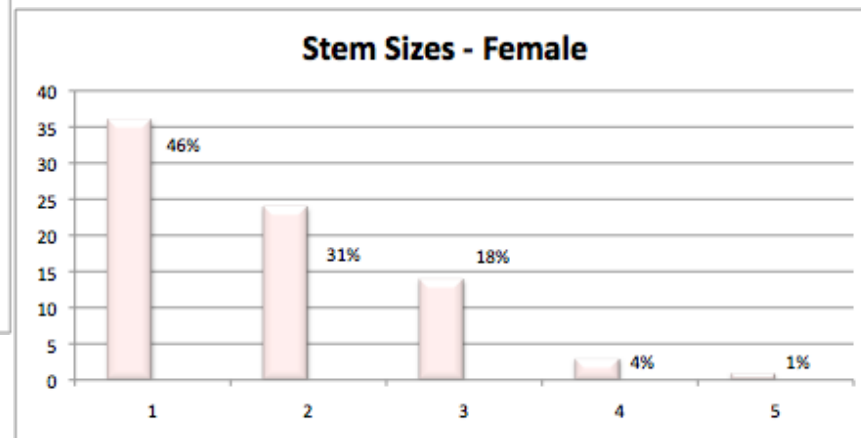
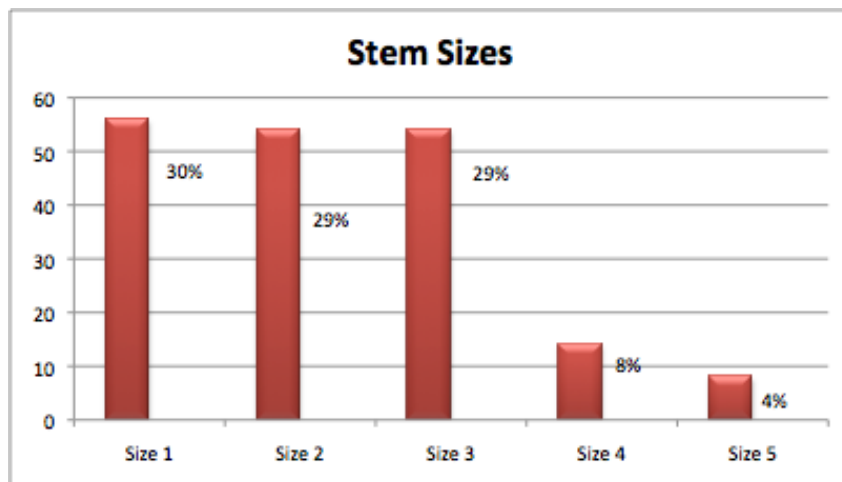
➤ Type A bone distal slot pinched in

