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Case report

Fracture of an S-ROM stem at the sleeve-stem junction

Kilian Rueckl, MD [a, b, *], Friedrich Boettner, MD [a], Ulrich Bechler, MD [a], Elexis C. Baral, BS [a], Timothy M. Wright, PhD [a], Peter K. Sculco, MD [a]

[a] Hospital for Special Surgery, New York, NY, USA
[b] Department for Orthopedic Surgery, University of Wuerzburg, Germany

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ABSTRACT

Fracture of a well-ingrown femoral component is a rare and often challenging complication. Modular junctions and sleeve interfaces have been identified as one potential point of weakness with corrosion and fretting being contributing factors to ultimate femoral component fracture. Stem fractures at the sleeve interface were reported occasionally for the proximal ingrowth modular Emperion System (Smith and Nephew, Memphis, TN). However, this failure mechanism has been reported infrequently, often associated with corrosion at the modular junction, for the similarly designed S-ROM system (DePuy Orthopedics Inc., Warsaw, IN). We present the case of a 52-year-old patient, with a body weight of 84 kg (185 lbs) and a body mass index of 30.6 kg/m^2, who suffered a fatigue fracture of a 14 × 09 × 130 mm S-ROM stem 42 months after implantation. The present study presents the results of the surface analysis, discusses possible failure mechanisms, provides treatment guidelines, and a review of the literature revealing 15 cases of failure at the level of the stem-sleeve junction. In particular, modifiable risk factors for potential stem failure, including stem diameter, stem offset, and the resulting cantilever bending forces on the proximal sleeve-stem junction, are discussed in detail.

Introduction

Femoral component fracture in total hip arthroplasty (THA) is a rare complication that mainly affects uncemented distally fixed revision stems [1-3]. Risk factors include high body mass index (BMI), increased activity level, smaller diameter stems, and severe proximal femoral bone loss with loss of medial calcar support [2,4-6]. Contemporary diaphyseal engaging revision femoral stems often have a modular proximal body and fractures were reported at the modular junction, particularly with earlier stem designs [2,4]. Modular junctions are also used to combine a metaphyseal sleeve with a diaphyseal engaging stem allowing independent control of version to better address conditions such as metaphyseal bone loss, revision cases with stem retroversion, and excessive anatomic anteversion or retroversion in primary THA. But recent reports on the modular stem Emperion System (Smith and Nephew, Memphis, TN) demonstrated a stem fracture rate of 1.5% (8 of 547), and this stem has since been removed from commercial use [7]. The present study reports a similar failure mechanism at the sleeve-stem junction in a S-ROM Modular Hip System (DePuy Orthopedics Inc., Warsaw, IN) and includes a comprehensive review of the literature on S-ROM stem fractures [7-11]. The paper also discusses the proposed failure mechanism, potential risk factors, and surgical management of this complication.

Case history

A 52-year-old female with a height of 165 cm, weight of 83.5 kg, BMI of 30.62 kg/m^2, and no history of metabolic bone disease underwent a primary THA for osteoarthritis secondary to dysplasia of the right hip in December 2013 (Fig. 1). She already underwent contralateral total hip replacement after an injury due to a motor vehicle accident in October 1995 (cup: Implex 52 mm [Zimmer, Warsaw, IN], stem: Reality size 7 [Kinamed, Camarillo, CA], head: 28 mm + 4) with a highly satisfactory result at the last follow-up.

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* Corresponding author. Brettreichstrasse 11, D-97074 Wuerzburg, Germany. Tel.: +49 931 803 1101.
E-mail address: Kilian.rueckl@gmail.com

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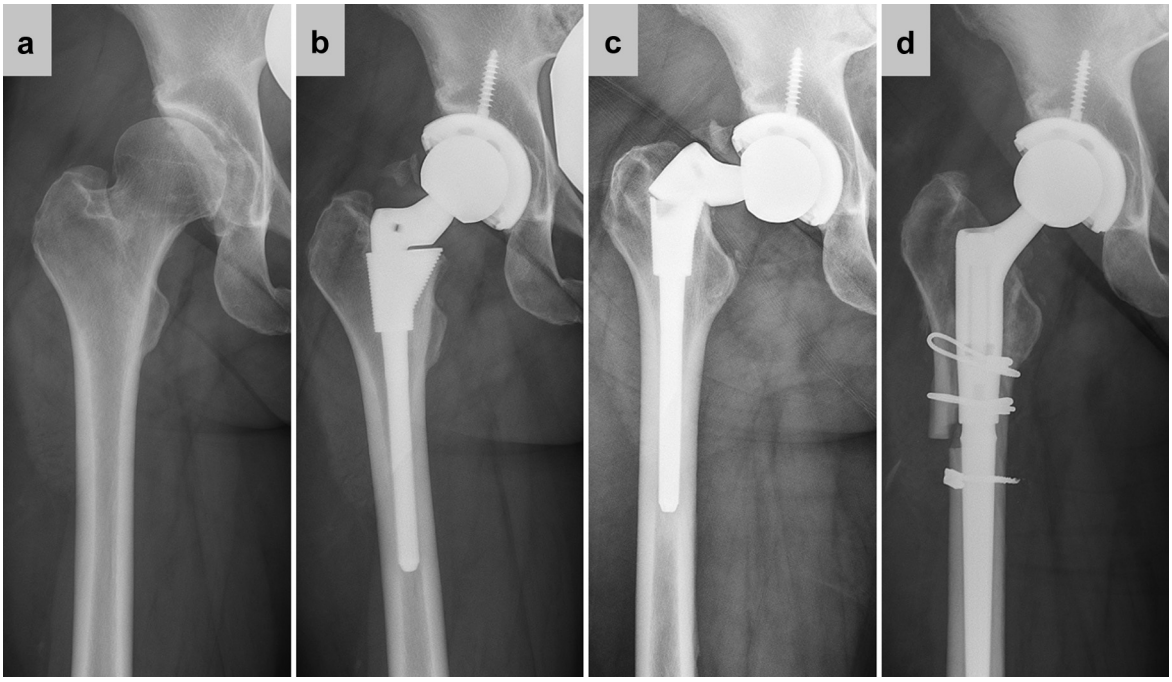

