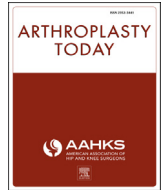




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Case report

Early fracture of the modular neck of a MODULUS femoral stem

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ABSTRACT

We present the case of a 46-year-old woman who underwent revision surgery approximately 4 years after total hip arthroplasty because of a fracture of the modular neck of a MODULUS femoral stem. The fractured surfaces of the retrieved implant were inspected using optical and scanning electron microscopy. Three-dimensional finite element analysis was also performed to identify the stresses that might have caused the failure. We concluded that active, obese patients who are implanted with a high-offset, small-sized modular component could experience stress-induced fractures of the modular neck, with proper fixation and osseointegration of the distal stem, especially if residual bone or tissue is present on the inner surface of the neck that could contribute to micromovement and decreased proximal fixation.

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Introduction

Over the past few decades, the use of modular femoral stems for total hip arthroplasty (THA) has substantially increased. However, the use of modular necks in standard primary stems has been a subject of study due to reports of fretting and corrosion failures at the modular junction [1–8]. Here, we report a fracture in the modular neck of a MODULUS (Lima Corporate, Villanova di San Daniele del Friuli, Italy) femoral stem in an obese and active patient.

Case history

The patient provided informed consent for the publication of this case study. We performed left-sided THA for advanced secondary osteoarthritis with acetabular dysplasia in a 42-year-old woman, during which we implanted a 14-mm-diameter MODULUS distal femoral stem (titanium Ti6Al4V alloy), a 125° high-offset (long type) small-sized modular neck (an A taper, to be used with stems sized

13–15 mm; titanium Ti6Al4V alloy), and a 32-mm Biolox forte ceramic head (32/0 mm) in the femur (Lima Corporate, Villanova di San Daniele del Friuli, Italy), and a 50-mm Mallory-head radial acetabular cup component (BIOMET, Warsaw, IN).

At the time of surgery, the patient was an active nurse (height, 1.47 m; weight, 70.8 kg; body mass index [BMI], 32.8 kg/m²). Ten months following implantation, radiography revealed osteolysis around the modular neck component and cortical hypertrophy of the distal femur. One year and 3 months after implantation, radiographic examination demonstrated the progression of osteolysis and cortical hypertrophy. Three years and 2 months after the left-sided THA, the patient underwent a right-sided THA for advanced secondary osteoarthritis with acetabular dysplasia. The procedure was performed by the same surgeon at the same institute.

Three years and 8 months following the left-sided THA, the patient reported sudden-onset groin pain on the left side while helping a heavy patient out of bed and experienced immediate loss of weight-bearing ability. Radiography revealed a fracture of the modular neck component of the MODULUS (Lima Corporate, Villanova di San Daniele del Friuli, Italy) stem (Fig. 1). Revision surgery was performed using an anterolateral approach with the patient in the right lateral decubitus position. The hip was dislocated anteriorly and the fractured modular neck component was removed (Fig. 2; white arrow). The safety locking screw securing

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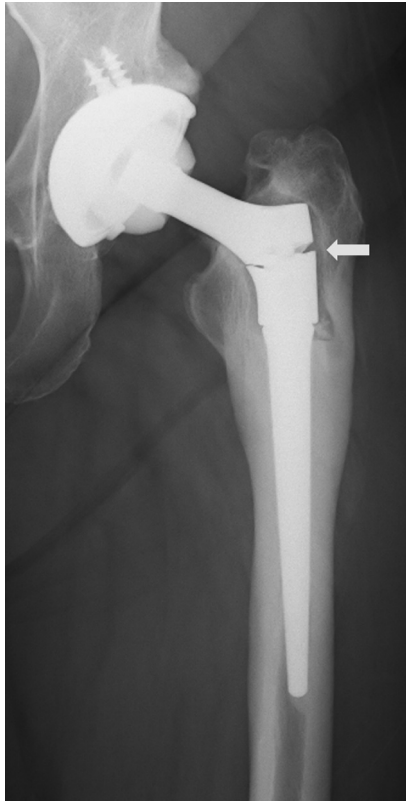


Figure 1. Radiographic examination of the patient's left total hip arthroplasty at 3 years and 8 months postoperatively showing a fracture of the modular neck component.

