Stubby Stems: Good Things Come in Small Packages

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abstract

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Standard-length porous-coated tapered femoral stems perform exceedingly well in primary total hip arthroplasty (THA) at long-term follow-up. Nevertheless, there are multiple reasons to strongly consider the relatively new concept of short tapered stems. First, there is already a wide variation in the lengths of “standard” components and the ideal length is unknown. The goal of tapered stems is to load the proximal femur, and shortened stems accomplish this task. Second, while the distal extension may help prevent varus, unlike cemented stems, which are failure-prone with varus alignment, tapered designs are not. Additionally, elimination of the distal extension may reduce potential stress shielding. Third, short stems obviate problems with proximal-distal mismatch, excessive femoral bowing, diaphyseal deformities, and preexisting hardware. Fourth, implantation of smaller components requires less violation of bone and soft tissue, facilitating less invasive surgical approaches and favorable revision settings if necessary. Fifth, in comparison to hip resurfacing and other unconventional short-stem designs, tapered stems are familiar to most orthopedic surgeons and do not incur a steep learning curve. Finally, our early experience with this implant in 1750 THAs since 2006 has been excellent. In a series of >650 THA, compared to standard-length tapered stems, the short stem had equivalent clinical outcome scores, significantly fewer femoral fractures (12/389 [3.1%] vs 1/269 [0.4%]), and only 1 (1/269 [0.4%]) femoral revision (infection) at 2-year follow-up. Short stems represent the logical progression of a proven precedent in standard-length tapered stems.

Figure: A 78-year-old woman patient presented with severe pain and discomfort of her left hip, worsening over the past 6 months. Radiographs reveal joint space narrowing, bone densing, and osteophyte and cyst formation consistent with end-stage osteoarthritis (A). The patient was treated with cementless primary THA using a 10×105-mm TaperLoc Microplasty stem with 32-mm-diameter modular chrome cobalt head articulated with a 50-mm porous plasma-sprayed hemispheric titanium alloy cup with highly cross-linked polyethylene liner. Radiograph at 5 years postoperatively reveals well-fixed components in satisfactory position and alignment. The patient has excellent function, with a Harris Hip Score of 95 (B).
Total hip arthroplasty (THA) is one of the most satisfying operations for patients and surgeons alike. It is highly cost effective and in the vast majority of cases provides excellent function. Although not all THA implants are able to stand the test of time, many well-designed prostheses have demonstrated good survivorship and persevered not only in long-term follow-up studies, but in the orthopedic marketplace as well.

Nevertheless, technological advancement and greater understanding of native and artificial hip biomechanics have continued to inspire novel ideas to achieve better results. For the past 5 decades, the modern femoral implant has undergone multiple evolutions in design philosophy, but several issues such as stress shielding, proximal-distal morphology mismatch, and bone-stock conservation remain unresolved. It is in this context that the conservative short stem recently arose, representing the newest generation in femoral component innovation.

Standard-length cementless femoral prostheses can generally be categorized into 1 of several major categories for overall shape and method of fixation. Anatomic prostheses require contouring of the host bone to accommodate the implant and achieve stability through maximal fit-and-fill of the proximal femur. Cylindrical, extensively coated stems rely on a diaphyseal scratch-fit between the distal prosthesis and a slightly underreamed canal. Tapered stems are wedge-shaped and have a rectangular cross-section to achieve proximal axial and rotational stability. A few of these different design attributes are compatible with each other, and some modern implants represent a synthesis of different design philosophies.

Conservative femoral components are not an entirely new concept. Dating back to the early 1980s, short stems such as the Mayo Conservative Hip (Zimmer, Warsaw, Indiana) have given rise to other novel designs such as the curved, neck-sparing Collum Femoris Preserving Prostheses (Waldemar Link, Hamburg, Germany), the lateral trochanteric flare engaging Proxima prosthesis (DePuy, Warsaw, Indiana) and, at the most conservative end of the spectrum, the Birmingham Hip Resurfacing System (Smith & Nephew, London, United Kingdom). The senior author (A.V.L.) has extensive experience with this implant in 1750 THAs and, at the most conservative end of the spectrum, the Birmingham Hip Resurfacing System (Smith & Nephew, London, United Kingdom) and, at the most conservative end of the spectrum, the Birmingham Hip Resurfacing System (Smith & Nephew, London, United Kingdom). The senior author (A.V.L.) has extensive experience with this implant in 1750 THAs. The TaperLoc Microplasty stem (Biomet, Inc, Warsaw, Indiana) is a self-seating, medial-lateral, tapered wedge design with circumferential porous plasma spray coating proximally, uses a broach-only preparation system, is available in 11 sizes, and has standard and lateralized options for offset. The TaperLoc Microplasty stem (Biomet, Inc, Warsaw, Indiana) is a self-seating, medial-lateral, tapered wedge design with circumferential porous plasma spray coating proximally, uses a broach-only preparation system, is available in 11 sizes, and has standard and lateralized options for offset. The TaperLoc Microplasty stem (Biomet, Inc, Warsaw, Indiana) is a self-seating, medial-lateral, tapered wedge design with circumferential porous plasma spray coating proximally, uses a broach-only preparation system, is available in 11 sizes, and has standard and lateralized options for offset. At first glance, the benefit of introducing something new would appear minimal, but at closer inspection, multiple reasons for adopting this short, tapered stem are revealed.

First, there is already a wide variation in the lengths of standard components, and the ideal length is unknown. The goal of tapered stems is to load the proximal femur, and shortened stems accomplish this task. Second, while the distal extension of the prosthesis may help prevent varus, unlike cemented stems, which are failure-prone with varus malalignment, tapered designs are not. Additionally, elimination of the distal extension may reduce potential stress shielding. Third, short stems obviate problems with proximal-distal mismatch, excessive femoral bowing, diaphyseal deformities, and pre-existing hardware. Fourth, implantation of smaller components requires less violation of bone and soft tissue, facilitating less invasive surgical approaches and favorable revision settings if necessary. These principles are naturally appealing to patients. Fifth, in comparison to hip resurfacing and other unconventional short-stem designs, tapered stems are familiar to most orthopedic surgeons, involve traditional femoral preparation techniques, and do not incur a steep learning curve. The TaperLoc Microplasty stem is a self-seating, medial-lateral tapered wedge design, uses a broach-only system, comes in 11 sizes, and has standard and lateralized options for offset. In a series of >650 THAs, compared to standard-length tapered stems, the short stem had equivalent clinical outcome scores, significantly fewer femoral frac-
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Short, tapered stems represent the logical progression of a proven precedent in standard-length tapered prostheses to a smaller, more efficient implant. It is attractive because of numerous potential advantages, including conservation of existing bone stock, compatibility with soft tissue sparing surgery, more physiologic loading of the proximal femur, and versatility with varying femoral anatomy. Our promising short-term clinical results and low rate of complications are likely confirmation of the solid biomechanical principles and time-tested fundamentals that served to guide the design rationale.

REFERENCES