➤ Valgus Modular
Neck Position



Stem Sizes

10% need for a smaller stem

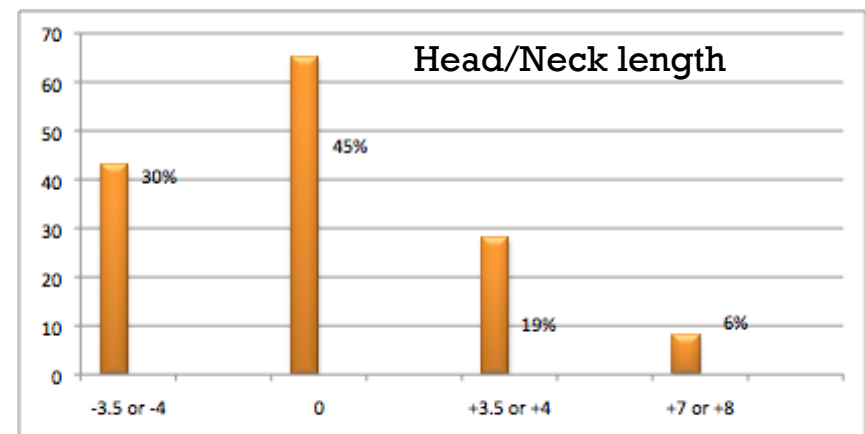
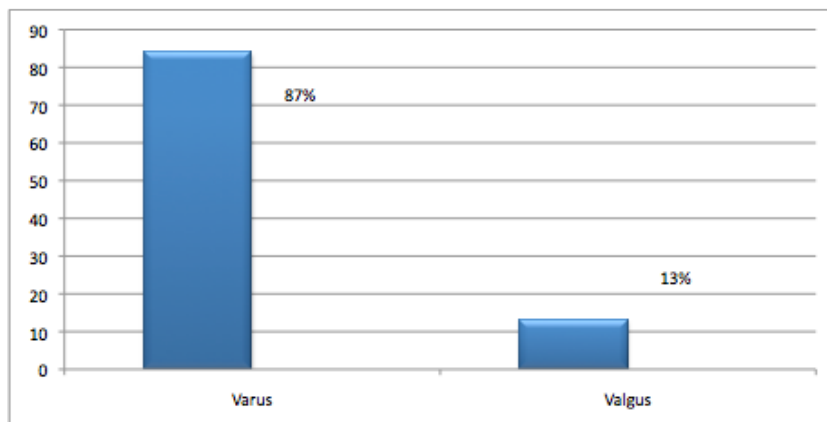
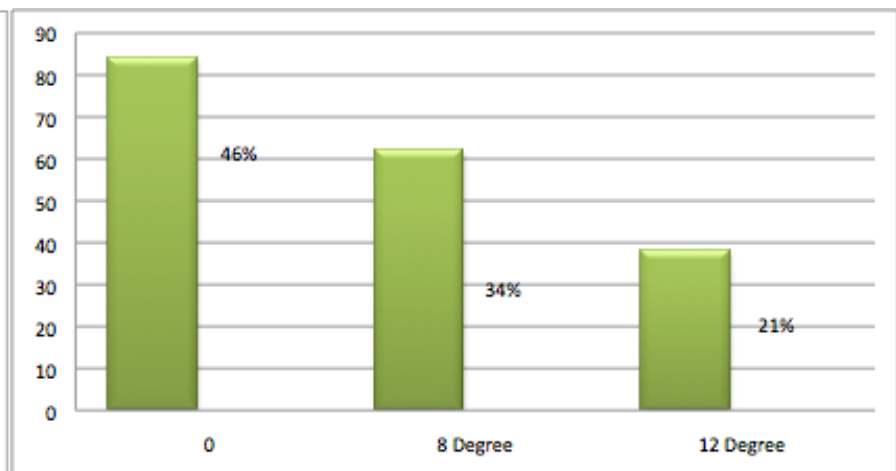
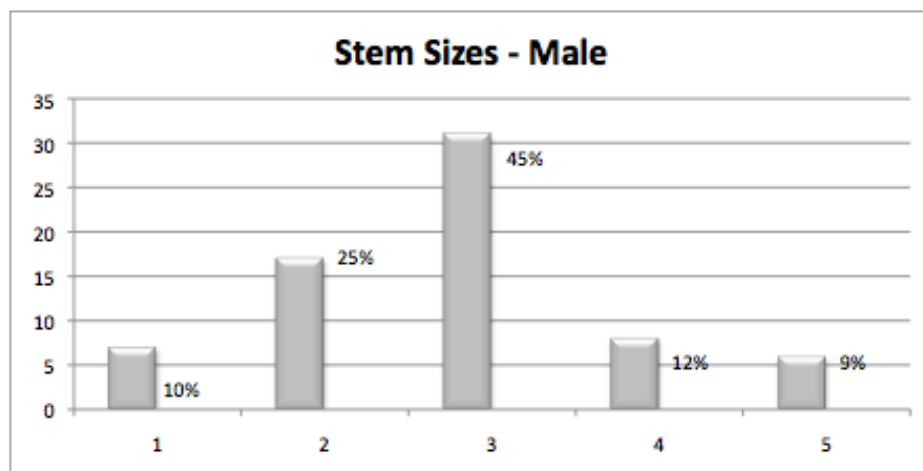


