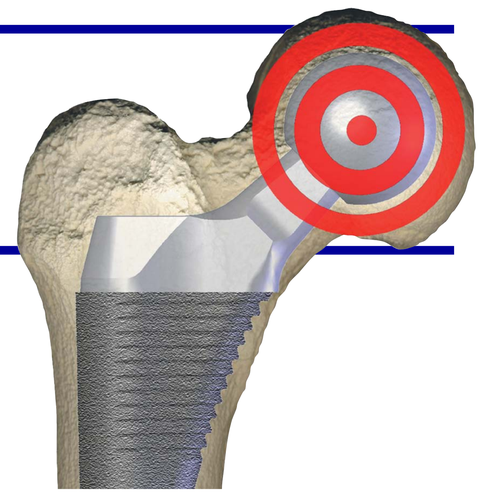
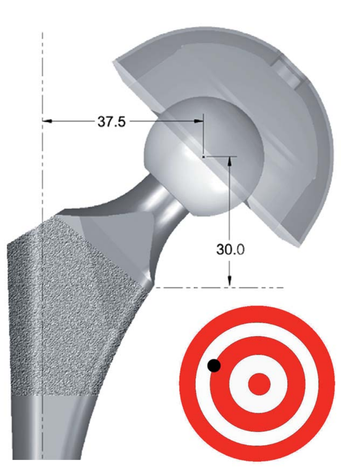
Target Restoration of Hip Mechanics in THA

By: Tom Tkach, MD[1]; Warren Low, MD[1]; George B. Cipolletti, MS[2]; Timothy McTighe, Dr. H.S. (hc)[3]

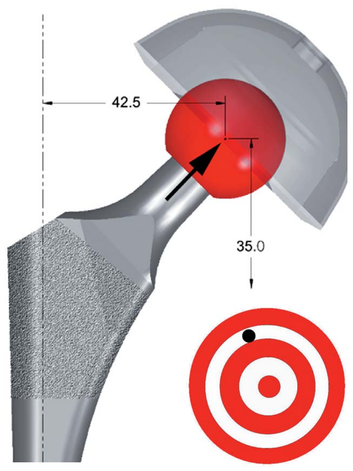


Introduction: THA continues to improve but complications still occur. Dislocation continues to be a significant problem. The causes for dislocation can be multi-factorial, and include: mal-positioned components, soft tissue laxity, and impingement of component-on-component or on fixed obstructions such as osteophytes. Weakness of the abductor muscles due to improper reconstruction can also be a contributing factor. In countering these factors, stability is often achieved at the expense of limb lengthening.

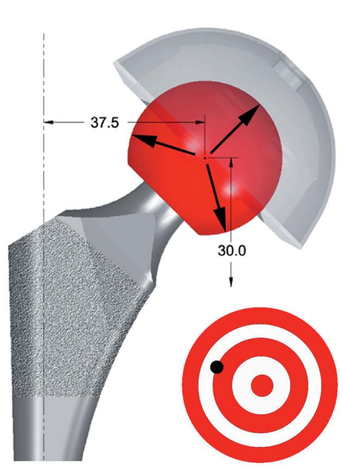
To study the influence of implant geometry on tissue balancing and joint stability, the authors selected a stem system that permits the independent selection of lateral offset, version and leg length. This study presents the short term results of this experience.



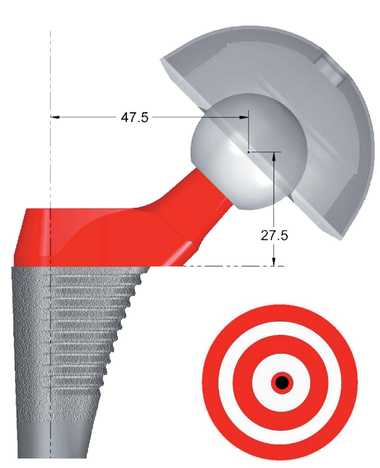
Instability - What should be done? Trail reduction demonstrates joint instability with slight increased leg length.



Modular Heads allow length adjustment, unfortunately increase head length increases leg length.

