



Joint Implant Surgery
& Research Foundation



AOA 2012 Annual Scientific Program

Dedicated to the Advancement of Total Hip Arthroplasty • Since 1971

The First 1,200 (1,790 updated May 2010 to Sept 2012) **U.S.A.** **Short Curved Neck Sparing Stems** **- Clinical / Surgical Observations-**

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and

TSI™ Study Group Members

www.jisrf.org



JISRF

Non Profit established in 1971 by Professor Charles O. Bechtol, MD



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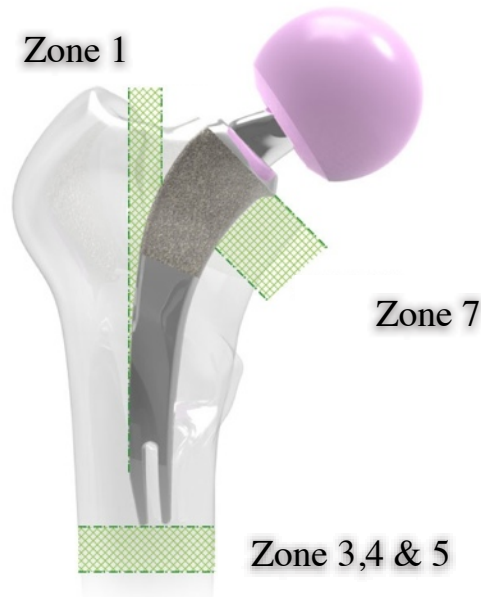
Declaration of Interest

I declare that in the past three years I have: Timothy McTighe

- held shares in: CDD, LLC; Omnilife Science, J&J, Zimmer
- received royalties from: CDD, LLC; Omnilife Science, GOT
- done consulting work for: Omnilife Science
- given paid presentations for: Omnilife Science
- received institutional support from 1971: + 30 companies
posted on web site: www.jisrf.org

Signed:

Short Curved Neck Sparing (Neck Stabilized) Stem



Design Goals

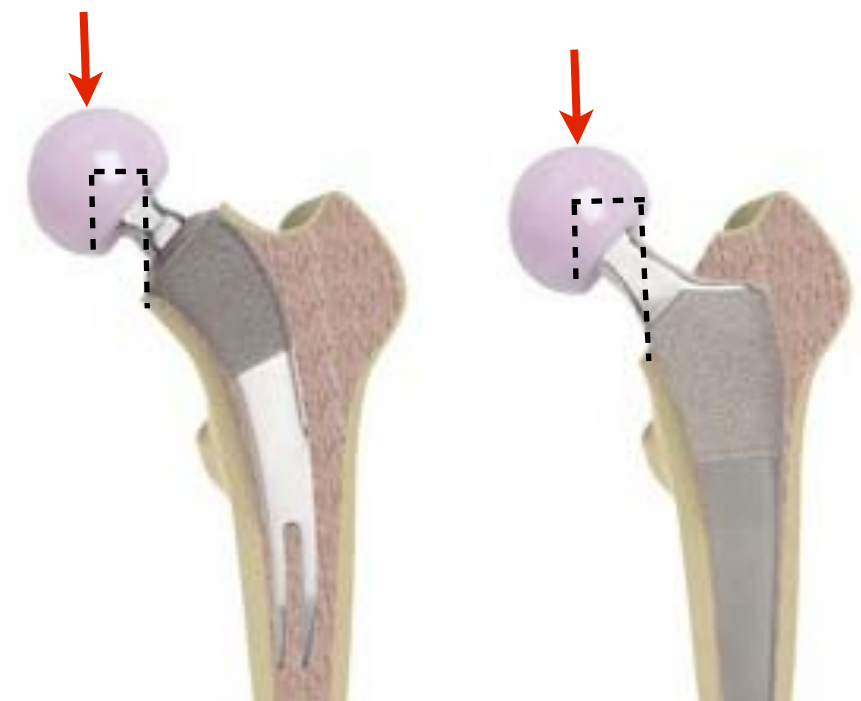
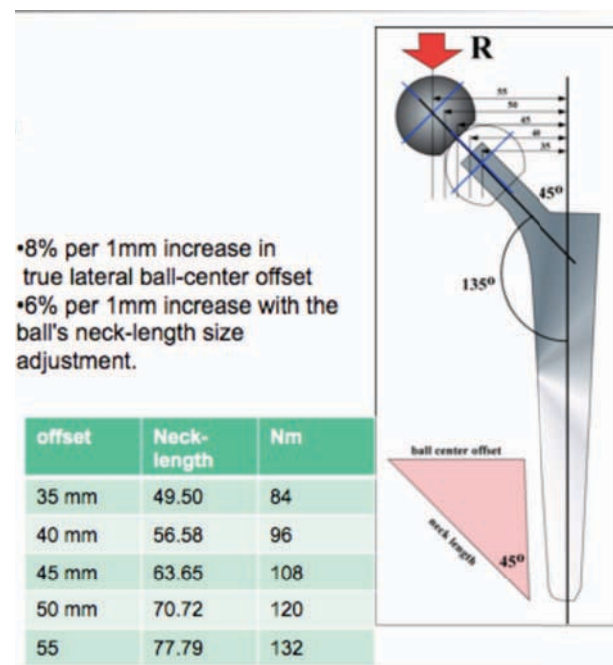
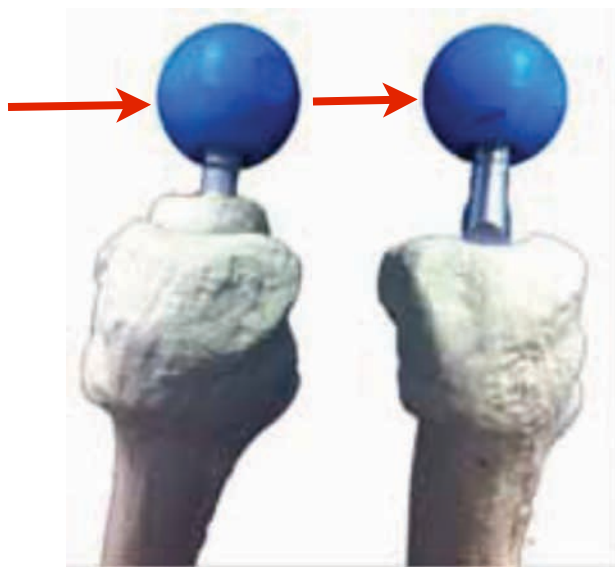
- Save both Hard & Soft Tissue
- Improve on Axial & Torsional Stability
- Reduced OR time & blood loss
- Works with all surgical approaches
- Requires less mobilization of the femur in the direct anterior approach
- Works in all type of bone
- Quicker Rehab
- Easier Explantation & Conversion
- Less inventory cost



**No need
to go
lateral**

Why Save the Neck? Freeman 1986 BJBJS

➤ Retention of the femoral neck reduces both torsional moment and axial moment at the stem bone interface (Shorter Fulcrum / Cantilever)