Note: 450 stems implanted in past 12 months sizing trend remains the same



Sizes Used

Necks Used

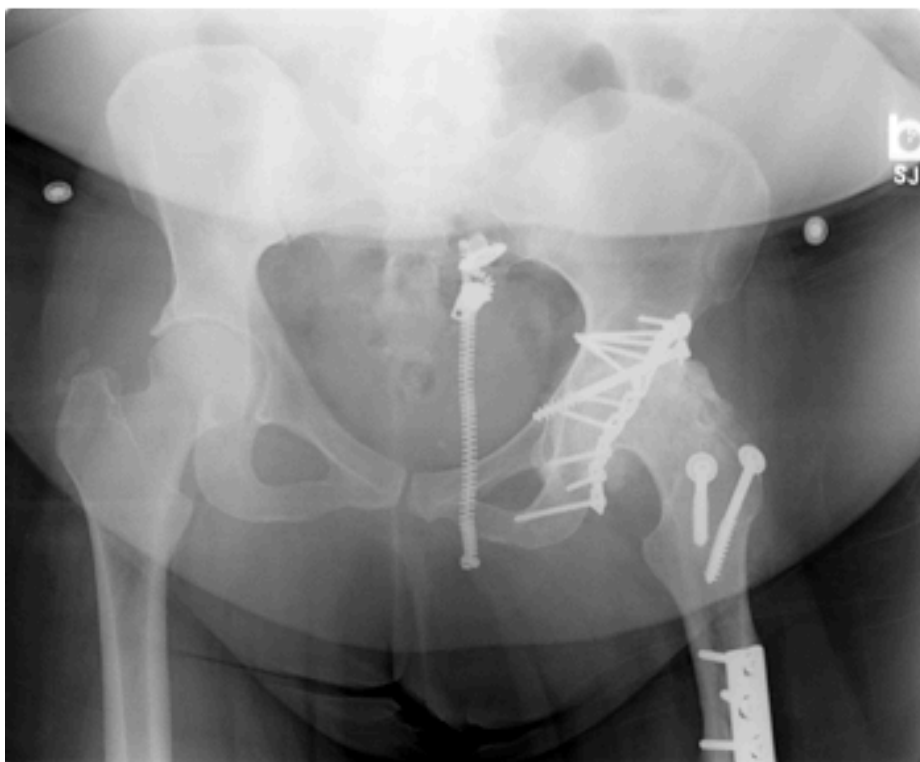


Note: 12° version being added

Note: additional 3.5 mm neck being added



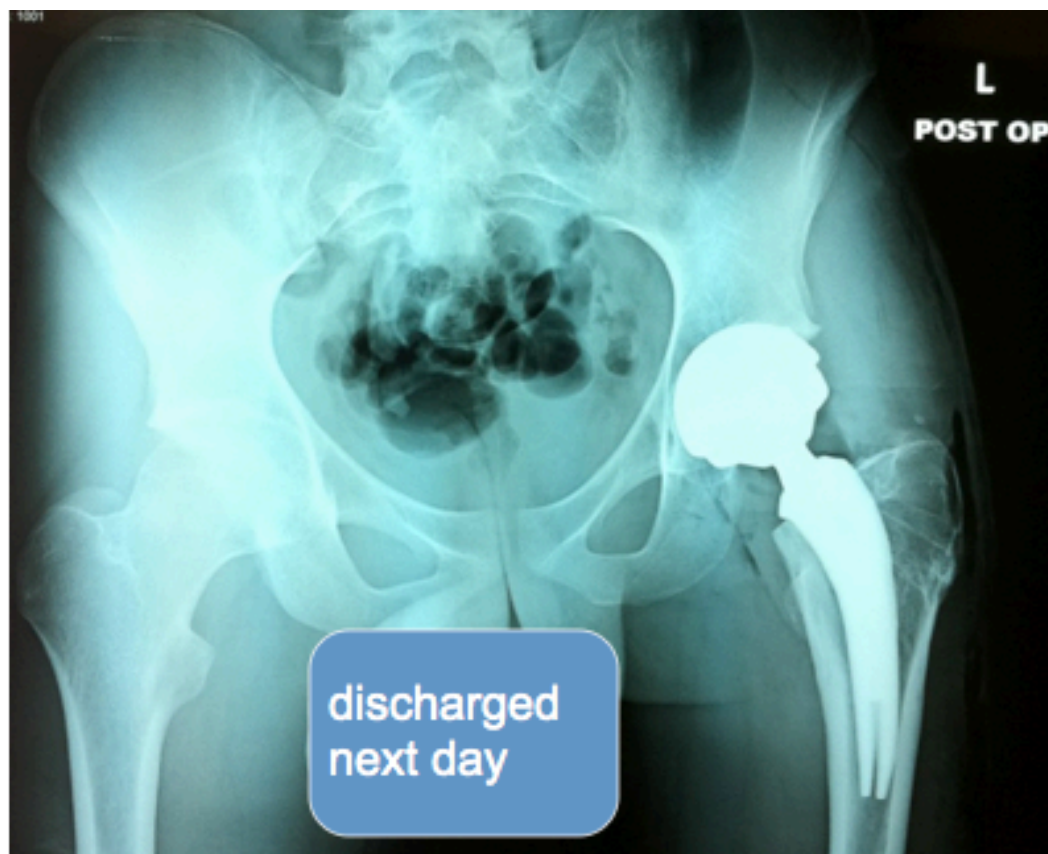
17 year post index surgery



C. Bryant



17 year old Motor cycle accident





A few calcar cracks have not been a problem



