

Proximal Modular Stem Design “Dual Press™” With a Dual-Tapered “K2™ Trapezoid Stem

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Abstract:

- **Fat tapered wedge style stems in THA have a long history dating back to Maurice Muller in the 1960's and Karl Zweymuller in the 1970's.**
- **The profile of this design allows for: simple surgical technique; sequential broaching; no reaming; wedge fit providing immediate implant to bone stability. Tapered cementless stems were introduced in the United States with the Tri Lock™ in 1981 in c.c. (2001 Ti) and Taperloc™ in 1982. Since then there has been a number of monoblock tapered stem designs (Corail, Accolaid, CLS) introduced into the world market.**
- **One problem associated with monoblock tapered stems has been leg length discrepancy. Proximal modularity increases the number of implant parameter variables, allowing semi custom or fine tuning of joint mechanics.**
- **This paper will review 550 K2™ proximal modular stems implanted since 2005 with a novel “Dual Press” Modular junction. We have found this design to increase accuracy of restoring joint mechanics and reducing hip dislocations. Key Words: Dual Press, tapered, joint mechanics, proximal modular. March, 2009 Published by JISRF.**



Material & Methods:

- A retrospective analysis of patients who underwent primary THA with a proximal modular “Dual Press K2™ Stem” was undertaken. The inclusion period was between January 2005 and March 2009.
- This is a continuation of previous work by the same group that presented data at the 2007 Australian Orthopaedic Association on restoration of head center data with this stem.



Material & Methods cont:

- There has been 550 stems implanted with this novel proximal modular stem design by three separate groups. Two used a small posterior incision, and one group used the anterior single and dual incision. A variety of acetabular components were used with two of the groups primary bearing being large MOM, while the anterior group used predominately COC.



Stem Design

- Unlike traditional dual-tapered stem designs, the K2™ proximal modular stem allows intra-operative versatility with the ability to independently select the correct stem, neck and head configuration based on individual patient anatomy.



Proximal
Modular Design



Monoblock
Design



Material

- The COC were 32 mm head diameter and the MOM were large heads greater than 36 mm. There has been an increased usage in the past year of ceramic on cross linked poly by the MOM users as a result of increased concern over published reports. These reports indicate high metal ions, metal sensitivity, and some minor short term acetabular component aseptic loosening problems.



Stem Review

- This review was limited to looking at revision rate for dislocation, aseptic and septic loosening. Since most patients underwent hard on hard bearings wear evaluation, at this point, was not a concern.



Indications

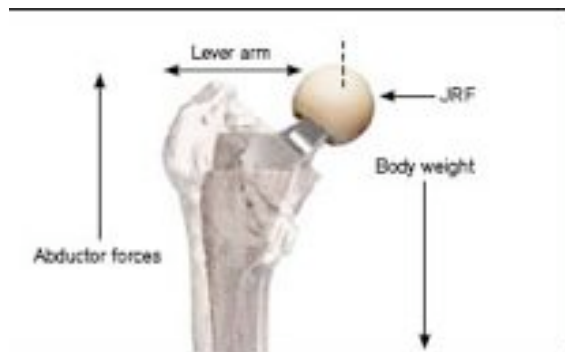
- Stem has been used in all Dorr bone classifications (A, B & C). Although two of the groups preferred using a modular straight stem design to provide proximal-distal mismatch resulting in less distal bone removal in type A bone.



(Apex™ Modular Straight stem)



Mechanics



The increased trend of using tapered stem designs places more of a burden on correct restoration of hip mechanics due to the variability of mid-stem contact point during stem insertion.



The importance of restoration of femoral offset is well published.

However, to properly restore joint mechanic separation of vertical height and femoral offset are necessary.



Biomechanics

Why should we restore joint biomechanics?

- Improved abductor function
- Less fatigue
- More comfort for patient

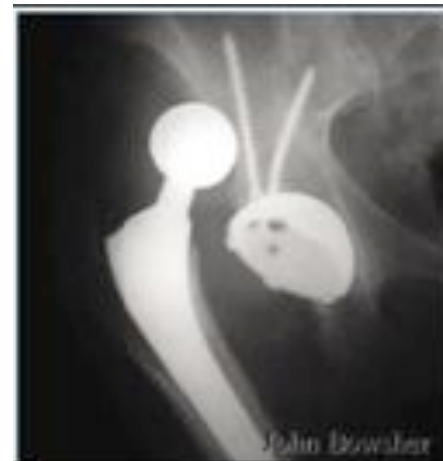
Leg length

- Annoying / Debilitating
- Back pain
- Litigation
- Over lengthening to achieve joint stability is a significant problem in THA.
- Leg length inequality is the number one cause of litigation in THA.