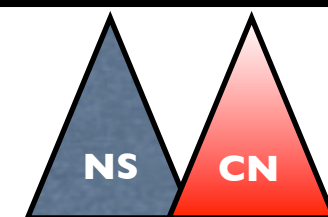
NS

CN

1mm increase in femoral offset increases torque by 8%

1mm increase in head/neck length increases torque by 6%

The support on which a lever pivots



Fulcrum

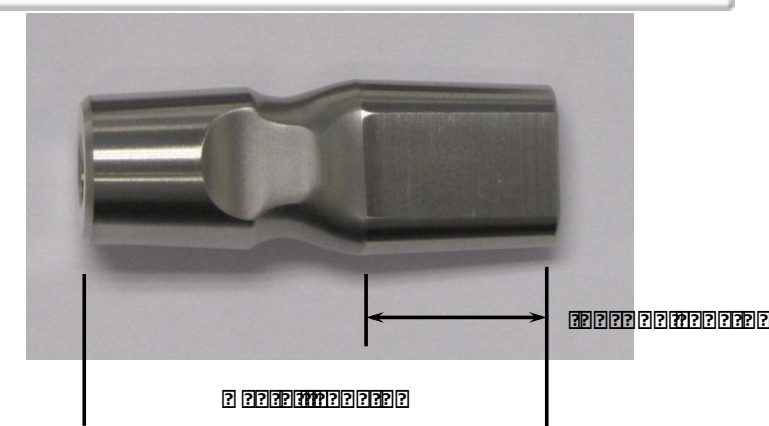
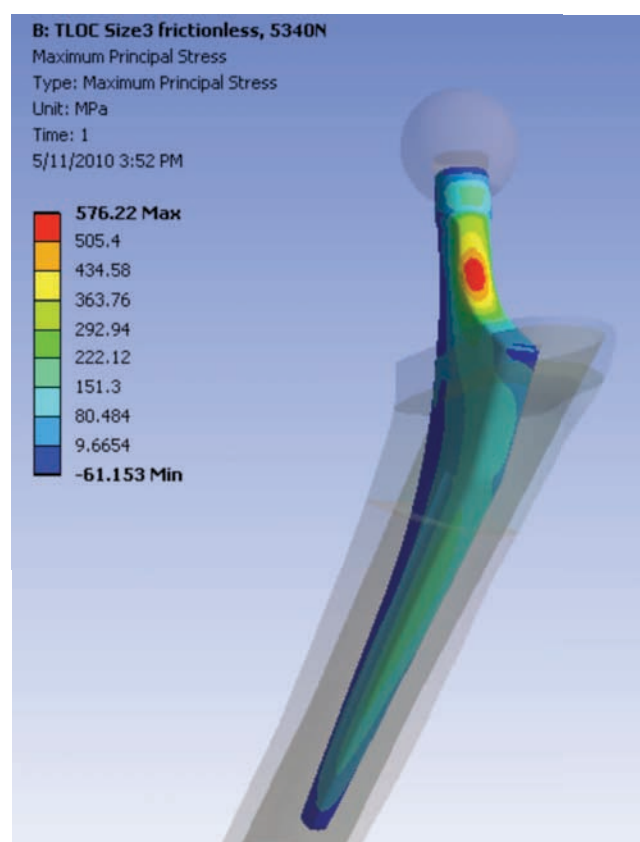
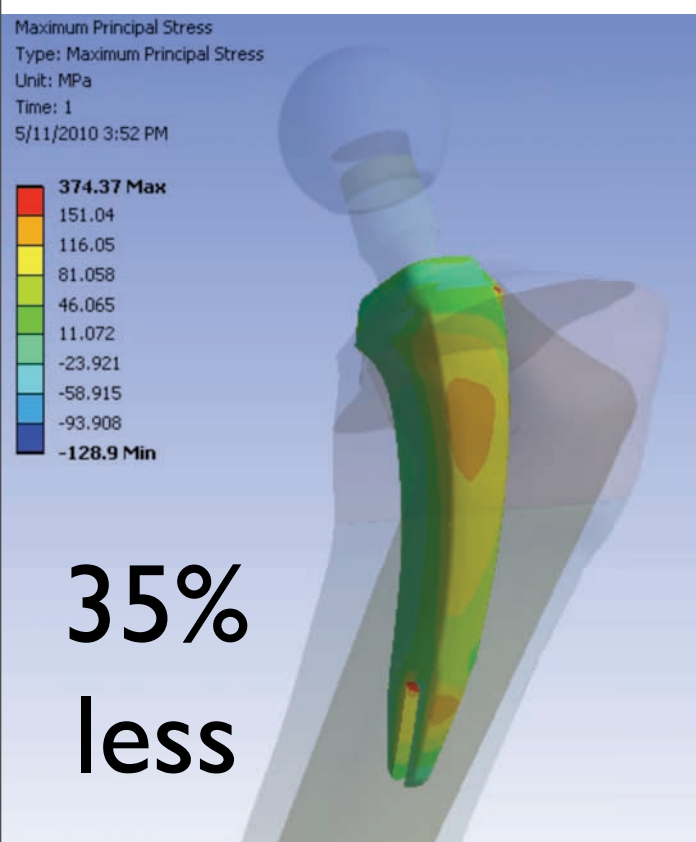
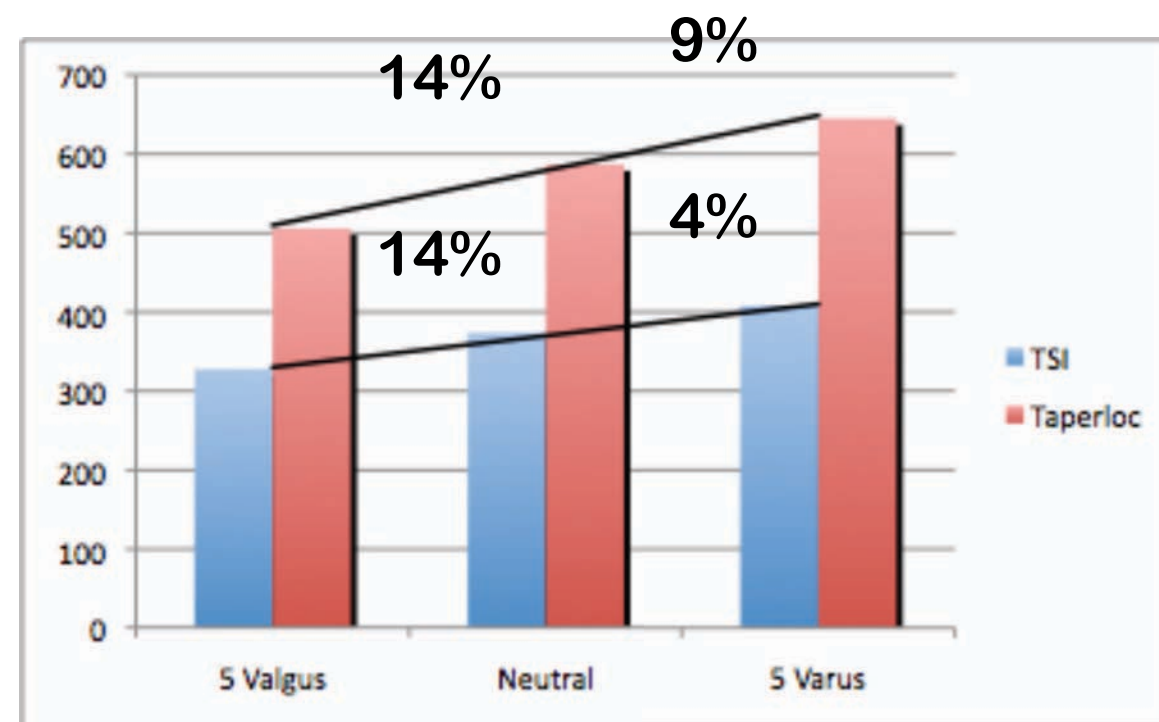
Reduced Stress in Stem

➤ Looking at failure mode

Neck sparing feature & C.C. material has basically eliminated potential fatigue failure of the neck.