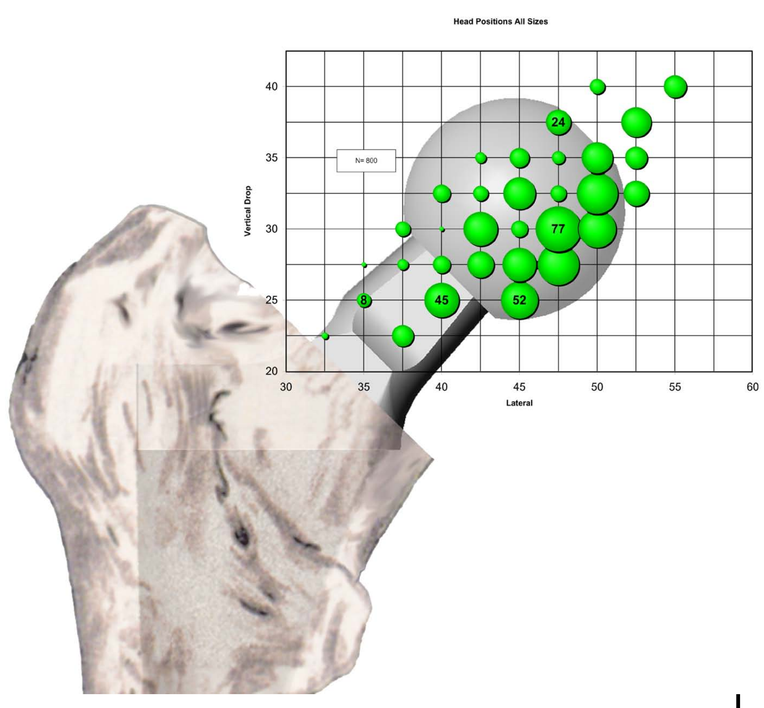


Big Heads! Theoretically, a bigger head is more stable... At the extremes of motion when the neck impinges In this case, intrinsic stability is unchanged (Head center stays the same).

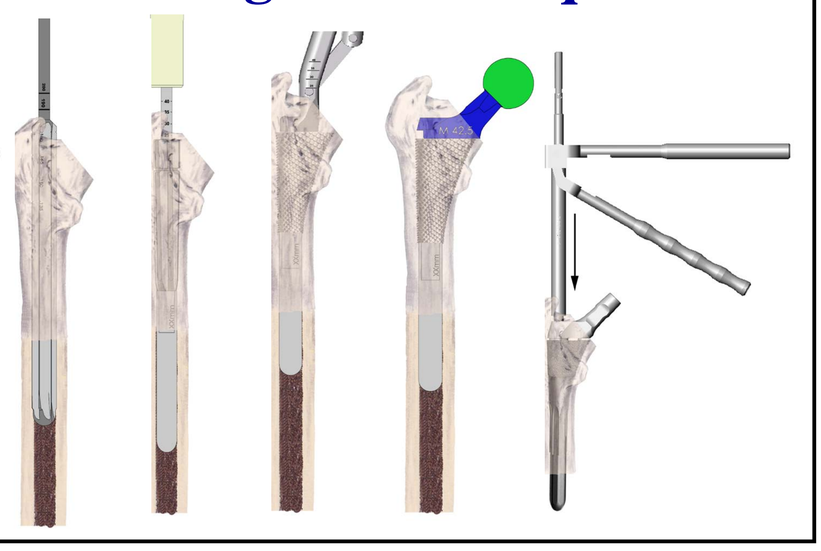


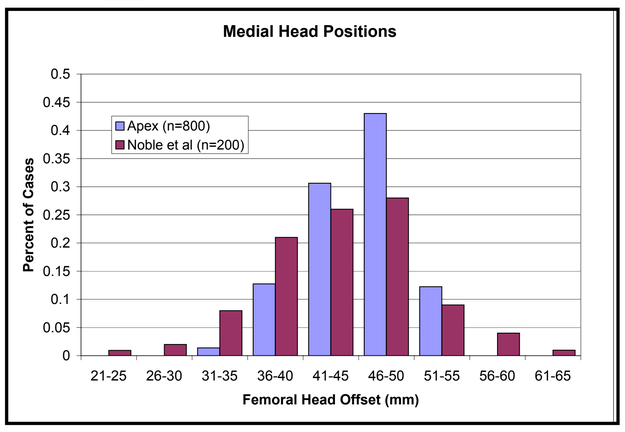
Biomechanical Solution Modular Neck! Add offset for joint stability reduce length for proper gait.

