Short-Term Survivorship of a Novel Variable-Angle Locking Screw Acetabular Component in Complex Acetabular Reconstruction

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Disclosures: George Guild (3B; ZimmerBiomet, 4; TJO, Forecast. 8; JOA Editorial Board. 9; Co-Chair AAHKS Focal Committee), Charles Long (N), Natalie Gresham (N), Alex Bradham (N), Anoop Chandrashekar (N), Emilio Arellano (N), Joseph Schwab (2; DePuySynthes. 9; Anterior Hip Foundation Board Member), Jacob Wilson (3B; ZimmerBiomet), J. Ryan Martin (1; Restor3d, Enovis, Depuy. 4; Restor3d. 3B; Restor3d, Enovis, Depuy), Charlotte Baker (N), Zachary Ricciardelli (N), Brandon Naylor (2, 3B, 6; Smith & Nephew)

Introduction: Highly porous shells have been used with success to manage acetabular bone loss in complex (cTHA) and revision total hip arthroplasty (rTHA) for nearly two decades. Acetabular reconstruction in the setting of bone loss has historically been difficult, with early techniques limited by suboptimal implant designs and lack of biologically active materials to promote osseointegration lack of biologically active materials to promote osseointegration. These limitations often resulted in poor fixation and unpredictable long-term survivorship. Recently, a 3D printed titanium shell with locking screw technology was developed. Our study seeks to evaluate the survivorship of the novel variable-angle locking-screw (VALS) acetabular component.

Methods: We conducted a multicenter retrospective review of patients who underwent cTHA (n = 64) or rTHA (n = 151) with the VALS component. A total of 215 patients were included, with a mean age of 64.5 years (range 15–94), BMI of 30.9 ± 7.4, and 59.5% female. Mean follow-up was 1.1 years (range 0.4–5.5). Patient demographics, surgical characteristics, and postoperative outcomes were obtained from the electronic medical record, and radiographs were evaluated for component positioning and signs of loosening. Kaplan–Meier analyses assessed implant revision and all-cause reoperation.

Results: Among the 215 included cases, there were 20 reoperations, 9 of which involved acetabular revision. One- and two-year revision-free survivorship was 96% and 95%, while all-cause reoperation survivorship was 91% and 87%, respectively. The observed acetabular revision rates were 1.4% for periprosthetic joint infection, 0.5% for aseptic loosening, and 1.9% for instability. In patients with severe bone loss (Paprosky 3A/3B defects), two-year revision-free survivorship was 91%. On average, 3.7 ± 1.9 screws were used per case (2.8 ± 1.7 locking, 1.5 ± 1.1 non-locking). Screw placement varied across acetabular zones, with a mean of 1.1 ± 1.1 screws in Zone 1 (range 0-6), 1.7 ± 1.1 in Zone 2 (range 0-6), and 0.7 ± 0.8 in Zone 3 (range 0-3).

Discussion: The VALS acetabular component demonstrated excellent survivorship, even in patients with substantial bone loss. Stable fixation was achieved with relatively few screws, supporting the versatility of this construct in complex and revision THA. Further research, including prospective trials and mid to long term follow-up, is needed to further understand the potential advantages of this construct compared to other traditional revision acetabular components.

Significance/Clinical Relevance: Locking-screw technology may reduce micromotion and enhance osseointegration, offering surgeons an additional tool for complex acetabular reconstruction. These findings provide early evidence for the durability of this implant, with longer-term studies warranted.

Images and Tables:

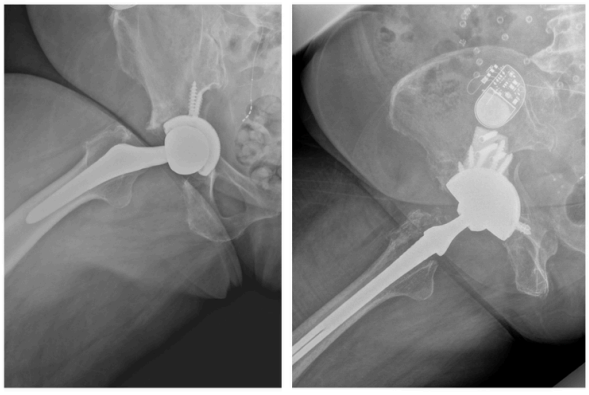

Figure 1. Preoperative (left) and postoperative (right) radiographs of a Paprosky 3B acetabular defect managed with a novel variable-angle locking hole acetabular shell.

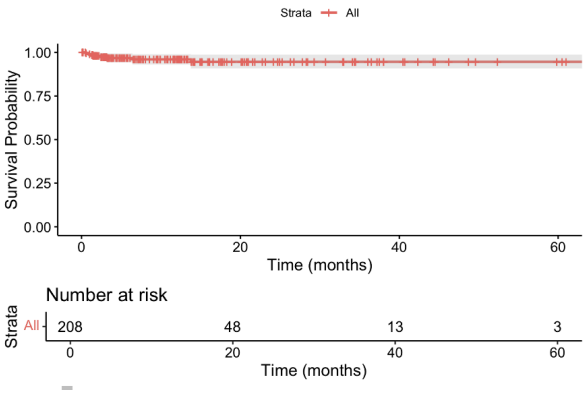

Figure 2. Kaplan-Meier Survival Curve: Cup Revision. The solid red line represents the estimated survival probability, and the shaded grey area indicates the 95% confidence interval.