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

➤ The effect of Varus tilting of the Stem **was much less for the neck sparing stem** compared to the monoblock design.



Implant Design

Key Design Features



Medial curve hugs the anatomy

Proximal Coating

Commercially pure titanium plasma spray provides immediate press-fit fixation.

Hydroxyapatite coating on top of the plasma spray intended to enhance early fixation.²

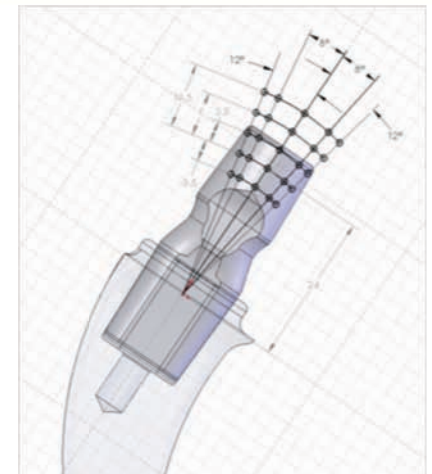
Modular Necks
Manufactured from wrought Cobalt Chromium. The use of modular necks allows intra-operative adjustment of joint stability, leg length, offset, and version.

Lateral T Flange™

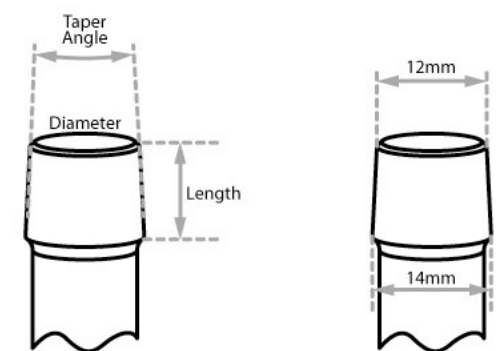
This unique feature is designed to enhance rotational stability of the stem.

Trapezoidal Stem Shape

The ARC's trapezoidal stem shape is designed to provide rotational stability.



Taper Terminology



ASTM standard for the Cone is size N listed as 5° 40', +2.5' -0' or 5° 40 minutes + 2.5 minutes, -0 minutes

Stem Design



Conical Flare

Engages the medial calcar.



Curved Femoral Stem

Manufactured from forged titanium (Ti-6Al-4V). The curvature of the femoral stem is designed to engage the calcar medially and avoid invading the trochanteric area laterally.

Proximal Conical Flare

Designed to enhance initial stability of the implant, load the medial calcar, and resist subsidence.

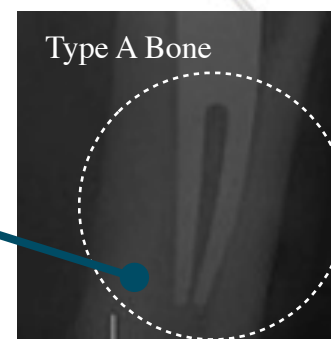
Lateral Relief

The lateral side of the distal stem has an angled relief cut designed to aid in stem insertion and to reduce the occurrence of the distal stem contacting the posterior cortex.



Sagittal Slot & Polished Distal Surface

The polished surface aids in avoiding bony fixation to the distal stem. The slot reduces the bending stiffness of the distal stem. Clinically this may result in reduced stress-shielding and a lower incidence of thigh pain.



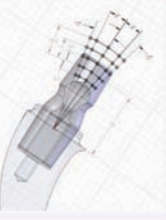
Type A Bone



No distal bone fixation



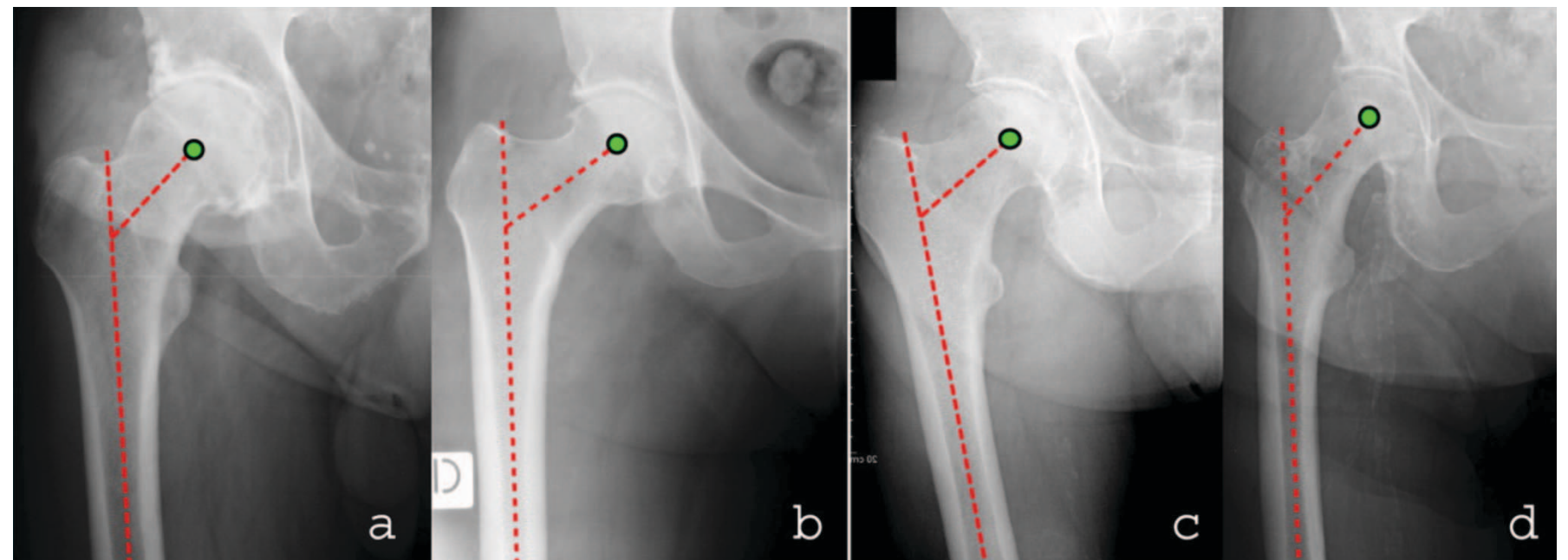
Neck Modularity



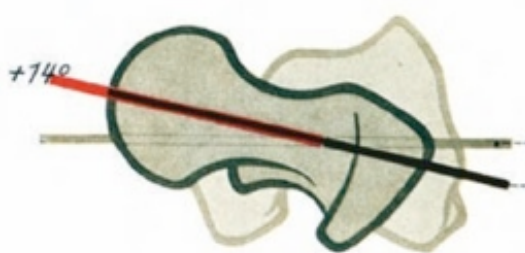
Controversial

Monoblock Hip Stems are Based on
Proportionality of Design

➤ As the stem gets bigger, the neck gets longer



Difficult to restore these anatomies commonly seen in primary arthritis patients using a monoblock stem:



a: large canal, short neck, low offset

b: thin canal, long neck, high offset

c: large canal, short neck, high offset

d: thin canal, long neck, low offset

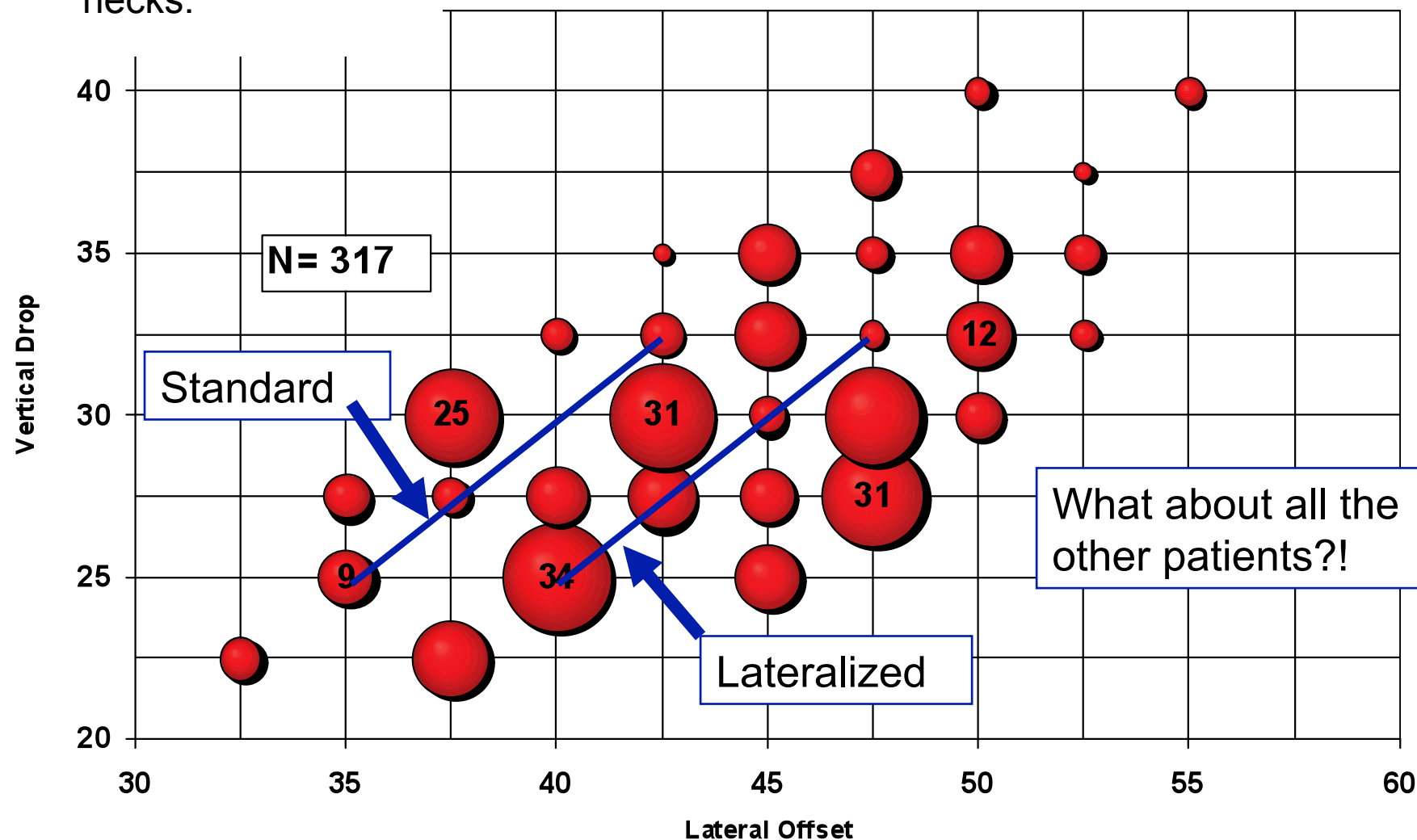
AAOS Scientific Exhibit 2006

“Target Restoration of Hip Mechanics in THA” by Tkach, Low, Cipolletti & McTighe

A conventional stem may have two necks:

Head Positions 11.5 mm Stems

(Encore Linear/Accolade)



➤ The head center location data clearly shows that a wide variety of offsets and lengths are required to properly balance the soft tissues.

➤ There is little correlation between head center and stem size.

➤ A significant number of small stem diameters (10 or 11.5 mm) required large >45 mm femoral offsets.

Design Inputs - Modular Neck Concerns

Fatigue Failure of Modular Neck - Wright Medical

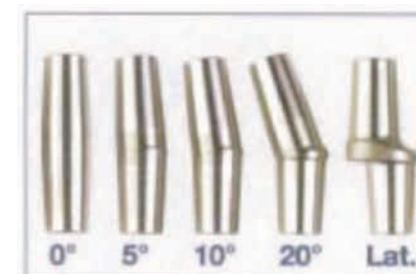


Significant Current Concern - Corrosion / Metal Debris Issue



Concern

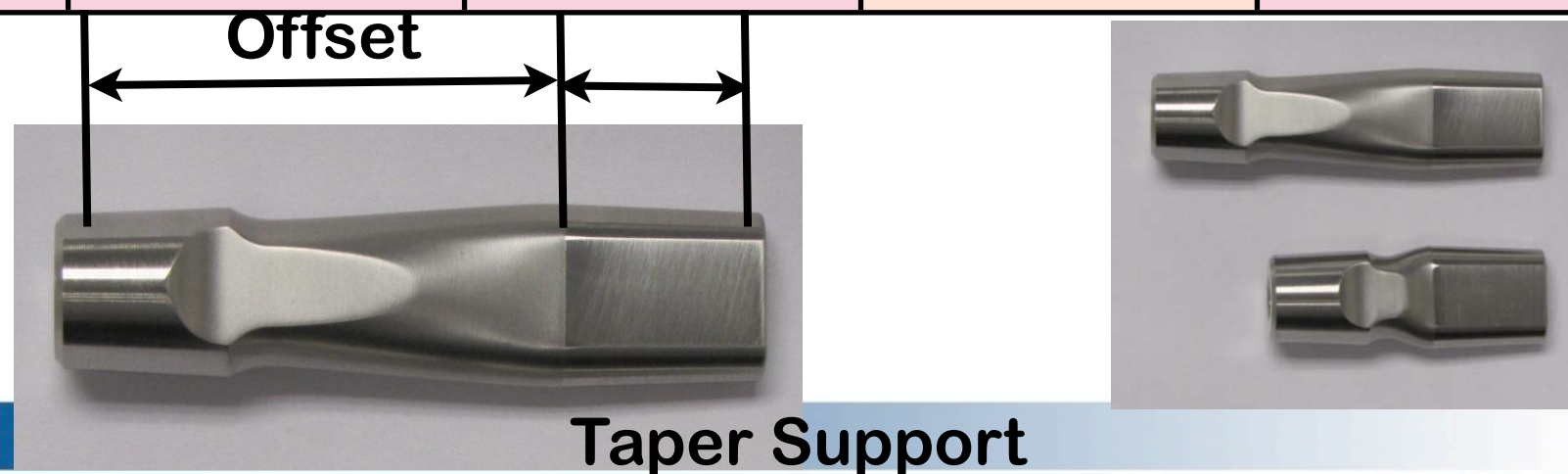
- > Short Taper ratio
- > Shot Peening of taper surface



