

A Novel Technique for Centering the Femoral Stem in Primary Total Hip Arthroplasty

John S. Shields, MD, and James V. Bono, MD

Abstract

Careful surgical technique is a critical component of total hip arthroplasty. Femoral preparation and component positioning are vital to improving outcomes and preventing complications. Using the starting awl when preparing the femur aids in opening and centralizing the canal for sequential reaming or broaching. Although traditional techniques can lead to a deviation from midline, a novel technique allows the awl to center itself in the canal with little risk for cortical perforation.

We evaluated 200 patients whose surgeries were performed by a single surgeon using the traditional technique (group 1) or a novel technique (group 2) and found a statistically significant difference in mean deviation from midline. In group 2, the mean deviation was 0.34°; in group 1, the mean deviation was 0.85°. Our novel technique provides a safe, easily reproducible approach to using the starter awl in femoral preparation.

Total hip arthroplasty (THA) is one of the most successful procedures in orthopedics. Meticulous surgical technique and component positioning are critical to avoiding complications and improving clinical outcomes.¹⁻⁴ Careful femoral preparation is crucial to prevent cortical perforation, undersizing, and malposition of the femoral component. Perforations can lead to intraoperative or postoperative fractures, or a divergence from the typical postoperative protocol.⁵⁻⁸ Deviation in the varus-valgus and anteroposterior (AP) planes can lead to undersizing with subsidence, thigh pain, and loosening.⁹⁻¹¹

Many hip systems provide the surgeon with a starting awl to open and centralize the canal for successive ream-

ers or broaches. The design of the tapered wedge, broach-only systems provides excellent mediolateral stability, and the initial pass with the awl serves to center the stem in the AP dimension.

We have developed and now present a novel technique for placement of the starter awl that centers the awl and minimizes the risk for cortical perforation.

Materials and Methods

Following Institutional Review Board approval at New England Baptist Hospital, we retrospectively reviewed 200 primary THA procedures performed by the senior author. Selection criteria were all primary hips performed with the Accolade TMZF stem (Stryker Orthopaedics, Mahwah, New Jersey), using a standard posterolateral approach

with an anatomic capsular repair in both groups (Figure 1).

In group 1, which consisted of surgeries performed from May 2002 to April 2004, the traditional technique of pushing the awl into the canal while turning it clockwise was used. In group 2, comprising surgeries performed from August 2011 to January 2012, a novel technique for centering the awl within the femoral canal was used.

Surgical Tip

The novel technique is simple: place the awl at the starting site and turn counterclockwise, applying only gentle pressure to the handle (Figure 2). The awl pulls itself into the canal and self-centers, limiting deviation from midline.

We obtained postoperative radiographs, including AP pelvis and Lowenstein lateral views, of each hip at routine follow-ups. Component positioning was analyzed on the lateral view, and the deviation from midline was recorded. A single reviewer made all radiographic measurements; radiographs were analyzed on an IMPAX Radiology Image Web Server (Agfa HealthCare, Greenville, South Carolina). A 1-sided t test was used to analyze the deviation from midline in each group, and a 1-sided χ^2 test was used to assess anterior versus posterior deviation.

Results

Group 1, in which the traditional awl technique was used, had a mean

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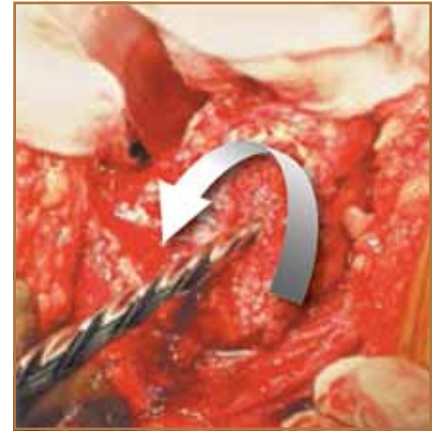


Figure 2. Femoral starting awl depicting the novel technique of centering the awl and turning counterclockwise.

Figure 1. Femoral starting awl from the Accolade TMZF stem kit (Stryker Orthopaedics, Mahwah, New Jersey), showing sharp tip and helical blades.

(SD) deviation from midline of 0.85° (1.15°). Group 2, using the novel counterclockwise technique, had a mean (SD) deviation from midline of 0.34° (0.77°). Group 1's change from midline was statistically significant compared with group 2's change ($P = .0002$; Table). Figure 3 shows the distribution of angles in each group.