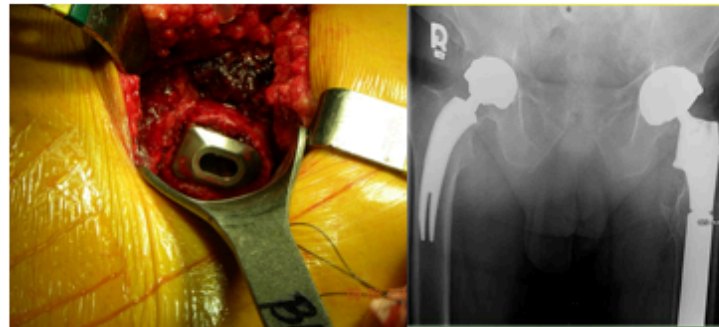
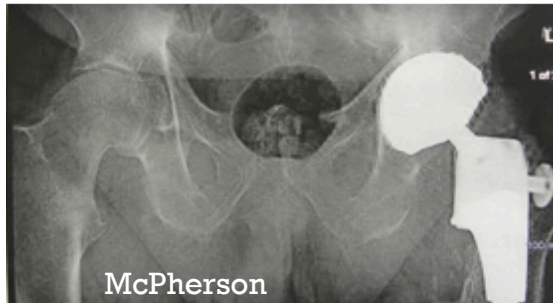
- Risk has been in small female profile need a smaller stem

- There have been no distal fx.





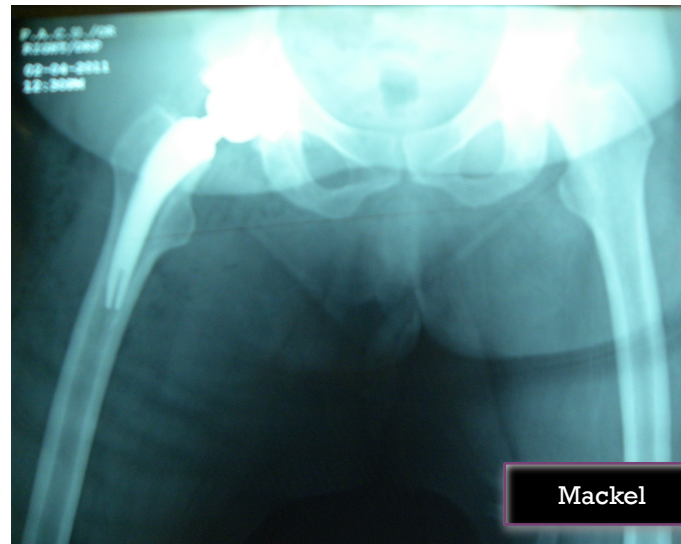
Subsidence in three cases



Note: large male first size 5 stem ever used could have taken a six. Subsided about 8 mm stabilized no additional complications