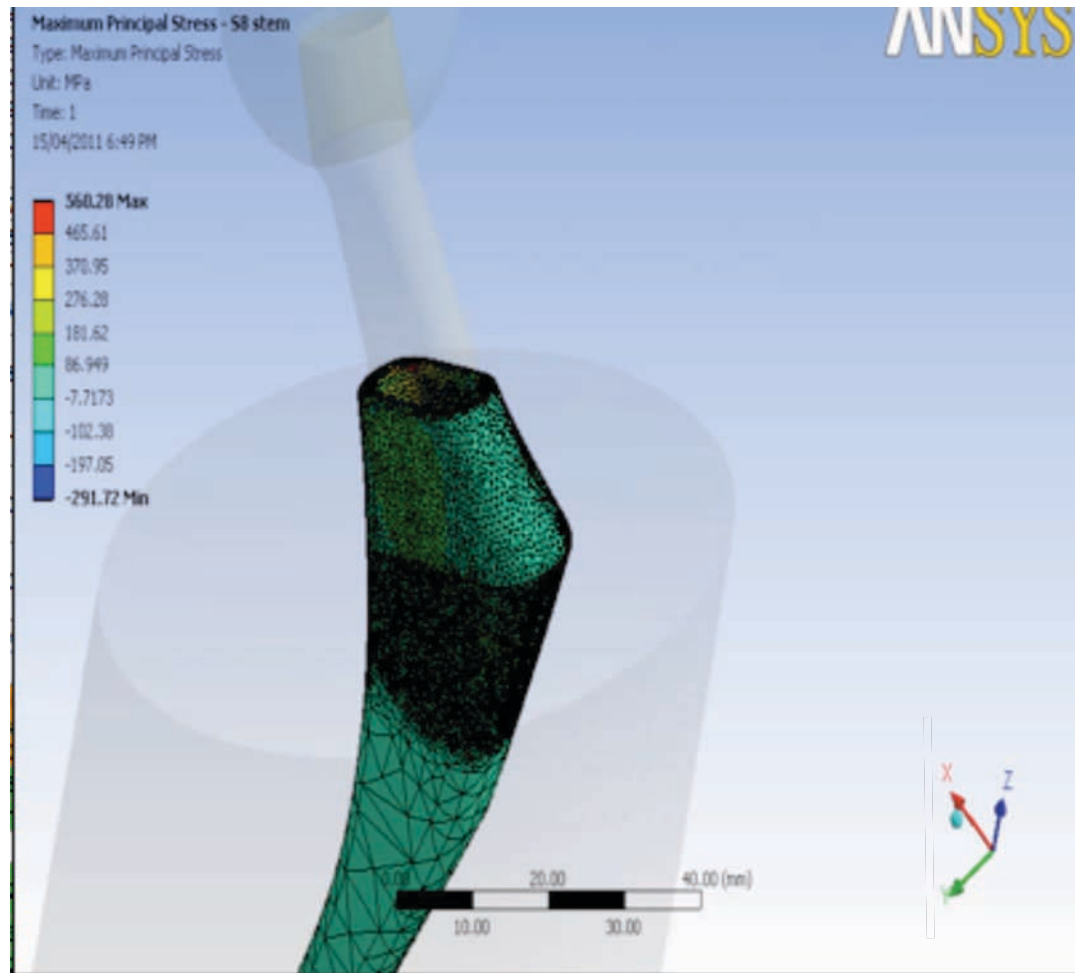
Circular Taper has insufficient intrinsic stability for in-vivo torsional loads

Optimal Taper Design through Neck Retention

System	Shortest	% > ARC	Longest	% > ARC	Taper Support
ARC	24 mm		27.5 mm		17mm
Wright Profemur	32 mm		42.5 mm	55%	15mm
Stryker ABG II	30 mm	9%	42 mm	53%	13mm

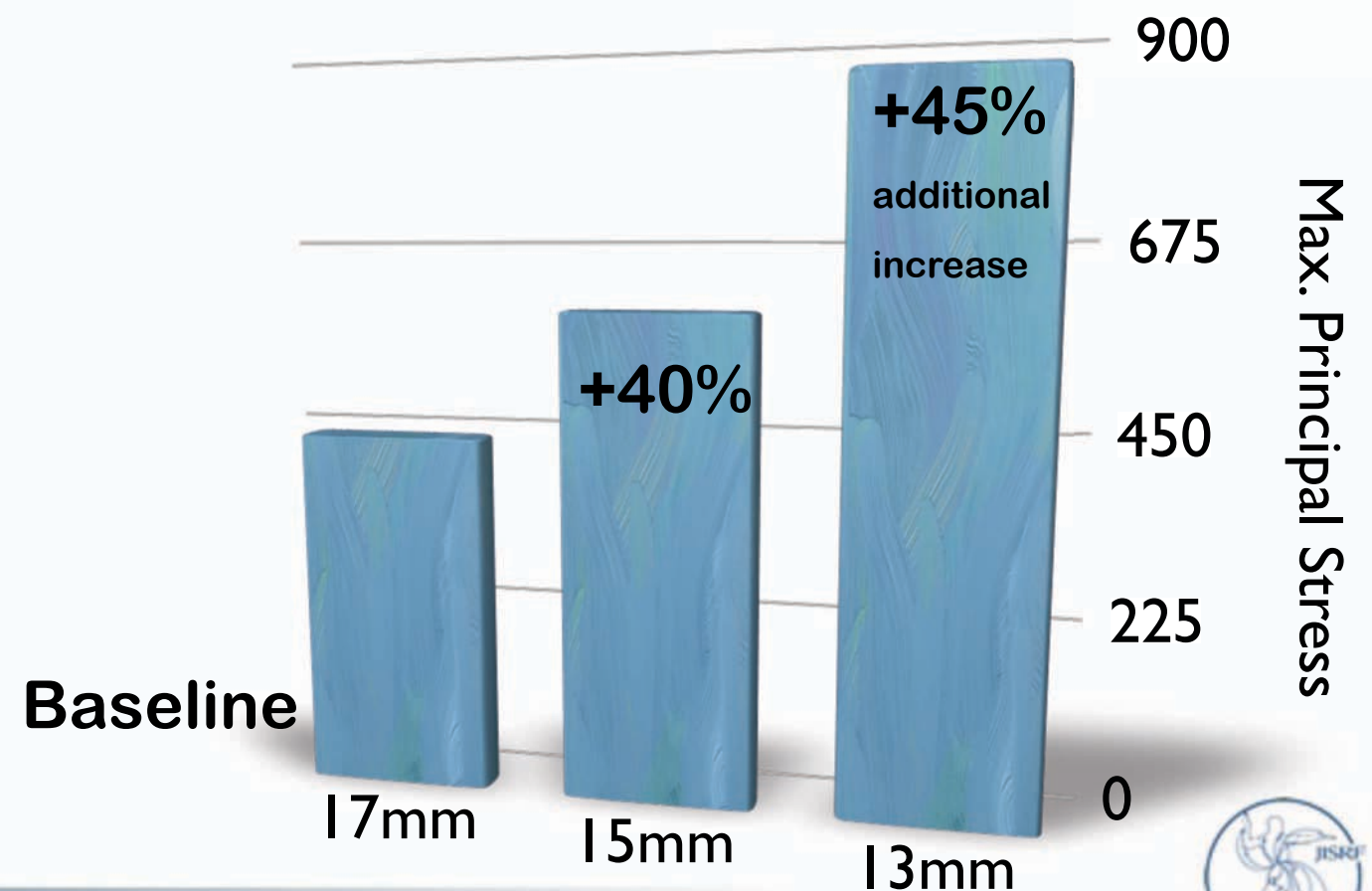
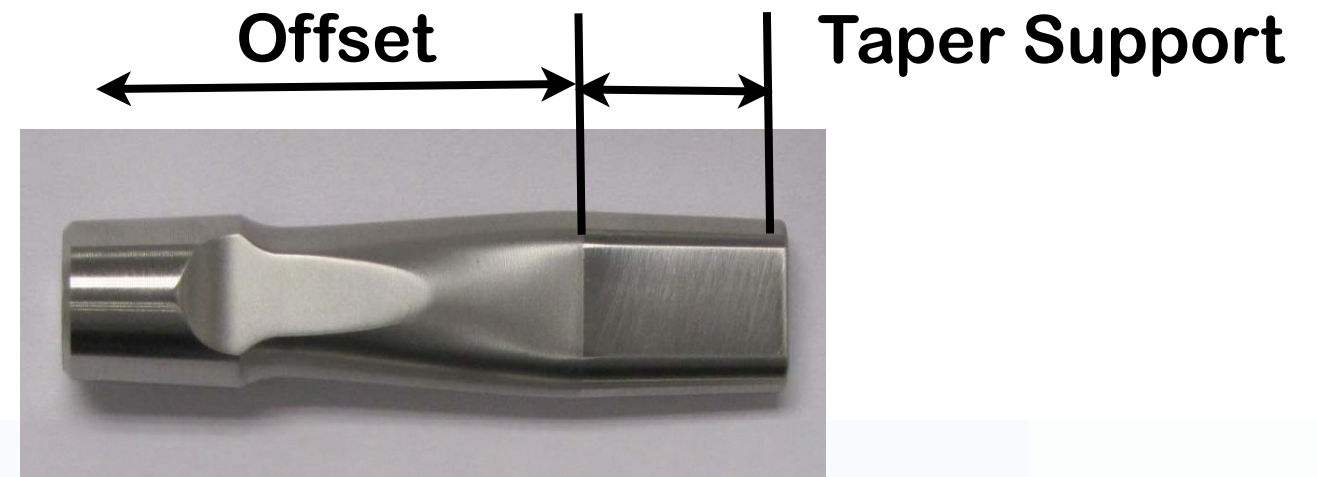