Methods: 957 THA's were performed using the Apex Modular™ Stem, beginning in May 2001. 842 were primary and 115 were revision cases. All were performed using the posterior approach. Acetabular implants from a variety of manufacturers were employed. All cases were fully cementless. Data on stem, neck and head selection were available for 800 of these cases. Head centers were plotted in bubble chart format. The center of the bubble is head location; the diameter is an indication of frequency. Representative frequency values are given for several locations.



Surgical Technique





1 Noble, Philip C., M.S., Alexander, Jerry W. B.S. et al, "The Anatomic Basis of Femoral Component Design", Clinical Orthopedics and Related Research, Number 235, October, 1988.

Lateral offset data are available in the literature for cadaver femora. We plotted our data on the same scale for comparison. The similarity of the lateral offset distribution confirms the appropriateness of the surgeons' head center selections.

Stem Size	Median Offset (mm)	Median Vert Drop (mm)
10 mm	42.5	30
11.5 mm	45	30
13 mm	45	30
14.5 mm	47.5	30
16 mm	50	32.5
17.5 mm	50	32.5

Table 1

Results: In this clinical series, 3 stem's locating pins failed*, we observed 2 dislocations**, 14 intra-operative fractures***, no significant leg length inequalities (+/- 5mm), and no significant thigh pain. Approximately 10% were indexed to a position other than neutral version. Lateral offset data were tabulated and compared to data from the literature.

The head center location data clearly showed that a wide variety of offsets and lengths are required to properly balance the soft tissues. Further, when the data were sorted by distal stem diameter, it was clear that there is little correlation between head center location and stem size. Further, a significant number of small (10 mm or 11.5 mm) stems required large (>45 mm) offsets.[Table 1]

*All three required revision of stems. One replaced with same device, one replaced with cementless monoblock and one replaced at different center.

**One of the dislocations was treated conservatively after closed reduction and went on to an unremarkable course. The second had received a neck in the anteverted position and dislocated anteriorly. The surgeon chose to reoperate, remove the modular neck component and reinsert it in the neutral position, after which the patient rehabilitated normally.

***Intra-op fractures were encountered during first twelve months during instrumentation development.

Typical 15 - 40° more ROM with neck anteverted.

Neutral neck position.

13° anteversion.

Anteverted neck used 18 times in the first 200 cases.

Discussion: Restoration of normal joint biomechanics on a consistent basis was possible using the Apex Modular™ Stem because of the intra-operative versatility that stem system offers in regards to head center location when compared to monoblock stems. It combines the fit and fill features of today's contemporary cementless stems with updated modular components that provide for independent offset, version and leg length adjustments. This unique modular design allows for a large selection of proximal bodies to enable targeted implant selection for the restoration of proper soft tissue tension and joint biomechanics. Continued long-term follow up will provide additional information to aid in validation of this design concept.

Conclusion: The head location data suggest that hip joint reconstruction benefits from the availability of many head centers for every stem size. This may be accomplished with a large inventory of sizes or with a modular device. Review of 957 hips implanted for both primary and revision cementless application leads the authors to conclude that this "Dual Press™" proximal modular stem design is safe, effective and provides for a more accurate approach for reconstructing the biomechanics of the hip. All current stems feature a larger, stronger locating pin and bolt.

McBride Clinic
(1) 1110 North Lee
Oklahoma City, OK 73101
www.mcbrideclinic.com

OMNIlife science™
(2) 175 Paramount Dr.
Raynham, MA 02767
www.omnils.com

Joint Implant Surgery and Research Foundation
(3) 17321 Buckthorne Drive
Chagrin Falls, OH 44023
440-543-0347
www.jisrf.org

New Zealand Orthopaedic Association
Annual Scientific Meeting
2-5 October 2005

Poster Exhibit
2005