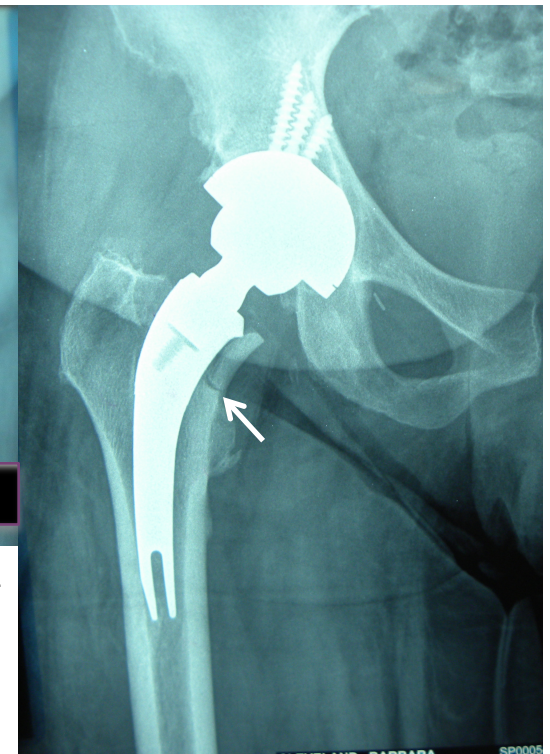
AU

One +80 year old male patient type C bone subsided 1 cm no symptoms stable and no treatment



Mackel

Note: Likely unrecognized calcar crack. Stem has subsided – stable - pain free - no treatment planned. Stem went from a slight valgus position to neutral and leg length looks better. Will this hold up?

