New Approach to the Anchoring of Macroporous Revision Cups in Large Acetabular Defects a Case Report

Wessling M, Usama Dib*, Gebert C

Department of Revision Arthroplasty and Tumor Orthopedics, Wetter (Ruhr), Germany

*Corresponding author: Usama Dib, Department of Revision Arthroplasty and Tumor Orthopedics, Wetter (Ruhr), Germany

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Abstract

Revision hip arthroplasty has become more common and will probably continue to give rise to significant controversies in treatment management. Many different surgical techniques for the procedure have been published, with a wide range of options, depending on the size and location of the acetabular defect. This report describes a case of a Paprosky type IIC-IIIB defect due to aseptic loosening of a total hip arthroplasty, which was treated with allograft augmentation and a high-porosity titanium laser-manufactured acetabular shell with an inverse anchoring technique (Implantcast GmbH, Buxtehude, Germany). The 1-year follow-up showed a 40 point improvement in the Harris-Hip score.

Introduction

Kurtz and colleagues predicted in 2007 that the rate of revision hip arthroplasty would double by 2026 [1]. Many different surgical techniques and solutions, depending on the acetabular defect involved, have since been published [2]. However, treating large bone defects in the acetabulum continues to be challenging, particularly in Paprosky type II and III defects [3]. Secure fixation of the implant in a biomechanically promising zone is critical to achieving good functional results. The diameters of the screws used in cup fixation vary from 4.5 mm to 6.5 mm [4]. Some authors have described the use of a bolt or peg to secure the implant [5-10]. In almost all recently used pressfit revision cups, the cup is implanted first with a 1-2mm press-fit, while screws or bolts are used to secure the position of the implant [11,12].

In addition to screw diameter and length, the number of screws also has an effect on primary stability [13]. When three screws are used, three-dimensional angular stability can be achieved, without using the locking screw fixation technique. The new implant used in the present case report combines both fixation strategies. An 8-mm dome screw provides a high degree of primary stability in the weightbearing area without the well-known disadvantages of the pedestal cup. In addition, the advantages of a modern high-porosity titanium cup can create better preconditions for long-term osseointegration (Figure 1).

This report describes the case of a 62-year-old man in whom a borderline Paprosky type IIC-IIIB defect was treated with this implant, and reports on the outcome after 1 year.

Consent

Written informed consent was obtained from the patient for publication of this case report and any accompanying images. A copy of the written consent is available for review by the author.

Case history

The patient presented in our department with pain in the left hip, having undergone a hip arthroplasty 25 years previously in a different institution. The initial examination showed a range of motion in the hip with extension/flexion of 0 to 90°, abduction/adduction of 10 to 10°, and internal/external rotation of 10 to 0°. The Harris Hip Score (HHS) estimated at the time of admission was 50 [14]. Pelvic radiographs showed loosening of the primary cup and mediocranial migration of the center of rotation, with no...
signs of loosening of the stem (Figure 2). Computed tomography of the pelvis showed an oval acetabular defect (Paprosky type IIC-IIIB), with no pelvic discontinuity and with a central and anterior wall defect and superior osteolysis (Figure 3). The patient’s body mass index was 27 kg/m². With the exception of high blood pressure, a paralyzed right foot due to poliomyelitis in childhood and hip arthroplasty to the right side, no other conditions were noted. Preoperative blood tests showed a C-reactive protein (CRP) level of 0.3 mg/dL (normal range < 1.0 mg/dL) and a white blood cell count of 5.06 10³/µL. The preoperative joint aspiration was dry, and intraoperative aspiration showed a Leukocyte count 0.410 Tsd/µl and 32.7% Neutrophils.

**Figure 2:** Anteroposterior radiograph of the pelvic, showing cranial migration and loosening of the cup.

**Figure 3:** Computed tomography of the left hip (a, coronal; b, transverse), showing loosening of the cup and an acetabular defect. C Transverse image, showing supra-acetabular osteolysis.

**Surgical technique**

With the patient under general anesthesia in the supine position and through the previous scar, the hip was then dislocated in a typical manner. The stem proved to be well fixed. The cup was extracted and after clearance of the debris, the acetabulum showed a central cranial defect with anterior and superior acetabular rim loss. To restore the COR and fill the acetabular defect, morcellized allograft was packed into the defect and a K-wire was fixed through the dome of the defect along the trajectory of the posterior superior iliac spine under radiographic guidance. The K-wire was overreamed and replaced with a guide wire for the PRS Cup (Implantcast GmbH, Buxtehude, Germany). This modification (screw first) of the standard implantation technique (implantation of the cup first, than screw fixation) is needed to obtain the longest possible lever arm of the dome screw. A trial implant was threaded and placed in the acetabulum. Intraoperative radiographs showed good coverage of the defect and restoration of the COR. The original PRS Cup (with a diameter of 64 mm) was then threaded and pressed into the acetabulum. The guide wire was removed, and an 8-mm wide, 90-mm long screw was placed. The cup was then hammered into position, achieving press-fit fixation. Two 6.4-mm screws were placed in rudimentary fashion in the ilium. The 8-mm wide screw was tightened. A dual-mobility hip cup (Implantcast EcoFit 2M, 54 mm outer diameter) was cemented into the PRS Cup shell. The cemented 2M implant was then angulated to re-establish the inclination and anteversion. Postoperatively, full-body weightbearing was allowed after radiography of the pelvis (Figure 4). The radiographs showed satisfactory restoration of the COR and proper placement of the pelvic screws.
Figure 4: Radiographs of the left hip after revision, showing screw placement in the ilium. a, Anteroposterior view; b, ala radiograph of the ilium; c, obturator radiograph.

The patient was discharged 10 days after the procedure. A follow-up examination after 6 weeks showed good functionality in the hip, with no need for crutches. The 1-year follow-up examination showed no signs of loosening, remodeling of the allograft that was used, and osseointegration of the PRS Cup, in addition to restoration of the COR, achieved by the allograft filling the acetabular cavity (Figure 5). The Harris Hip Score measured was 90 [14].

Figure 5: One year after revision of the left hip. pelvic (a), lateral (b) radiographs and coronal (c) computed tomography scan.

Discussion

The main goal of revision total hip arthroplasty (THA) is to achieve long term stable fixation, restore the centre of rotation [15], or at least to restore good functioning. This is made by packing allograft into the acetabular defect, using sustainable implants that allow bone ingrowth, filling the acetabular wall defect with wedges, and using cages and 3D-printed implants [2,11,16,17]. Porous implants such as trabecular metal (Trabecular Metal; Zimmer Biomet, Warsaw, Indiana, USA), which are commonly used in revision THA, have already shown good results in relation to osseointegration and functionality [18]. Porous titanium has been found to have a low modulus of elasticity, excellent bioactivity and biocompatibility, and allows bone regeneration as reported by Wen et al. [19], Trabecular Titanium showed encouraging results in revision hip arthroplasty in short and medium terms[20,21].

The LUMIC pedestal cup which has a similar anchoring principle by anchoring in the weight bearing area (supra acetabular area) [22]. This concept was then modified by Dijkstra’s tumor research group in order to reconstruct pelvic defects after tumor surgery [23]. However the pedestal cup has a conical shaped stem which has to be hammered in the ileum which could lead to Fissures and loosening. The study by Schoellner and Schoellner reported a complication rate of 20% the results in tumour operations show an implant failure rate for the modular cup of 2.1% after two years and 17.3% after five years [22]. These results must be regarded critically as a tumour operation which is not compatible with the
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