Optimal Taper Design by Neck Sparing Approach



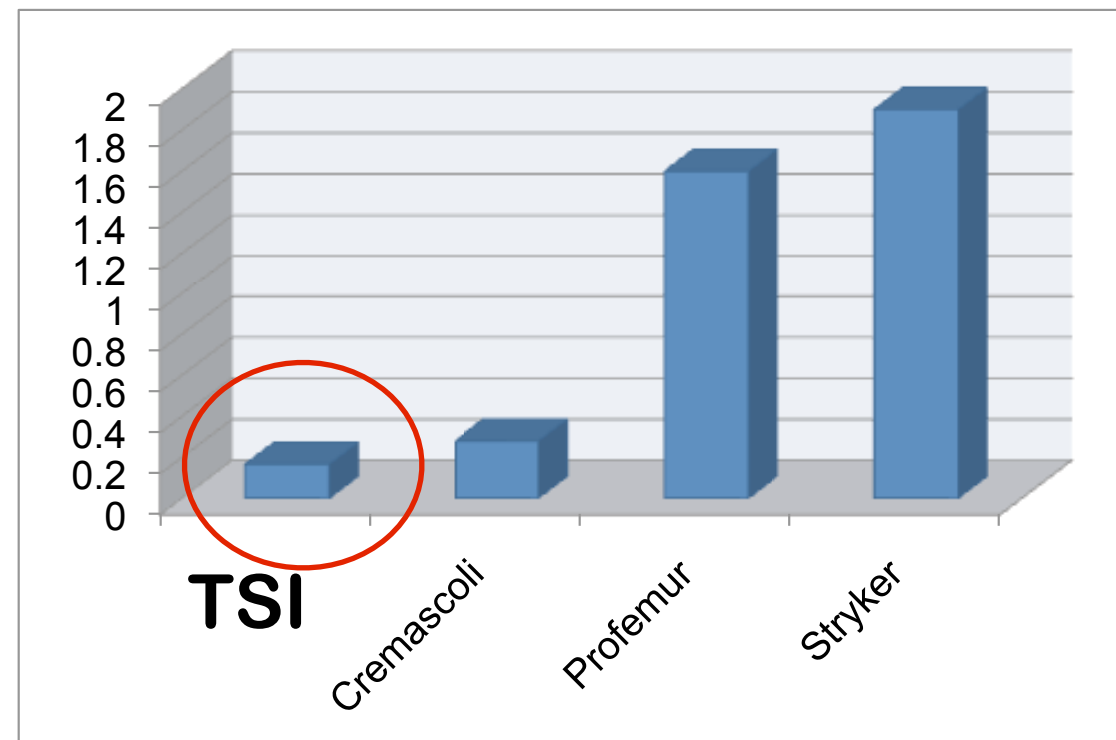
Analysis performed with
Fixed Offset, Fixed load &
Boundary Conditions.

Design Variable Taper
Support length



Optimal Modular Neck Design

- Biomechanical advantage of neck stabilization stem produces lower stress in stem compared to monoblock equivalent (for identical head centre restoration)
- Neck Sparing design enables lower stresses due to combined **shorter offset** with larger **taper engagement**, thus reducing corrosion / debris generation.



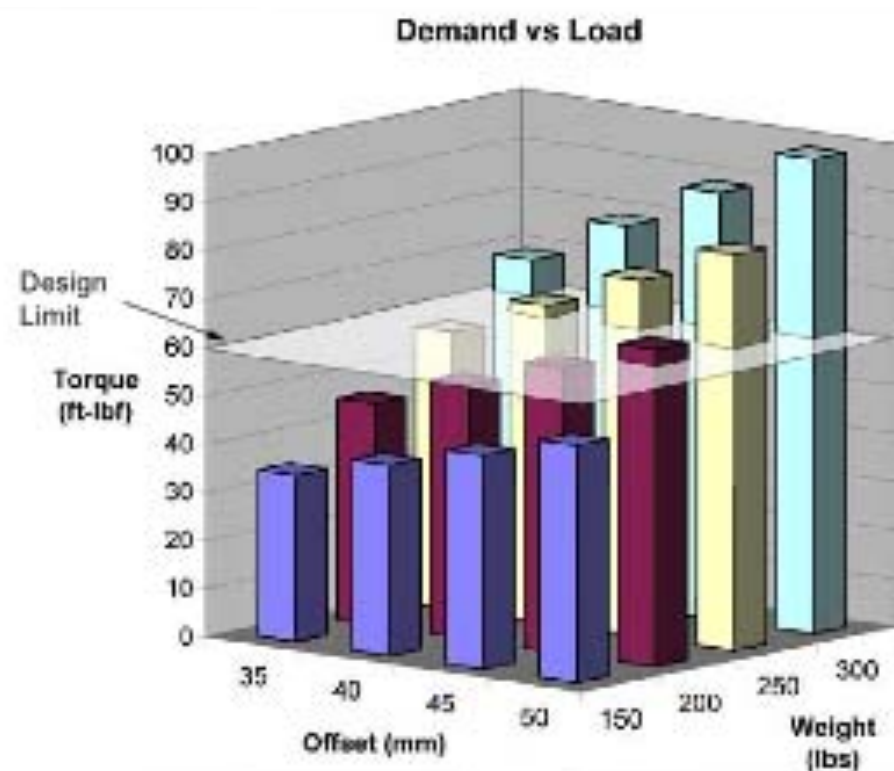
Published Data compared to
Neck Sparing Design (TSI)