Figure 1. Chronologic radiographs (a) October 2, 2013 preoperative anteroposterior radiograph of the right hip showing secondary osteoarthritis due to hip dysplasia (b) December 18, 2014 postoperative radiograph of the right hip after total hip arthroplasty with a S-ROM prosthesis and a Pinnacle cup (c) July 5, 2017 follow-up radiograph of the right hip showing a fracture of the femoral component at the level of the sleeve-stem junction with a valgus malalignment (d) August 14, 2017 postoperative radiograph of the right hip after revision performing and ETO, implanting of a Restoration Modular Hip System and reposition of the greater trochanter with Dall-Miles cables. The original cup could be preserved.

Owing to a pre-existing developmental dysplasia at the time of primary surgery, the right hip was replaced utilizing a standard S-ROM Modular Hip System with a 14 × 09 × 130 mm stem, a 36 mm standard neck, and a 14D large proximal sleeve combined with a 36 + 0 mm Biolox ceramic head, a 54 mm Pinnacle cup and a highly cross-linked polyethylene liner (DePuy Orthopedics Inc., Warsaw, IN). The postoperative course was unremarkable.

In June 2017, she developed progressive discomfort in the right thigh reporting only a minor trauma while walking on a side walk and thrusting her right foot against a raised grate. Initial radiographs showed no evidence of fracture or loosening, and the clinical examination showed no limitation in range of motion. The patient developed worsening pain over the next few days and went to the emergency department owing to inability to bear weight on her right leg. Radiographs showed a fracture at the sleeve-stem junction of the right femoral component. There was no evidence of loosening or periprosthetic fracture (Fig. 1). Revision surgery was therefore indicated and performed in July 2017.

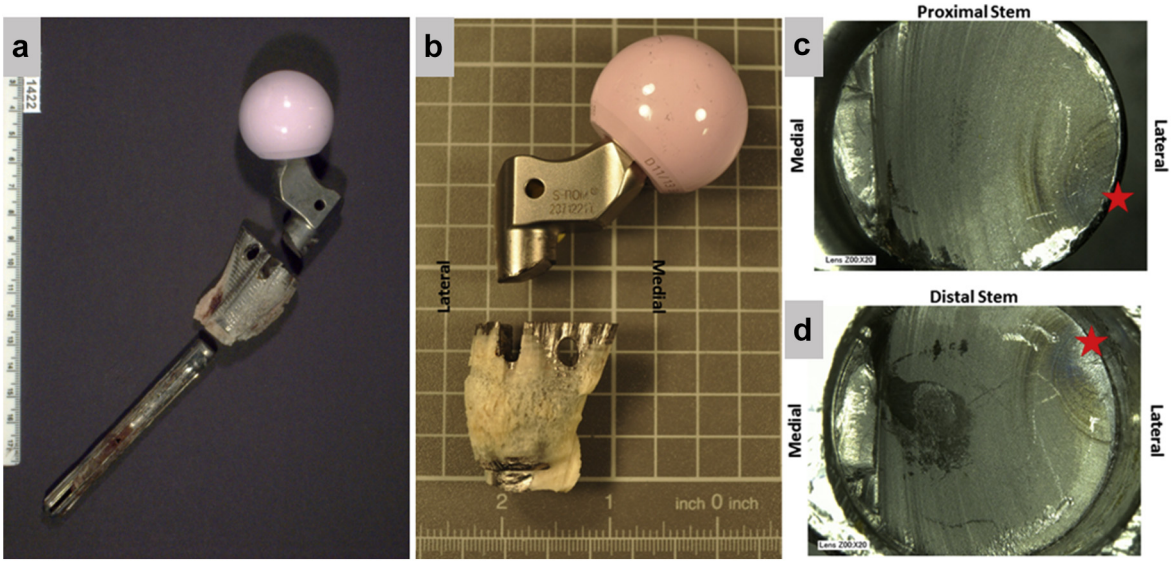

Figure 2. Macroscopic image and surface analysis of the revised S-ROM Modular Hip System. (a) The sleeve and the polished stem show substantial bony ingrown; (b) retrieved fractured component oriented to show where the fracture occurred at the stem within the femoral sleeve. Magnified images of the proximal (c) and distal (d) stems are shown highlighting the fracture origin at the red star. Beach marks propagate medially across both surfaces to the final fracture point, at medial edge.