Archives of Orthopaedic and Trauma Surgery (2004. Mar) 124(2):137-139.

Periprosthetic acetabular bone loss using a constrained acetabular component

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Case Report

Periprosthetic Acetabular Bone Loss Using a Constrained Acetabular Component

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Abstract

We describe 2 patients with a constrained acetabular component who required treatment for recurrent dislocation showing postoperative periprosthetic acetabular bone loss. These hips required revision surgery and demonstrated considerable bone loss caused by the migrated acetabular component. Impingement may have occurred with increased stress at the bone-prosthesis interface, and the sharp ends of screws with a metal shell may have gradually plowed up the acetabular bone. These failures illustrate the potential risk of using a constrained acetabular component.

Keywords: Hip joint, Prosthesis, Instability, Dislocation, Modular

Introduction

Dislocation after total hip arthroplasty presents a clinical challenge. Numerous procedures have been reported to solve this problem, and the use of a constrained acetabular component is one of the options. Increased interfacial stress between the prosthetic femoral head and the polyethylene liner is considered a disadvantage in using such a device. A major theoretical complication may be fixation loss of the acetabular component before bone ingrowth to the porous surface due to this disadvantage. This complication is then followed by progressive migration of the component. We report 2 cases using a constrained acetabular component that resulted in postoperative

periacetabular bone loss without apparent fixation loss of the acetabular component, which needed reoperation 24 months and 26 months after index surgery. This failure illustrates the potential risk of using a constrained acetabular component.

Case 1 A 63-year-old woman with rheumatoid arthritis underwent total hip arthroplasty of the right hip through a posterolateral approach without trochanteric osteotomy. A 50-mm Harris-Galante Porous II cup and a non-constrained liner (Zimmer, Warsaw, IN, USA) were inserted without cement and a Harris precoat plus stem (Zimmer) was inserted with cement. The patient had a posterior dislocation 6 days postoperatively which had occurred after marked flexion with the hip in adduction. The patient subsequently had 6 additional episodes of posterior-superior dislocation. Each dislocation occurred after the hip had been placed in marked flexion with adduction. Revision surgery was performed 10 months after index surgery. The Harris-Galante Porous II cup was removed and a 54-mm S-ROM ZTT II acetabular cup (DePuy / Johnson & Johnson, Warsaw, IN, USA) was inserted in a position of 15° anteversion 35° abduction without cement. Three dome screws were inserted for augmentation of the cup. A constrained polyethylene liner was placed and 4 peripheral bone-screws were inserted. The well-fixed femoral stem was left in place. A new femoral head was fit into the liner with a reinforcing ring (Fig. 1A). Fourteen months after revision, the patient

complained of slight hip pain without any preceding traumatic event. A radiograph demonstrated proximal and medial migration of the acetabular component and acetabular bone destruction (Fig. 1B). A radiograph obtained 24 months after revision surgery demonstrated progression of the acetabular component migration and bone destruction (Fig. 1C). A second revision surgery was performed. Apparently, there was no obvious loosening of the acetabular cup. Medial and superior bone defect of the acetabulum without any signs of infection was observed. The acetabular component and the femoral head were removed and a 58-mm Harris-Galante Porous II cup was inserted without cement. Five bone-screws and a non-constrained elevated liner were inserted. A new femoral head was placed into the neck taper. Intraoperative assessment of hip movement indicated that the hip did not dislocate in a position of 70° flexion and 45° internal rotation, which was evaluated as providing acceptable stability. The patient wore bracing to prevent excessive flexion and adduction for 4 months postoperatively. At the most recent follow-up 26 months postoperatively, the patient was able to walk using a cane without hip pain and had no symptoms that would suggest recurrent subluxation or dislocation. Serial radiographs have not demonstrated any signs of cup migration.

Case 2 A 74-year-old woman with right subluxated osteoarthritis underwent total hip arthroplasty. A 56-mm Harris-Galante Porous II cup and a

non-constrained liner were inserted without cement and a Harris precoat plus stem was inserted with cement. The patient had a posterior dislocation 3 weeks postoperatively which occurred after marked flexion with the hip in internal rotation. The patient subsequently had 5 additional posterior dislocations. Revision surgery was performed 10 months after index surgery. The Harris-Galante Porous II cup was removed and a 68-mm S-ROM ZTT II acetabular cup was inserted in a position of 15° anteversion 35° abduction. Three dome screws, a constrained polyethylene liner, and 4 peripheral bone-screws were inserted. The well-fixed femoral stem was left in place. A new femoral head was fit into the liner with a reinforcing ring. Twenty-four months after revision, the patient complained of hip pain. A radiograph demonstrated proximal migration of the acetabular component with superior acetabular bone destruction. The second revision surgery was performed 26 months after the previous surgery. The acetabular component and the femoral head were removed, and a 70-mm Trilogy cup (Zimmer) was inserted without cement. Six bone-screws, a non-constrained elevated liner, and a new femoral head were also inserted. The patient wore bracing to prevent excessive flexion and internal rotation 5 months postoperatively. At the most recent follow-up 24 months postoperatively, the patient had no symptoms that would suggest recurrent subluxation or dislocation.

