Neck Sparing Total Hip Arthroplasty
-Lessons Learned-

Mini-Symposium
held prior to AAHKS 20th Annual Meeting
Friday, November 5, 2010
2pm-4pm

Sponsored by
The Joint Implant Surgery and Research Foundation
Non Profit Founded in 1971 by Professor Charles O. Bechtol, MD

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Supported in part by Omnlife science™
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Acknowledgement
A number of surgeons over the years have participated and shared some of their work. Pioneers of Neck-Sparing concept: Pipino, Freeman, Townley and Whiteside
In accordance with ACCM guidelines we acknowledge that there is a financial relationship (non-exclusive) between JISRF and orthopaedic industry and that individual members of JISRF and Faculty have financial relationships with a variety of medical device companies.

This meeting was supported in part by and an educational grant from OmniLife science™

Institutional support: From a variety of medical device corporations (+20)
Note: JISRF Board Members have a variety of industry relationships
Design Features
For a Tissue Sparing THA Stem

Timothy McTighe, Executive Director
Joint Implant Surgery and Research Foundation
Chagrin Falls, Ohio
Architectural Changes

- Changes take place after THA and these changes can lead to a loss of bone, implant loosening and implant revision.
Motivation to improve on tissue sparing (hard & soft)
Both Bone conserving and soft tissue conserving

- Short Curved Stem (following medial curve)
- Neck Sparing (mid/high neck resection)
- Conical Flare for proximal load transfer
  - Intrinsic torsional and axial stability
- Proximal porous Ti & HA coating (long-term fixation)
  - Modular Neck- fine tuning joint mechanics
    (c.c. modular neck)
- 12/14 Euro head/neck taper
- Lateral T-Back for increased torsional stability
- Semi-polished stem for reduced distal fixation
- Sagittal slot for reduced bending stiffness & reduction of potential lateral perforations.
- Distal lateral tip angle for reducing end stem contact
  - Simple reproducible instruments
- Five stem sizes (+90%) of routine THA
- Threaded Tapped hole in neck for retrievability
- Threaded Tapped hole in stem for retrievability
Short Curved Stem

- Taped hole for stem retrievability
- Medial Curve
- Saggital slot & distal 11° lateral angle
- Conical Flare
Why Save The Neck?

- Neck resection generates significant torsional moment at the stem/bone interface.
The conical flair was built off a conical collar of 1993 stem design. McTighe et al. patent.

Transfer hoop tension into compressive loads.
Stabilized Stems
Fixation Points

- Head Stabilized
- Neck Stem less Stabilized
- Short Curved Neck Stabilized
- Short Metaphyseal Stabilized
- Short Diaphyseal Stabilized
- Conventional Stems

Combination example: fit & fill
Retrievable Features

Tapped threaded hole in neck and stem for slap-hammer extraction.
Head Stabilized

Hip Resurfacing  Mid-Head Resection
Hip Resurfacing

- Steep Learning Curve
- Limited Indications
- Risk of Fracture
- Late Remodeling and Aseptic Loosening
- Limited to MOM Bearings
- Extensive Soft Tissue Dissection
- Conservative
HR
high learning curve
limited indications 8-15%

• Decreasing use
(8.9% of primary THR 2005)
(8.2% of primary THR 2006)
(7.6% of primary THA 2008)
Yearly Cumulative % Revision Primary THA vs. HR in OA Patients

8 Yrs

4.0% revision in 92.3% indication

5.3% revision in 7.6% indication

HR

THA

2008
Neck Stem Less Stabilized

To early to tell if this is going to be a viable concept. Will be design and technique dependent McTighe
Short Taper Styles
Interesting history on conservative devices

A modern movement

Some recent short stems
Neck Retention

• Provides better blood flow vs. hip resurfacing Pipino

• Provides better axial and torsional stability vs. conventional THA Whiteside

• Provides for more tissue sparring approaches (both hard & soft tissue) Pipino

• Potential for less blood loss

• Potential for quicker rehab
Save the Neck

There is a historical reference to neck sparing THA

- Pipino started arguing save the neck 1977-78
- 1979 Pipino started implanting the Biodynamic stem
- Freeman, made the argument back in 1984 that modern hip stems should retain the femoral neck
- Studies showed that 70% of the blood flow to the femoral neck is retained after THA and the vitality of the bone is good (Pipino et. al., 2006)
Pipino was the first, however, Freeman is acknowledged to be the “Godfather of the neck sparing concept”!

- Freeman went on to design both cemented and cementless stems and these are still used in the international market.
- He was at that time very concerned with aseptic loosening and the torsional loads that he and many believed to be the principal cause of THA failure.
- Freeman advocated a straight stem and it required significant lateral effort!
The varus-turning moment increases by a factor of 4 when the neck is resected.
Increase of femoral offset also increase torsional loads on the implant interface.

“the neck of the femur is not obviously reduced in strength in the osteoarthritic hip and is no more weaker than the rest of the femur in the inflammatory arthropathies.”
Why Save The Neck?

- Neck resection generates significant torsional moment at the stem/bone interface.
Review of previous work

Surgeon designers have advocated neck sparing designs with variable results and most have been conventional length stems.

Freeman

Townley

Pipino

Short

Whiteside

1948 Thompson
Professor Pipino

- Is the Acknowledged Leader in advocating short curved neck-sparing THA
- He has argued for tissue sparing both hard and soft tissue
- His original work dates back to 1979 and started implanting his first stem “Biodynamic” from 1983-1996
- This early design featured c.c. material, collar porous sintered beads on 2/3 of the stem, distal polished tip, 4 stem sizes 1 curve and 135° neck shaft angle.
- He had encouraging results but was disappointed with bone remodeling
Pipino current stem design CFP™

- He has experienced improved results over the c.c. material, but still encounters some stress shielding.