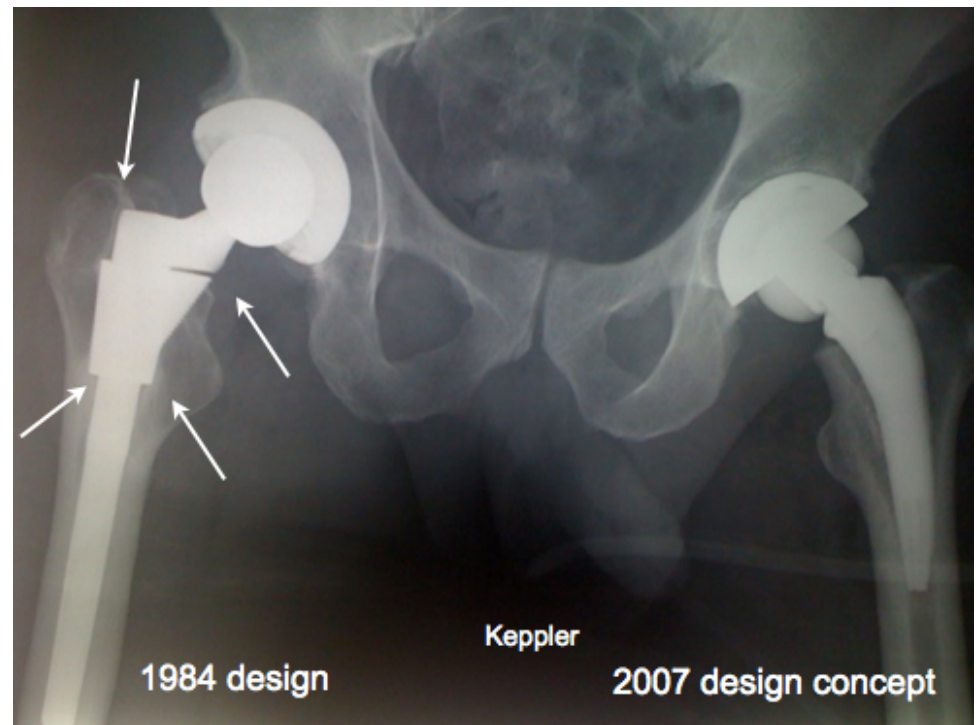




First Bilateral



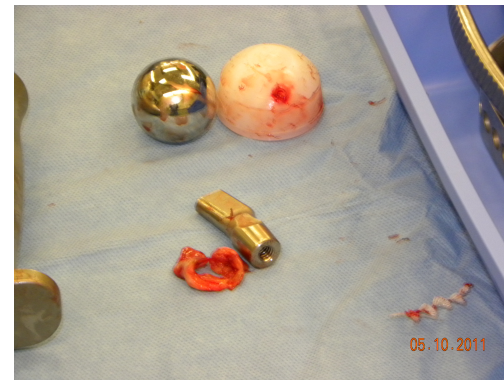
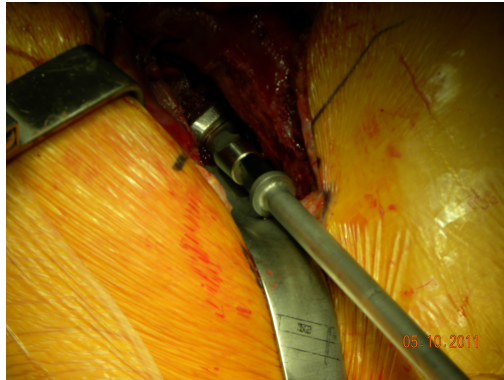
From fit & fill to a more conservative approach





Two Neck Exchanges

Keppler



Female with a posterior dislocation
Poly exchanged for a 15° and an increase in 4 mm
vertical height neck position into max 12° varus position



One major advantage to proximal modularity is improved exposure in the case of revision surgery! Keppler

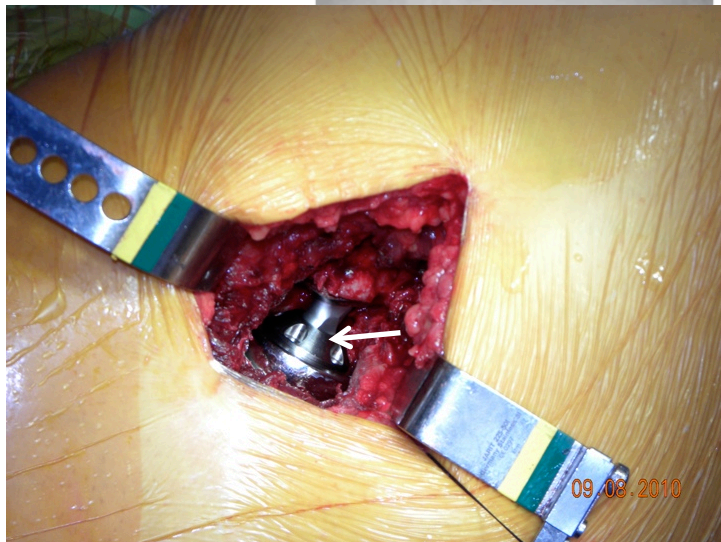
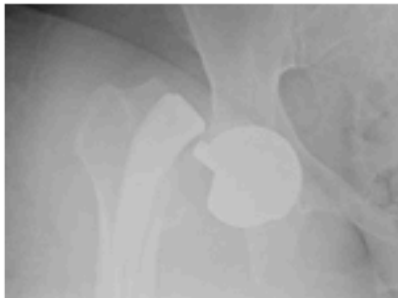


Note: At the time of surgery a large soft tissue mass was found anteriorly and was thought to be associated with bowstringing of the anterior superior capsule as an unusual consequence of the posterior capsular repair.



