http://dx.doi.org/10.2106/JBJS.19.01397

February 10, 2021

Letters to the Editor On "Current Concepts Review: An Update on Cementless Femoral Fixation in Total Hip Arthroplasty"

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To the editor:

We read with enthusiasm "An Update on Cementless Femoral Fixation in Total Hip Arthroplasty", by Michael M. Kheir, Nicholas J. Drayer, and Antonia F. Chen in Volume 102-A, Number 18, published September 16, 2020. In this well written manuscript, the authors update outcomes of cementless femoral stems and combine two prior classification systems of "short bone conserving stems" and "conventional stems. "

We appreciate the need for this update and the desire for a single classification system for all cementless femoral stem designs. The original classifications were constructed based on the location of fixation and the geometries of the stems, with the general principle of increased fixation moving distally. The concept of location of fixation of a cementless stem classification is essential, as the "preservation of bone" is determined by its most distal point of fixation, not the length of the stem. We agree that having a single consistent reproducible classification is necessary for comparing outcomes. However, in combining the short stem and conventional stem classifications as proposed, some of the principles of location of fixation have been blurred, leaving room for overlap of stem types.

In the previously described short bone-conserving cementless stem classification, Type 1 stems achieve

fixation only in the femoral neck. Type 2 extend to the metadiaphysis, achieving fixation in the calcar and the lateral proximal femoral cortex. Type-3 stems extend just beyond the metaphysis, and with a tapered, trapezoidal geometry and lateral flare, they achieve fixation in and transfer load to the calcar and lateral cortex. Type 4 stems are similar to conventional, proximally porous-coated designs but with a shorter length. In this updated combined classification, all short stems are classified as Type1 and subclassified according to the original short bone preserving stem classification as: 1A femoral neck, 1B calcar loading, 1C calcar loading with lateral flare. The newly proposed Type 1D subclassification however are shortened conventional stems. As the principles and location of fixation are the same for 1D as Type 2 and other stems, in a comprehensive classification this subset of Type 1D stems, should not exist but should be classified accordingly. In fact, the examples and outcomes referenced for Type 1D are of shortened “conventional” single taped or Type 2 stems.

We appreciate the work and provide this feedback to avoid confusion and ensure appropriate classification for future comparison and outcome studies.

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Conflict of Interest: None Declared

Article Author Response

9 March 2021

Article Author(s) to Letter Writer(s)

To the Editor:

As the use of short stems has increased in recent years, publications have increased most notably since

2010 (1). Multiple review papers have been published in the interim discussing types of short stems and outcomes (1-5). An initial classification system was created for short stems by Khanuja et al. (6) We appreciate the feedback from Harpal Khanuja, Samik Banerjee, and Kevin Mekkaey on our Current Concepts Review article, which provides an updated classification for cementless femoral implants. Their feedback is that the Type 1D and Type 2 stems have a similar location for fixation and should both be potentially classified as Type 2.

We thought carefully about the classification system that was published, and we believe that it should remain as is for multiple reasons delineated in this letter. One of the goals of our classification was to include short stems as Type 1, and then to subclassify stem designs by increasing fixation. Even though fixation for a Type 1D stem is in a similar metaphyseal location to Type 2 stems, the differentiator for our classification is the length of the stem.

Type 2 stems are specifically single-wedge (single taper) stems in our classification. Type 1D stems, however, have not been substratified based on taper design, and thus the category contains both single taper and dual taper designs in the Type 1D subclassification.

Some Type 1D stem designs have shorter zones of fixation compared to their conventional counterparts, which consequently results in less surface area for fixation. The zone of fixation, however, is manufacturer-specific, with some short stems having an equal length of fixation compared to their longer counterparts. This is important to consider when opting to use a short stem. Thus, careful attention must be given to the fixation zone for specific implant designs, especially if a design sacrifices fixation surface area for an overall shorter design.

What all Type 1D stems inherently have in common is a short distal taper, which further differentiates them from Type 2 stems. Type 1D stems were designed for proximal stress transfer. Although conventional stems have demonstrated excellent clinical outcomes over decades of literature, there still remain challenges to overcome, particularly stress-shielding. Part of the theoretical advantages of having a shorter stem is to avoid engagement of the diaphysis and to hopefully avoid proximal stress-shielding and loss of proximal femoral bone. With a shorter distal taper, there is a decreased potential for stress-shielding as these stems often only extend to the proximal aspect of the diaphysis.

Lastly, short stems, including Type 1D stems, were designed as an alternative to conventional stems to preserve proximal femoral bone stock. A short primary stem could allow for a potentially shorter revision stem in the future compared to a conventional primary stem. From a long-term perspective, if the stems were to fail and would need to be revised, there would be different solutions for each stem. Since the goal

of a short stem is to preserve bone stock, failure of this type of stem may offer the opportunity for revision with a standard-length stem and ease biomechanical reconstruction as compared to a failed conventional stem.

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