Modular Joints Are Not Equal

Historical Torsional Loads have been underestimated



examples of under-designed modular joints



95 ft-lbs/128.8 Nm

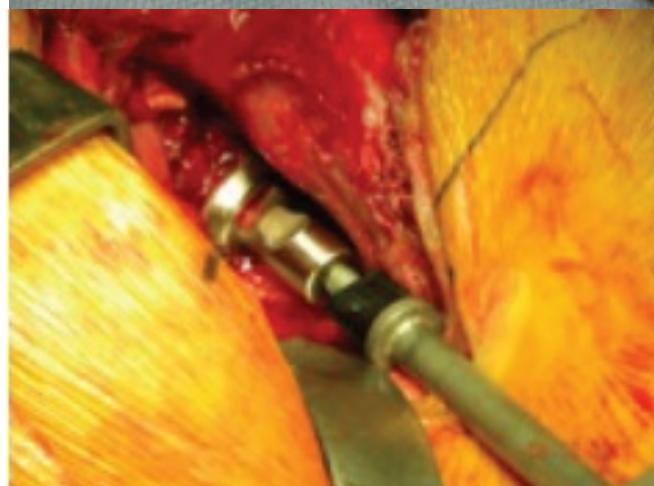


Design limit
for intrinsic stability of
cone tapers
60 ft lb./81.3 Nm

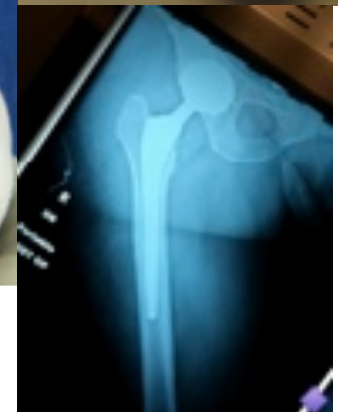


We now know the hip sees over 128 Nm of torque

Retrieval



*mismatch head
head skirt prevented
full neck stem engagement



Stem & Neck Usage

1,790



Stems

Size 0 = 4% new size
Size 1 = 21%
Size 2 = 36%
Size 3 = 26%
Size 4 = 10%
Size 5 = 3%

} 87%

Necks

Neutral Standard = 33%
Neutral +3.5mm = 3%*
Total Neutral = 36%



8° Varus/Valgus = 19%
8° +3.5 Varus/Valgus = 3%*
8° Total = 22%

12° Varus/Valgus = 17%
12° Version = 25%*

Total Angled Necks = 64%

Note:

Antverted for posterior approach

Retroverted for anterior approach

* new sizes

Results & Observations

On adjusted total of 1,790 stems from May 2010 to September 2012

Stems Explanted = 8 (bone attached on 7 of 8)

Dislocations = 3

(2 traumatic & 1 chronic)

Aseptic Loosening = 2

(1 traumatic subsidence & 1 undersized)

Infections = 2

(1 pending)

Mismatched head to neck resulted in disassociation & revision = 1



Note:

- No signs of fretting corrosion on 8 explants
 - No signs of elevated metal ions
- 3 hip pain suspect: 1 due to subsidence (undersized) 2 suspect spine
 - No soft tissue pseudo tumors observed

Additional Observations

Complications

Mismatched head to cup = 2 head exchanged (cup liner 36mm head 38mm) One caught in recovery one at 6 wks post-op

Neck Exchanges = 3 (2 for cup revisions 1 for dislocation)

Intra-op perforations = 3 anterior approach (no treatment caught during surgery corrected stem path)

Intra-op calcar fx's resulting in stem bail out = 5 (early on) none since size 0 added calcar fx's wired = 3