One case of disassociation McPherson

12/14 Euro Taper
ASTM Standard F1636



Revised to a standard Mallory/
Head primary stem

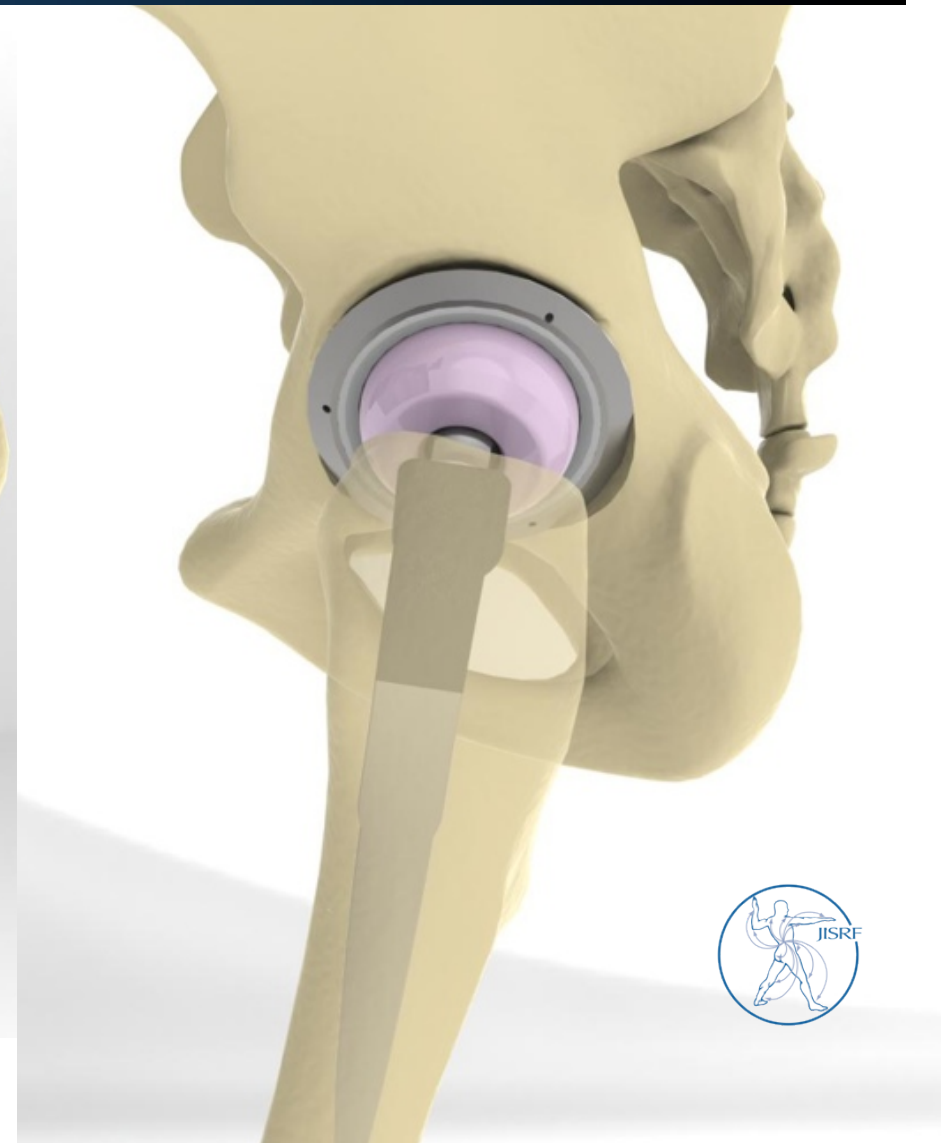
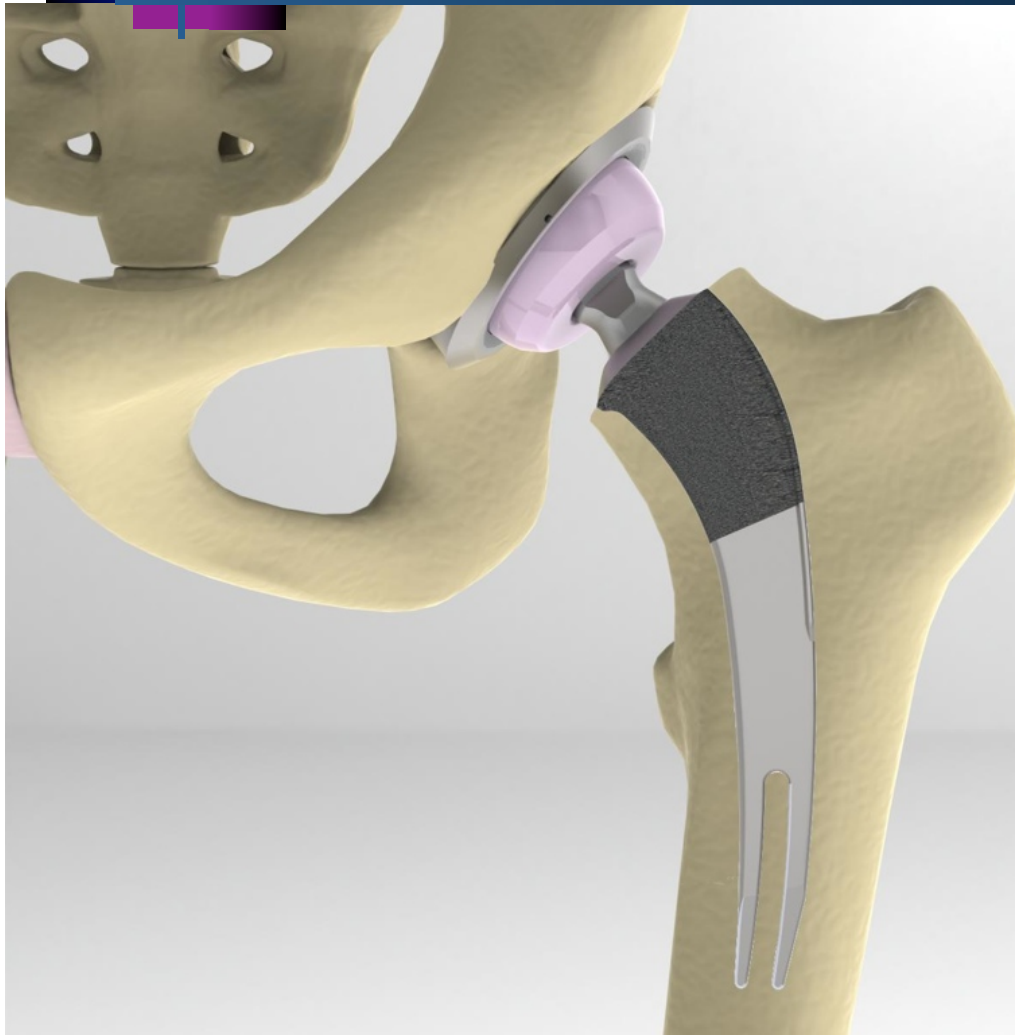
Note: Truncated skirt on head kept
taper from a solid lock