- FEA modeling of the MSA/ARC stem has demonstrated better bone loading patterns compared to the Biodynamic™ design.

- The CFP stem is the current benchmark in clinical/surgical results for short curved neck-sparing stems.
Concept to improve on Prof. Pipino’s work of Tissue Sparing

- Tissue Preserving for early intervention
- Alternative to HR (broader indications)
- Choice of bearings
- Revision option after HR
- Easier surgical technique for anterior approach
- Reproducible technique for all surgical approaches
- Modular neck for fine tuning joint mechanics
- Ease of retrievability and conversion to conventional THA if necessary
The History of curved stems

“The curve was right”

The application was wrong!

A modified shorten Muller Press fit stem function well for 15 years, K. Berend
Short Curved Neck Stabilized

Pipino

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

Corin
Save Hard Tissue & Lateral Hard and Soft Structures
Tissue Friendly

J. Keggi neck sparring
The design process was to address tissue sparing approaches with improved load transfer in a simple curved stem design. Reduced inventory (instruments & implants). We looked at a lot of different parameters. These are just a sample. 

*patents pending*
The conical flair was built off a conical collar of a 1993 stem design. McTighe et al. patent. Transfer hoop tension into compressive loads.
Novel: proximal conical flair loads the medial neck
Check Range of Motion
Lessons Learned Summary

Three key technique related features

1. The level of neck resection

- Top of level A is too short risk leg length being long and increased in risk of mechanical impingement.
- You can go down to the top of C without risking stability.
Lessons Learned Summary

② The angle of the neck resection

50° at 5-8 mm

Note:
Slight varus, valgus does not appear to make any significant difference in early clinical results.

➢ Too vertical stem can be in varus
➢ Too horizontal stem can be in valgus
Lessons Learned Summary

➢ Rasp shape the medial curve

③ Work the medial curve

There is a learning curve (3-4 cases) and a different technique as compared to broaching.
Clinical Usage

Stem Sizes - Female

- Size 1: 51%
- Size 2: 26%
- Size 3: 23%
Neck Angles
Varus/Valgus
Head/Neck length

-3.5 or -4: 36%
0: 38%
+3.5 or +4: 19%
+7 or +8: 8%
Dual Mobility Cups
Sub Cap FX. Keppler
Anterior Approach  J. Keggi
AP helps determine neck level of resection
- Lateral helps determine stem size
- 20° of internal rotation is more accurate for offset and medial curve measurement

You don’t template like a conventional stem. This would be too tight. The distal stem is a pilot. A size #2 will ensure proper seating of the conical flair.

(Ideally AP film should be in Internal Rotation)
Intra-operative Assessment
X-Rays are helpful

- No problem in taking more neck
- Make a intra-operative assessment and fine-tune your mechanics
- Decision to take a little more bone

70% of the time some change is made (25 yrs.)

Less need to go lateral
17 year post index surgery

C. Bryant
17 year old
Motor cycle accident
McPherson

discharged next day
Calcar Cracks
Lesson Learned

12/14 Euro Taper
ASTM standard F1636

When mixing and matching double check compatibility

3-mm Head/Neck
Lg MoM
MSA™ 2 1/2 follow up

Good maintenance of lateral structures

Bone filled in conical flare

Post-op

2 ½ yr. post-op
Lessons Learned
Complications

- One case in Au that subsided 1.5 cm (80 yr. old male) no pain stable 12 months post-op was this due to a intra-op fx or post-op?
- 3 cases we needed a smaller stem size (all female)
- Two intra-operative calcar cracks one significant converted to primary stem and one minor treated with a wire.
- One neck/head disassociation (converted to a Mallory/Head)
Neck Stabilized Design

- Short curved trapezoidal style
- Proximal conical flare
- T-Back
- Saggital slot
- Distal lateral portion of the stem angle 11°
- Porous Coating (Plasma Ti & HA)
- C.C. modular neck (two lengths, two varus/valgus angles 8° & 12°, anteverted neck 12°
- Neck has a taped threaded hole for retrievability
Bi-lateral
First Side May
Second August

F. Schmidt
Neck Retention Has Value
Continuing Education
Mini-Symposium
2-4 PM Friday Nov. 5, 2010
AAHKS Annual Meeting

Lessons Learned: Tissue Sparing THA
Mini-Symposium at AAHKS 20th Annual Meeting
Date & Time:
Friday, November 5, 2010
2pm - 4pm
Location:
Hyatt Regency DFW
1 N. International Parkway
DFW Airport, Texas
Register online at:
www.AAHKS.org
A special invitation activity sponsored by:
Joint Implant Surgery & Research Foundation
www.jisrf.org
Thank You
Where we are

• Hundreds of x-rays templated for base line sizing in Australia and U.S.
• In depth review of the history on neck sparing total hip stems
• Attendance in Pipino’s continuing educational course
• Cadaver workshops in Australia and U.S.
• Five custom cases to validate original concept out 2 1/2 years
• Over 20 intra-operative trials before implantation in two countries by over 12 surgeons
• 100 cases in Australia
• 150 cases in U.S. (FDA approval May 2010)
• 1 case of stem subsidence (1cm) in 80 year old male 6 months post-op no symptoms no plan on revision (was a crack not sure if intra-op or post-op)
• Over 28 (papers, abstracts, oral papers) presented on this concept in past 2 1/2 years (posted on JISRF web site)
• International Study Group established on the concept of tissue sparing THA (JISRF)
• One stem revision to-date.
• All surgeons continue to use the stem, indications increasing (still very early but encouraging at this stage of development and clinical follow-up