the 2 modular components was also broken. We could only remove the distal fragment of the screw, which remained within the stem, by turning it with a small flat chisel (Fig. 2; black arrow). An extended trochanteric osteotomy was performed to remove the remnant of the fractured modular neck, which was still coupled to the stem (Fig. 2; gray arrow), by hammering from the bottom rim of the component. Because the surface at the stem taper junction appeared to be scratched (Fig. 3), the surgeon attempted to replace the distal stem, but it was not possible without risking extensive damage to the bone. Leaving the distal stem in situ, the modular neck was replaced with a new 135° standard-offset modular neck

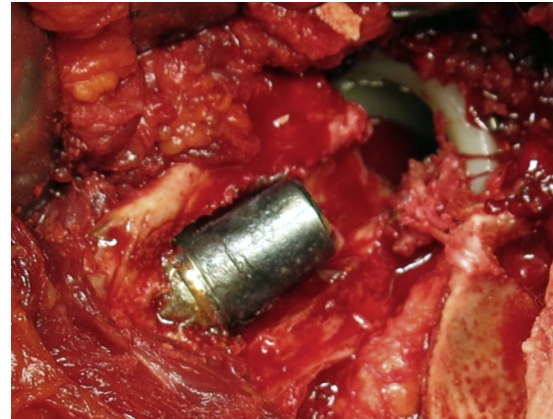


Figure 3. Intraoperative picture of the tapered portion of the proximal stem with evidence of scalloping and pitting.

and a Delta ceramic head (32/0 mm). The greater trochanter was then reattached using a pin-sleeve system (AI-medix, Tokyo, Japan) [9] and ultra-high-molecular-weight polyethylene fiber cable (although the fiber cable is not observable on the radiographic images; NESPLON Cable System; Alfresa Pharma Co., Osaka, Japan) [10]. The properly fixed, cementless acetabular cup was preserved along with its highly cross-linked polyethylene liner (Fig. 4). One year postoperatively, the patient's pain resolved and she was able to return to work without using a walking aid.

We requested that the manufacturer investigate the cause of the component fracture, and Lima Corporate agreed to provide the information reported in this study without any conflicts of interest.

Fracture rate of the MODULUS femoral stem—Lima Corporate postmarket surveillance data

The clinical and mechanical safety of the MODULUS system is confirmed by the low in vivo breakage rate associated with the implant; the total breakage rate, according to the company's post-market surveillance data, is 0.084%, which includes all reported breakages that occurred between November 2001 and November 2015 (13 breakages in a total of 15,444 MODULUS prostheses implanted worldwide). The patient's BMI was known in 11 of the 13 breakages. The average BMI was 31.72 kg/m² and was <25 kg/m² in only 2 cases. The breakage rate specifically related to modular neck of the MODULUS is significantly lower, with the breakage reported

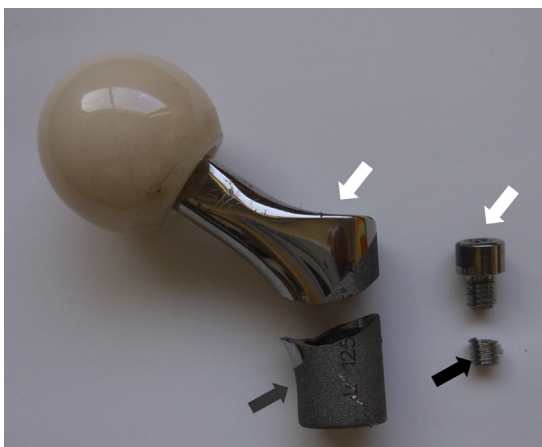


Figure 2. Picture of the broken components after retrieval.

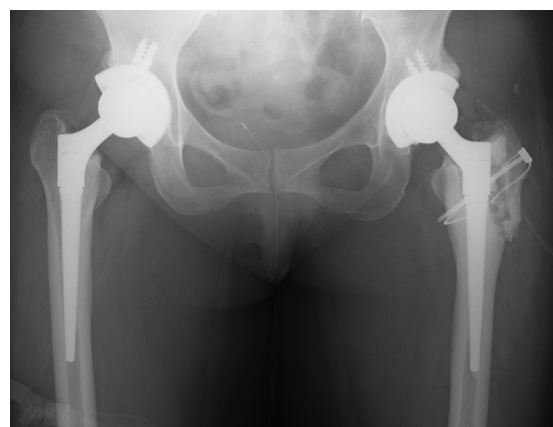


Figure 4. Immediate postoperative radiographic control image after revision of the broken components.

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