Case Report

Modular Femoral Neck Fracture After Primary Total Hip Arthroplasty

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Abstract: The use of modular femoral stems in primary total hip arthroplasty has increased considerably in recent years. These modular components offer the surgeon the ability to independently alter version, offset, and length of the femoral component of a hip arthroplasty. This increases the surgeon’s ability to accurately recreate the relevant anatomy but increases the possibilities of corrosion and fracture. Multiple case reports have highlighted fractures of these modular components. We present a case of a fracture of a modular design that has had no previously reported modular neck fractures. The patient was informed that data concerning the case would be submitted, and he consented. Keywords: femoral neck fracture, total hip arthroplasty, modular components, kinectiv.

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Case Report

A 49-year-old man underwent primary total hip arthroplasty secondary to posttraumatic arthritis. The patient had a history of a remote right acetabular fracture that was treated nonoperatively. At the time of presentation he was 5 ft, 10 in (177.8 cm) and 255 lb (115.8kg). This equated to a body mass index of 36.6 kg/m². He underwent the procedure in the lateral position through a posterior approach. A 63-mm Converge cup (Zimmer, Warsaw, Ind) was placed, along with a 15-mm Kinectiv stem (Zimmer). A 4-mm extra-extended, 15° anteverted neck segment was used, which matched the preoperative template. Finally, a 32-mm, 10° hooded Metasul liner (Zimmer) with a 32-mm + 0-mm CoCr head was placed. Stability was noted to be acceptable when tested intraoperatively. The postoperative course was without complications. (Fig. 1) The patient underwent regular follow-up.

Approximately 15 months later, the patient presented to the emergency department at our institution after stepping 2 ft off of a delivery truck, landing on his feet. He noted immediate right hip pain. Review of his radiographs (Fig. 2) noted a fracture of the modular neck of his femoral stem. The patient was taken to the operating room 2 days later for revision of his femoral component. At the time of surgery, an exhaustive attempt was made to remove the modular neck from the femoral stem. Multiple attempts were made to tap and extract the modular neck using techniques devised by the senior surgeon and an engineer from the respective implant company. These attempts were unsuccessful. An extended trochanteric osteotomy was then undertaken to remove the well-fixed femoral stem. The stem was removed with minimal bone loss. At this point, a 16.5 × 170–mm bowed ZMR XL stem (Zimmer) was implanted with a 78-mm XL body extension and a 32-mm +8-mm CoCr head (Fig. 3). The remaining neck segment was unable to be further analyzed secondary to the damage from attempted removal of the segment. Of note, the patient experienced transient neurologic complications in the contralateral upper extremity from the extended amount of time spent in the lateral decubitus position for the revision procedure. Otherwise, the patient underwent a relatively uneventful postoperative course and was released to follow-up in an outpatient setting.

Discussion

The increasing use of modular femoral stems in total hip arthroplasty has provided significant advantage to the orthopedic surgeon in a more exact match of the patient’s native anatomy by allowing independent adjustment of version, offset, and length through the
use of a modular neck segment. There has been some concern that increasing the number of interfaces has the possibility to increase fretting corrosion [1], metal-on-metal debris, and increase the risk of failure through a modular junction [2,3].

Failure of revision stems through a modular interface is not an uncommon complication [4,5] and has led to the introduction of larger-diameter stem designs, which are intended to be more resistant to fatigue fracture. A larger-diameter interface was used in the revision procedure in this case, with the intention of reducing the chances of a repeat implant failure.

There have been recent case reports of the failure of another modular primary hip stem (PROFEMUR Z; Wright Medical Technology, Arlington, Tenn) [6,7]. This failure has been attributed to fatigue fracture of the titanium alloy. These failures have been felt by some in the arthroplasty community to be isolated to the aforementioned stem design. This case report indicates that fatigue fracture of the modular neck is not isolated to the PROFEMUR Z design but can occur with the Kinectiv design as well.

As is noted in the Kinectiv Performance Evaluation performed by Zimmer, CoCr alloy monoblock head and neck segments were tested in the laboratory setting and had acceptable fatigue testing results, but the junction between the titanium alloy stem and the CoCr alloy neck showed significantly higher mass loss secondary to fretting corrosion and was not considered for final design testing [8]. Because of this increased corrosion, a modular titanium alloy stem segment was used. This design is similar to the PROFEMUR Z design.

The modular stem used in this patient was an antverted, varus neck with increased offset and reduced length. This style of modular neck creates the highest

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**Fig. 1.** Postoperative radiograph at the time of index operation.

**Fig. 2.** Radiograph taken at the time of emergency room visit.

**Fig. 3.** Postoperative radiograph at the time of revision surgery.
strain at the modular neck/stem junction and is similar to the geometry reported in other case reports of modular neck failure.

The authors would recommend against routine use of a modular femoral stem in the primary setting unless it is absolutely necessary to achieve stability intraoperatively. It is also necessary to note that the modular neck is unlikely to disengage in any revision scenario, especially given a fractured component. The titanium alloys used for the modular neck components have been shown through multiple case reports to be susceptible to fatigue fracture at the neck/stem junction. Once the modular neck has fractured, there have been no reported successes in removing the remaining portion of the neck and simply replacing the modular neck segment. There are multiple reports in the Food and Drug Administration’s Manufacturer and User Facility Device Experience database reporting inability to disengage intact neck segments during revision procedures [9]. This is believed to be due to fretting and/or corrosion occurring at the modular interface [10]. All reported cases of modular neck fracture have required an extended trochanteric osteotomy to remove these fully ingrown stems and replacement with a revision stem.

References