Discussion

Anderson et al. [1] reported that 15 (71%) of 21 patients showed successful results after insertion of an S-ROM constrained acetabular component. Goetz et al. [2] reported excellent results using a constrained acetabular component (Omnifit constrained acetabular bearing insert; Osteonics / Howmedica, Allendale, NJ, USA), in which only 2 (4%) of 55 patients had repeat dislocation after insertion. Their short-term results showing clinical success were superior to the previously reported success rates for recurrent instability [6, 7, 8]. These authors also reported excellent results in which the indications for surgery included intraoperative instability and neurologic impairment [4].

Use of a constrained component has major theoretical disadvantages: increased polyethylene wear and increased interfacial stress. Several different modes of failure were reported including dissociation of the polyethylene liner from the acetabular cup (a so-called pull-out mechanism) and disengagement of the femoral head from the liner with or without failure of the metal constraining ring on the neck of the liner (a so-called lever-out mechanism) [1, 2, 5]. Kaper et al. [5] reported that 4 of 12 patients had failure of an S-ROM constrained acetabular component. They reported that 2 of the failures were associated with fracture of the constraining ring on the neck of the liner, but only 1 of the 2 resulted in dislocation or clinical instability, and that the other 2 failures occurred in hips with an intact constraining ring; in both instances, the femoral head was dislocated but the acetabular shell and liner remained in place.

We describe another failure mode in which increased stress at the

bone-prosthesis interface lead to gradual component migration, resulting in periprosthetic acetabular bone loss. The photos of case 1 and 2 were almost identical. The main reason for this failure might be increased bone-implant interfacial stress caused by impingement between the prosthetic femoral neck and the polyethylene liner. Sufficient initial and continuous stability of the constrained acetabular component may be difficult to achieve compared to that of the non-constrained acetabular component because of increased bone-implant interfacial stress. The manufacturer recommends using at least 4 peripheral screws to achieve initial stability when using the S-ROM constrained acetabular component. The present failures suggest that continuous stability of the constrained acetabular component was difficult to achieve even after the initial stability had been obtained. The acetabular cancellous bone in these 2 patients was osteoporotic due to rheumatoid arthritis and advanced age. The increased bone-implant interfacial stress continued and the sharp ends of the screws with a metal shell gradually plowed up the periprosthetic acetabular bone. The present failures suggest that a constrained acetabular component can migrate without apparent fixation loss especially in patients with osteoporotic bone. This complication usually occurs within the first 2 years postoperatively. These gradual migrations of the acetabular component might have resulted in subluxation or dislocation if we had used a non-constrained component.

Goetz et al. [4] emphasized that the loosening rate did not increase when using a constrained component. They reported only 2 hips with

postoperative component migration occurring 8 months and 53 months after the index surgery and indicated that the cause of failure might be due to technical error as the component had been placed in excessive abduction greater than 60°. Fisher and Kiley [2] reported two cases of polyethylene dissociation from metal and described that the only factor predicting failure of the constrained liner was an increased abduction angle of the cup. The abduction angle of the present 2 hips was both 35°, suggesting that an appropriate abduction angle does not necessarily predict a good result.

We have implanted 23 S-ROM constrained acetabular components to date. Two hips failed as described above. Another hip resulted in early postoperative fixation loss and needed revision 12 days after index surgery. Five other hips failed because of the so-called lever-out mechanism. A total of 8 (35%) hips failed. Results in the other 15 (65%) patients remained satisfactory without postoperative dislocation or aseptic loosening. We suppose that the present failures were likely related to the constrained nature of the component, and not likely related to the particular use of an S-ROM type prosthesis. Radiograph of these successful 15 patients did not demonstrate remarkable migration of the acetabular component at the most recent follow-up, however, gradual migration is possible in the near future because of the unfavorable constrained nature.

Indications for using the constrained acetabular component remain controversial. Currently, recurrent dislocation is often accepted as the reason

for using this device. A constrained acetabular component provides an effective treatment for recurrent dislocation, however, implant stability and longevity may sometimes be traded off. The decision to use this device should be made carefully because of the potential risk described in the present report.

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Figure Legends

Fig. 1 Case 1: Anteroposterior radiographs of the right hip of a 63-year-old woman with rheumatoid arthritis.

A Early postoperative radiograph.

B Radiograph obtained 14 months postoperatively.

C Radiograph obtained 24 months postoperatively.