

# Short stem in primary total hip arthroplasty

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## Editorial

Cementless fixation in total hip arthroplasty (THA) is currently the technique of choice in many Countries, such as North America, Australia and southern region of Europe.<sup>1,2</sup> Although conventional uncemented stems showed excellent results in the long term,<sup>3,4</sup> they could be associated with reduction of the trochanteric bone stock and thigh pain. Moreover, the revision of conventional cementless stems can be technically demanding and lead to significant bone loss after the removal.

Over the last decade, several implants with conservative designs have been produced, and some authors advocated their use particularly in young patients with high-activity recreational interests.<sup>5,6</sup> All designs aim to preserve the bone in the trochanteric region, achieve a more physiological loading in the proximal femur to reduce the risk of stress shielding, and avoid a long stem into the diaphysis preventing impingement with the femoral cortex and thigh pain.<sup>7,8</sup> Finally, they aim to provide a proper primary stability, despite less invasive design. In a biomechanical study,<sup>9</sup> a shortened tapered stem demonstrated a comparable rotational stability to conventional uncemented stem, even though the reduced longitudinal length and trochanteric shoulder. However, the bone-implant flexibility with short stems varies according with the design of the prosthesis. The GTS™ stem demonstrated a good bone-implant flexibility as reported with the CLS® stem.<sup>9</sup> On the other hand, the Fitmore® stem demonstrated to act more rigidly during the bending of the femoral shaft when compared with the CLS® stem.<sup>10</sup>

The term “short stem” is misleading, because it is currently referred to stems less invasive when compared with conventional uncemented stem, but deeply different in terms of design, biomechanics, and bearing. McTighe et al.<sup>11</sup> proposed the term “short” for stems that do not extend below the metaphyseal region of the proximal femur. In this respect, they proposed three types of stems: 1) metaphyseal stabilized; 2) neck stabilized; 3) head stabilized (resurfacing). Recently, Khanuja et al.<sup>12</sup> classified short stems according with fixation principles and location of proximal loading. The authors distinguished four categories: 1) femoral neck fixation; 2) calcar loading; 3) lateral flare and calcar loading; and 4) shortened tapered. In this classification system, the resurfacing was not included.

All current designs of short stems demonstrated excellent survival rate, ranging from 98% to 100%, in both short and midterm.<sup>6,8,13,14</sup> Although the current designs showed good survival in the short term, they can be associated with malalignment, incorrect stem sizing, and intraoperative fractures. For this reason, the surgical technique plays a critical role to prevent these complications. The femoral neck cut is strongly related with the design of the stem. Authors supporting the Proxima™ suggested to perform the resection starting at the head-neck junction in the medial side.<sup>13,15</sup> Moreover, METHA®<sup>16</sup> and other designs<sup>17,18</sup> present a resection level of the neck higher than those required by Proxima™. On the other hand, for the GTS™ stem, the femoral neck cut should be performed perpendicular to the neck axis in order to respect the native shape of the femur. Therefore, the level

of resection is lower when compared with other conservative stems. However, Schmidutz et al.<sup>19</sup> demonstrated that the neck-preserving technique has been correlated with a higher incidence of increased limb length when compared with conventional THA.<sup>19</sup>

The definitive alignment of the stem is strongly related with the preparation of the femur. Several conservative stems need femoral compaction rasps that may be inserted following the curve of the femoral medial cortex, gradually increasing the size until proper fit is achieved. Because of the rasps are not introduced straight into the femoral canal but should follow the medial curve of the femur, the stem can be placed in a varus position. Coronal malalignment of the stem, particularly in varus position, has been reported in studies investigating short stems, with a rate ranging from 5% to 56%.<sup>13,20-22</sup>

Intraoperative periprosthetic fracture is another complication that occurs with a variable prevalence in literature. Banerjee et al<sup>8</sup> showed that the mean rate of fracture is greater with the Mayo design (4.2%) compared with Proxima™ and shortened stems (2.4% and <1%, respectively). Finally, Morales de Cano et al.<sup>22</sup> reported a rate of 1.2% with the GTS™ design. Although the design of the rasps and definitive stems aim to spare the bone stock in the trochanteric region, we believe that the experience of the surgeon is particularly relevant in determining the proper size of the stem preventing intraoperative fracture.

In conclusion, the short stems have reported very good clinical outcomes and survivorship rates, similar to those demonstrated by the conventional uncemented stems for the primary THA. However, no studies with long follow-up are currently available in literature. Therefore, comparative studies with longer follow-up are required to demonstrate that short stems can provide the same results of clinically well-established uncemented stems in the long term. Moreover, a standardized classification system for conservative stems should be developed to compare the clinical and radiographic outcomes of these implants each other.

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## Conflicts of interest

None.

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