Discussion

Femoral preparation is vital to appropriate alignment and sizing, and preventing complications. With the starter awl, the surgeon gains entry and localizes the center of the femoral canal. The traditional technique involves applying firm axial pressure while rotating the awl clockwise, allowing the helical blades to carve a path in the direction in which it is guided. The sharp tip and blades applied with axial force allow the surgeon to direct the awl, but this can lead to cortical perforation or misalignment in difficult cases (Figure 4). Perforations are most commonly seen after previous hip surgery, hip dysplasia, poor exposure, and in elderly patients with osteoporotic bone.^{12,13}

Perforation of the femoral cortex creates a stress riser that can lead to intra-

operative or postoperative fractures if it is missed.^{6,9} If perforations are recog-

nized during surgery, they can require a change in stem to bypass the defect, augmentation, or changes in the standard postoperative protocol.^{6,7,9}

When the awl is directed into the canal by the surgeon, the path is often misguided and the awl can deviate from

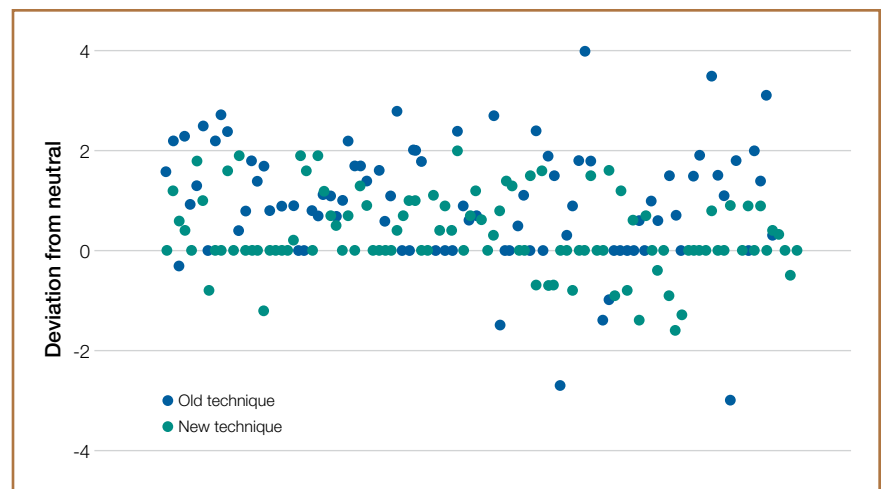


Figure 3. Distribution of angles of group 1, the old technique, and group 2, the new technique.

Table. Comparison of Deviation From Midline Between Groups 1 and 2

Technique	Lateral Angle Mean (SD)	Minimum Deviation	Maximum Deviation	P
Group 1	0.85° (1.15°)	0°	3.5°	.0002
Group 2	0.34° (0.77°)	0°	1.9°	

Abbreviation: SD, standard deviation.



Figure 4. Lowenstein lateral view of a right THA prepared with traditional technique depicting a posteriorly directed femoral stem deviating from midline.



Figure 5. Lowenstein lateral view of a left total hip prepared with the new technique, showing a centered femoral component.

midline, with the potential for cortical abutment and undersizing of the femoral prosthesis. Undersizing of the femoral component can lead to early migration, fibrous ingrowth, and disabling thigh pain.^{14,15} If the stem is cemented, malalignment can lead to a thin cement mantle and compromise results.^{16,17}

When the awl directs its own path however, the awl self-centers within the canal with little risk of cortical perforation. The technique employs placing the tip at the start site on the proximal femur, then turning the awl counterclockwise with little to no pressure on the awl handle. The counterclockwise motion allows the awl to follow the path of least resistance as the helical design pulls itself into the center of the canal, while keeping the blades from cutting a new path away from midline (Figure 5).

In our series, there were no cortical perforations or any complications from malalignment of the femoral prosthesis. The senior author is a fellowship-trained orthopedic surgeon in a high-volume total joint practice. This new technique allows self-centering of the femoral stem, which minimizes the risk for malalignment, perforation, and undersizing of the femoral component, and provides a safety mechanism for lower volume surgeons who perform THA, and for those who train resi-

dents and fellows to prevent technical complications.

Conclusion

We propose our novel technique as a simple, reproducible solution to centering the femoral component, while avoiding unnecessary risk for cortical perforation. This technique is especially useful in difficult cases, in elderly patients with osteoporotic bone, in obese patients, and in training orthopedic fellows and residents. Our series is a single-surgeon experience using 2 different techniques with a statistically significant difference in alignment of the femoral stem. No cortical perforations occurred, and no patients have needed to be revised for thigh pain or loosening. We recommend this simple, surgical technique to avoid problems during femoral preparation.

Dr. Bono is Vice Chairman, Department of Orthopaedic Surgery, New England Baptist Hospital, Tufts University School of Medicine, Boston, Massachusetts. Dr. Shields is Staff Surgeon, Department of Orthopaedic Surgery, Wake Forest Baptist Health, Winston-Salem, North Carolina.

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Address correspondence to: James V. Bono, MD, Department of Orthopaedic Surgery, New England Baptist Hospital, 125 Parker Hill Ave., Suite 573, Boston, MA

02120 (tel, 617-754-5901; fax, 617-566-2257; e-mail, jbono@neb.org).

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