Intrinsic Stability

- Reduction of mechanical impingement can be helped with larger head technology but do not confuse mechanical impingement with intrinsic instability. Muscle laxity is rarely improved with the use of just large heads.



Previous Papers on Modularity

- Two previous papers have clearly demonstrated improved outcomes with this style proximal modular Dual Press junction.
- **“ Target Restoration of Hip Mechanics in THA”
AAOS exhibit 200614**
- **2007 AOA exhibit15 “Restoration of Femoral
Offset Using a Dual-Tapered Trapezoid Stem.”**



Historical Reference

- The K2 Dual-Tapered Trapezoid Stem is built off the design and clinical experience of our senior author's experience in using the Zweymuller stem.



The stem profile provides excellent torsional stability but can be difficult with the large lateral shoulder during stem insertion in smaller muscle sparing approaches. K.Keggi



K2 Stem Design

- The K2 features the flat stem profile of the Zweymuller with reduced lateral shoulder profile and proximal porous coating for enhanced long-term fixation.
- The proximal shoulder features the novel “Dual-Press™” modular junction which provides for fine-tuning joint mechanics without disruption of implant-bone-interfaces.



Dual Press™ Modular Junction

- The patented Dual Press™ modular connection mechanism allows the neck to fully seat against the proximal surface of the stem utilizing a simple assembly device. Unlike traditional taper-style modular junctions, this eliminates gapping and evenly distributes forces throughout the entire shoulder of the stem.



Dual Press



Junction assembled



Provides for large selection of femoral offsets. Novel design also allows for independent selection of version orientation



Results

- 550 K2™ stems have been implanted since 2005. 410 with the anterior approach approximately half with a single incision and half done with a dual incision.
- 210 patients are past two year follow-up.



Anterior Approach

- Dislocations = 0
- Stem Revisions = 3
- Aseptic loosening = 0
- Septic loosening = 1
- Leg/length discrepancy +/- 5 mm = 0
- Thigh Pain = 0
- **0 mechanical failure of modular junction**
- The three stems revisions were for one septic loosening and two post-operative peri-prosthetic fractures in women (type C bone). The two peri-prosthetic fractures were treated with long stem cementless Zweymuller stems and both healed uneventfully.



Posterior Approach

- Dislocations = 1
- Stem Revisions = 0
- Aseptic loosening = 0
- Septic loosening = 0
- Leg/length discrepancy +/- 5 mm = 0
- Thigh pain = 1
- **0 mechanical failure of modular junction**



Results cont.

- **Note: One female patient in the posterior group has recently been seen at first post-op visit (7 weeks), presenting with anterior thigh pain. Bone quality is Dorr B type. Stem is in a neutral position and appears to be well sized. This is a concern and patient will be followed-up in six weeks.**



Posterior Results

- Two patients in the posterior group with MOM bearings have had cup revision due to cup spin out. One patient was one (1) year out with an ASR metal acetabular component. Patient presented with increasing groin and buttock pain. X-rays demonstrated that original cup position had changed and did not appear to be ingrown. The proximal modular junction of the K2 stem was disengaged allowing access to the socket.
- K2 removal instruments provide ease of removal of proximal modular body making cup revision significantly easier with less bone destruction.



- The Explant cup removal system (Zimmer) was used making removal with minimal bone loss possible.



Results _{cont.}

- A cementless porous component with adjunct screw and poly bearing was then inserted.
- Second patient was female that presented a spun out MOM (Wright Medical) acetabular bearing component at her first post-op visit at seven (7) weeks.
- Since intra-operative x-rays are taken on all patients it is assumed that cup slippage accrued during the early post-op period and then stabilized. Again the proximal modular junction was disengaged and cup removed with Explant system.
- Eight (8) week post-op retrieval Demonstrated in-growth
- A new proximal modular neck and head were implanted with a cementless porous cup with one (1) screw for adjunct fixation.
- One patient in the posterior group had multiple dislocations and was revised by disengagement of the proximal modular junction and exchanged with an increased femoral offset and antverted modular neck.





Conclusion

- Proximal modularity of the femoral neck stem junction is an attractive option allowing fine-tuning of the mechanics of a hip replacement during the procedure, particularly with cementless fixation where the surgeon may have little control of the position of the implant within the bone. This is especially true where there are variations of the femoral anatomy.
- We have found in both the anterior and posterior small incision approaches that in-situ assembly of the proximal modular “Dual Press™” design greatly facilitates minimally invasive surgery compared to insertion of a monoblock stem.

