Cementless Total Hip Arthroplasty With a Short Femoral Component

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Introduction

In most patients undergoing total hip replacement, cementless fixation is a reliable technique.\textsuperscript{1–3} Stable cementless femoral component fixation may be accomplished by either distal fixation in the diaphysis or proximal loading in the metaphysis. The benefits of proximal metaphyseal loading are well documented.\textsuperscript{4} Titanium is an ideal material for cementless fixation of the femoral component, as well as circumferential plasma spray for long term fixation.\textsuperscript{5,6}

The Balance\textsuperscript{®} femoral component (Biomet, Warsaw, IN) has been in use since 1994. This stem is a titanium three degree tapered design of traditional length. Metaphyseal fixation and loading is enhanced by its proximal geometry. The proximal geometry of the Balance\textsuperscript{®} stem creates a side specific implant with near custom fit and fill of the proximal femur (Figures 1A and 1B). This geometry was defined by the best approximation of normal femoral anatomy based on the analysis of one thousand computerized tomograms which had been catalogued after production of custom femoral implants by Biomet. (Figures 2A and 2B). A recent report documented excellent results using the Balance\textsuperscript{®} Hip in 399 hip replacements from May 1994 through December 2002.\textsuperscript{7} These results were achieved with reliable osteointegration and no subsidence in spite of immediate postoperative full weight bearing.

Fig. 1
(A) Anterior-posterior and (B) Lateral diagram of the Balance\textsuperscript{®} Hip stem.

Fig. 2
(A) Two cross-sectional levels in the proximal one-third of the Balance\textsuperscript{®} Hip compared with fit and fill of a custom stem and (B) comparison of those levels to that of a custom stem.
The use of a shorter cementless femoral stem may have a number of advantages. Short stems are more easily utilized when performing minimally invasive surgery through an anterior approach. In addition, a short stem will preserve diaphyseal bone for later surgery, should a revision be required. A report by Kim, Y.H. et al. showed excellent results when using a cementless titanium component with a short tapered distal stem. This component was designed for metaphyseal fixation, but extends into the diaphysis with a shorter stem. Diaphyseal extension may be unnecessary with a metaphyseal filling design.

The Balance® Microplasty™ stem is a short (80mm) component, which was created by utilizing only the upper one-third of the original Balance® component. This component depends solely on metaphyseal fixation without entering the diaphysis. We hypothesize that the Balance® Microplasty™ stem can provide initial stability, long-term porous fixation, excellent clinical results and still allow immediate full weight bearing. The Balance® Microplasty™ stem was evaluated in a prospective study to determine whether a short (80mm) stem could achieve the same excellent results of the traditional length stem.

Materials and Methods
The Balance® Microplasty™ stem (Figures 3A and 3B) is manufactured by Biomet, Warsaw, IN. This stem was created by using only the upper one-third (80mm length) of the original Balance® stem. Limited sizes (7–14mm) were available for implantation in this study. Similar to the Balance® stem, long-term fixation is accomplished by circumferential plasma spray ingrowth. Shorter three-degree conical reamers and finishing broaches were created and utilized for femoral preparation (Figures 4A and 4B).

Fig. 3
(A) Anterior-posterior and (B) lateral picture of a Balance® Microplasty™ stem. In the lateral projection, the ventral flare is noted and the circumferential plasma spray is also demonstrated.

Fig. 4
(A) Short three-degree conical reamers and (B) short finishing broaches created to implant the Balance® Microplasty™ stem.

Thirteen patients (14 hips) were available for study one year postoperatively. Eight (57%) were implanted on the right side and six (42%) on the left. The ages ranged from 46 to 78 years. Weight ranged from 139–272 pounds. The primary diagnosis included eight (57%) hips with osteoarthritis, three (22%) with avascular necrosis, two (14%) with a previous slipped capital epiphysis and one (7%) with a fracture. All patients had Dorr A bone quality in the proximal femur. All surgeries were performed through an open posterior lateral approach, utilizing shorter three-degree tapered power reamers and finishing broaches to prepare the femur. In all patients, the acetabulum was resurfaced with a M2a-Magnum™ metal-on-metal acetabular component manufactured by Biomet. Clinical and radiographic evaluations were performed preoperatively, as well as six weeks, six months and one year postoperatively. All patients were allowed immediate full weight bearing in the postoperative period.

Results
At one year, eleven cases (79%) had no pain and three cases (21%) had slight pain. There were no reported instances of thigh pain. Harris Hip scores preoperatively were all below 70. At one year, Harris Hip scores increased to excellent (90–100) in twelve cases (86%) and good (80–89) in two cases (14%). All patients demonstrated osteointegration without subsidence radiographically (Figures 5A and 5B). One patient dislocated a hip in the acute postoperative period which required a closed reduction in the emergency room, but has remained stable.
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**Discussion**

Cementless femoral stems traditionally range from 140–180mm in length. This length was based on the premise that some form of fixation in the diaphysis would be necessary to provide a stable implant for eventual ingrowth. Early results utilizing the Balance® Microplasty™ stem support the hypothesis that diaphyseal fixation appears to be unnecessary for this device. A short (80mm) titanium stem with near anatomic proximal metaphyseal fit and fill can provide for initial stability and long-term fixation through porous ingrowth. The design of this stem avoids stress shielding and thigh pain and has many other advantages. This stem allows immediate full weight bearing and this study has demonstrated no subsidence or aseptic loosening. The Balance® Microplasty™ stem utilizes only the upper one-third of the original Balance® stem and has achieved the same excellent clinical results. Finally, this device is more easily utilized during minimally invasive surgery, particularly with the anterior approach, and preserves diaphyseal bone, should a later revision be necessary.

**Conclusion**

Reliable osteointegration with no subsidence, despite immediate full weight bearing, may be achieved with a short (80mm) femoral component. Excellent metaphyseal proximal fit and fill is the key design feature in such a short stem.

**References**


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