A New Approach to Stem Design for THA

-Time will tell-

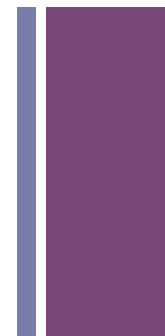
Encouraged at this point in time!





Thank You

www.jisrf.org



Joint Implant Surgery & Research Foundation
Since 1971
Dedicated to the Advancement of Total Hip, Knee, and Shoulder Surgery

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Joint Implant Surgery & Research Foundation
Total Joint Replacement Study Groups and Clinical Orthopaedic Research

JISRF specializes in clinical and surgical orthopaedic study groups, and product development for the advancement of total hip, knee, and shoulder surgery. The Foundation has a long rich history in the area of total hip, total knee, patella-femoral and total shoulder reconstructive surgery.

Continuing this tradition, JISRF efforts have included design, development, consultation, education, and promotion of both implants and surgical techniques. Over the past 35 years, JISRF has worked with numerous orthopaedic companies, and many institutions in the area of education, product design, mechanical testing, and clinical / surgical research.

Clinical / Surgical Study Groups
Product Development
Education & Communication

JISRF Founder Professor Charles O. Bechtol, M.D.
Formed in April, 1971, the mission for the Foundation has remained the same:
The specific and primary purposes are to operate for scientific purposes by conducting medical research of improvements in medical and surgical methods and materials for preserving and restoring the functions of the human body joints and associated structures which are threatened or impaired by defects, lesions or diseases.

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JISRF STUDY GROUP Tissue Sparing Implant™ (TSI™) Total Hip Stem Designs

Tissue Sparing Total Hip Arthroplasty Study Group

The Joint Implant Surgery and Research Foundation has a long history in the study of THA. It began back in 1971 when Professor Charles O. Bechtol, M.D. established JISRF as a nonprofit scientific and educational foundation.

JISRF continues this study with the formation of a new study group of international surgeons and scientists. Findings will be posted on the foundation's web site at www.jisrf.org.



Surgeons interested in learning more contact the Executive Director at www.JISRF.org

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