calcar fx's not wired = 6

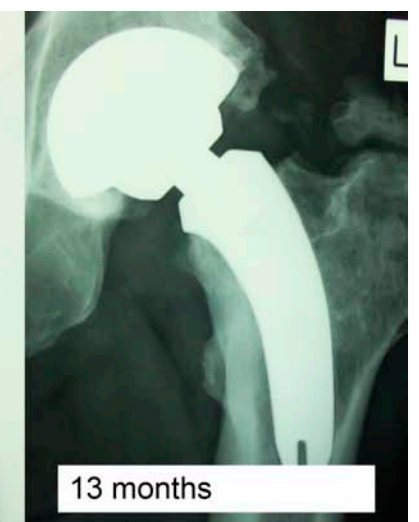
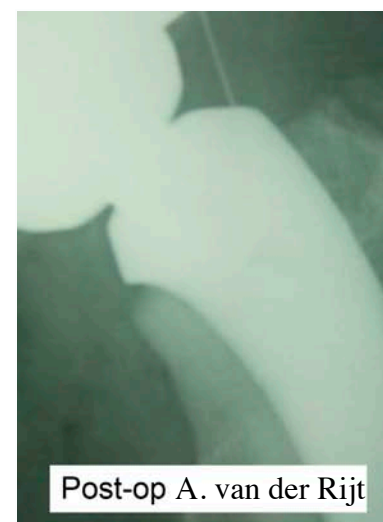
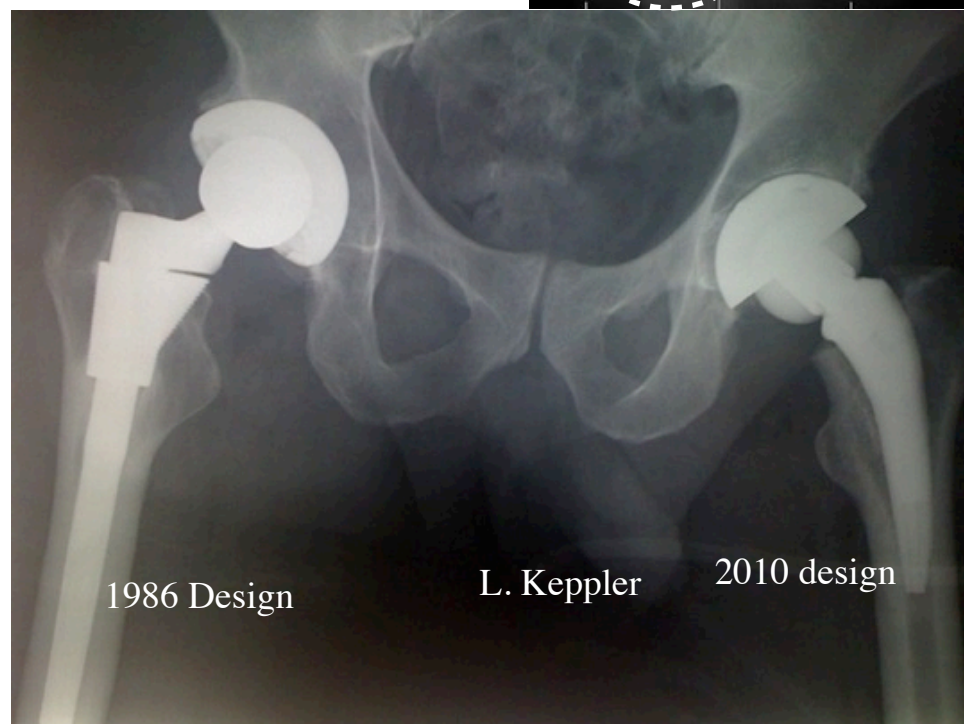
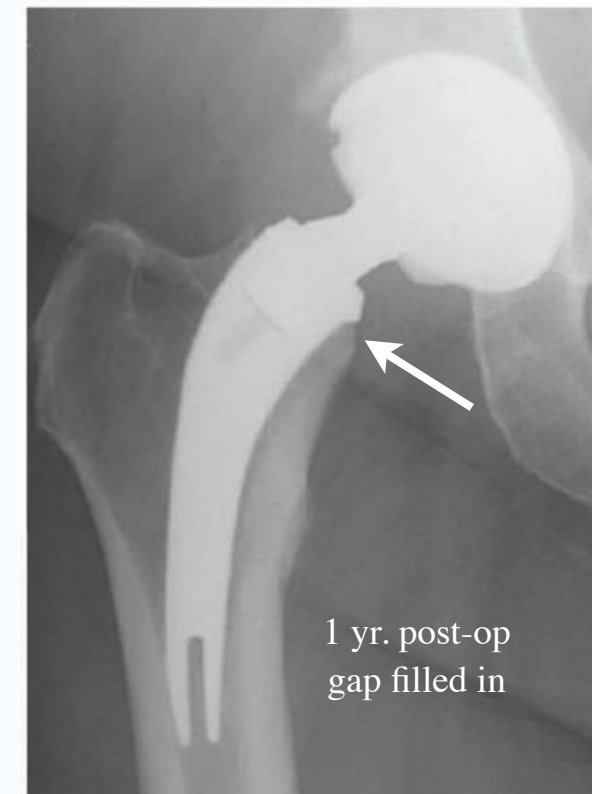
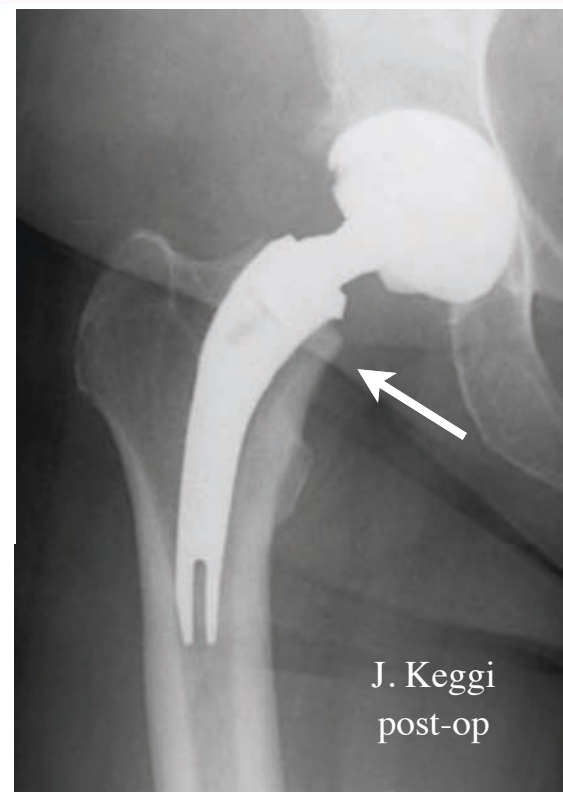
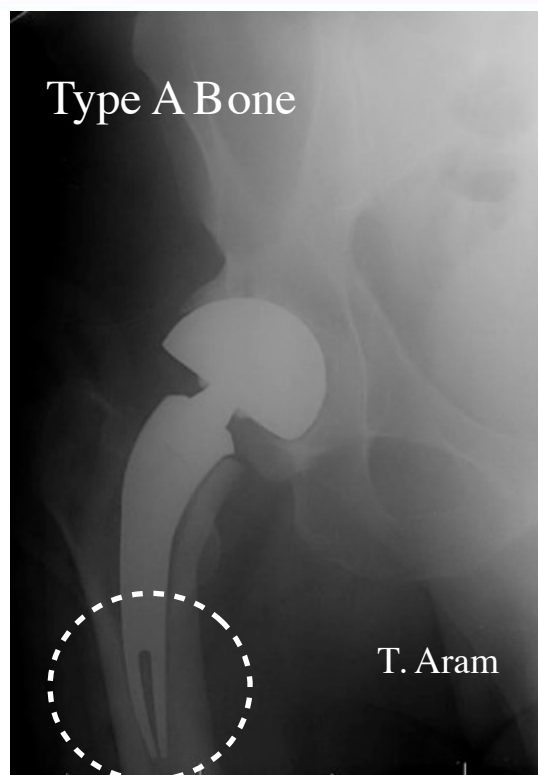
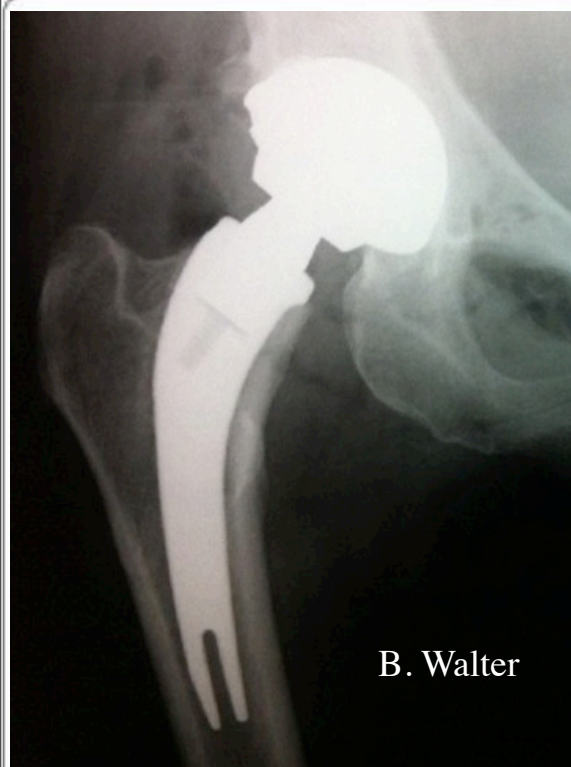
Leg Length +/- 7 mm = 10

Stem Subsidence > 5mm = 6 (all stabilized no treatment)

Hip pain being followed = 3 (1 due to subsidence (undersized) 2 suspect spine)

We are encouraged with our initial clinical / surgical observations (patients are happy) and we believe the potential and real benefits warrant not only further evaluation but expanded evaluation of this tissue conserving approach to THA. This is equivalent to results presented at recent European Hip Society. (A. van der Rijt)

Thank You



Male
49 year old

184cm
102kg

BMI 31
Marked stiffness

Bilateral
simultaneous

A. van der Rijt

