Minimum 10-year radiographic follow-up of a cementless acetabular component for primary total hip arthroplasty with a bulk autograft

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Abstract We radiographically investigated 36 hips in 34 patients with osteoarthritis of the hip who had undergone total hip arthroplasty. Their mean age was 59.2 years (range 36–79 years), and the mean follow-up period was 11.2 years (range 10–14 years). The long-term outcome and the chronological changes in the bulk autograft were examined. The acetabular component of the prosthesis was a Lord-type threaded cup with a smooth surface. At follow-up, bone absorption was minor in 17 joints, moderate in 11, and major in 8. The hips with graft coverage of ≥20% (group A) had a significantly higher loosening rate than hips with coverage of <20% (group B) (P < 0.05). The cup position changed markedly in group A. Our findings indicate that graft coverage should be less than 20% when a bulk graft is used together with a smooth-surfaced cementless cup.

Key words Bone graft · Radiography · Loosening · Cementless

Introduction

Total hip arthroplasty (THA) is an excellent treatment for deteriorated hip joints, and it is commonly applied throughout the world. However, when it is applied in the presence of secondary osteoarthritis due to acetabular dysplasia, THA is associated with various problems (e.g., leg length discrepancy, muscle contracture, acetabular bone loss55).

McQueary and Johnston19 covered the area of bone loss with cement and reported that there were no revision cases due to loosening at 8.5 years, and the loosening rate was 10%. However, MacKenzie et al.18 reported that, on average, revision surgery had been performed in 7% at 16 years and the loosening rate was 32% with this method; they concluded that the outcome was poor.

Charnley and Feagin2 stated that the cup should not protrude more than 5 mm from the original acetabular bone. To cover the cup with host bone, Russotti and Harris24 introduced a technique wherein there was proximal placement of the acetabular component; they reported an 84% success rate at 10 years. Some problems have remained, however. For example, this technique did not solve leg-length discrepancy, and it does not provide bone stock for future revision surgery.

To place the cup within the original acetabulum and to cover the cup with bone, THA with a bone graft is an excellent technique. When this technique was introduced, the cup was fixed with cement in combination with the bone graft; a good short-term outcome was reported, but the long-term success rate varied.6,13,17,23,26 Recently, cementless THA was reported to have good success rates,5,14 and cementless THA with bone graft came to be applied to patients with acetabular dysplasia. In the short term this technique achieved good outcomes,1,3,20–22 but long-term results have not yet been fully discussed.7 It is therefore important to clarify the long-term changes of the graft bone to determine the indications for cementless THA with bone graft.

The authors have applied bulk bone grafts in cementless THAs in patients with dysplastic hips. This study radiographically examined the changes in bulk autografts applied together with the smooth-surfaced threaded cup.

Subjects and methods

Subjects

The subjects were 34 patients (36 hips) with osteoarthritis caused by acetabular dysplasia. The patients underwent cementless THA with bone graft between January 1984 and December 1989, and they were followed for 10–14 years (mean 11.2 years). Their
mean age at surgery was 59.2 years (range 36–79 years); there was 1 man and 33 women. All 34 patients underwent primary surgery.

Surgical technique and postoperative management

The cementless Lord-type threaded cup (Howmedica, Benoist Girard, Bagneaux, France) is cone-shaped, and its surface is smooth and has no coating. The cup is screwed into the acetabulum for fixing, with no cementing.

Two surgeons with equivalent experience and technique performed all the surgery on these 36 hips. The patient lay on the operating table in the lateral position. A posterolateral approach without trochanteric osteotomy was applied. The need for a bone graft was evaluated on preoperative anteroposterior (AP) radiographs. During the surgery, reaming was performed on the AP diameter of the acetabulum, being careful not to break the medial acetabular wall. Bulk bone graft was performed when the cup protruded 5 mm or more from the original acetabular bone. All bone for grafting was obtained from the femoral head of the patient. Briefly, the femoral head was divided, and bulk bone was fixed into the original acetabular bone using two or three A-O malleolar or cortical screws (diameter 4.5 mm) (Robert Mathys, Bern, Switzerland) according to the method of Morsi et al.20,21 Reaming was again performed using an acceabular reamer to shape the grafted bone, and the cup was screwed into the original acetabular bone. The femoral component was the Lord-type madreporique porous-coated stem. After surgery, weight-bearing was prohibited for 6 weeks; partial weight-bearing was permitted during the 7th week and total weight-bearing during the 12th week.

Radiographic evaluation

Preoperative evaluation of acetabular dysplasia was done on AP radiographs using Crowe’s classification and the acetabular head index (AHI).18 In regard to the stability of the cup, the inter-teardrop line on the AP radiographs was set as the baseline, and chronological changes in the inclination angle of the cup, the vertical distance from the line, and the horizontal distance from the teardrop were measured according to the methods of Knight et al.18 and Goodman et al.5 Lengthening of the affected limb was measured by the AP radiographs. After confirming that there was no anteroposterior tilting of the pelvis, radiographic analysis was performed, with graft coverage expressed as its ratio to the entire circumference of the cup on the AP radiograph according to the method of Silver and Engh26 (Fig. 1). The cases were divided into two groups according to graft coverage: group A (graft coverage ≥20%, n = 21) and group B (graft coverage <20%, n = 15). Bone union was said to be present when a trabecula was formed between the graft and the host bone.20 Absorption of the graft bone was grouped into three levels according to the classification of Gerber and Harris,8 i.e., minor, <one-third; moderate, one-third to one-half; major, >one-half. The radiolucent line was classified into grades 0–4 according to the classification of Hodgkinson et al.11,12 Kaplan-Meier survival analysis was conducted by setting the endpoint at the time when radiographic loosening was confirmed. Loosening of the cup was defined as (1) radiolucent lines appearing on the entire circumference, (2) 5° or larger change in the inclination angle, or (3) vertical or horizontal migration of 5 mm or more.

Statistical analysis

For statistical analysis, the Cox regression analysis, Student’s t-test, and the χ² test were conducted using a computer program (Statview 5.0; Abacus Concepts, Berkeley, CA, USA). Results were considered statistically significant at P < 0.05.

Results

The severity of acetabular dysplasia was assessed using the classification of Crowe et al.:4 group I, 28 hips; group II, 5; group III, 1; group IV, 2. The acetabular head index (AHI) was 67.6% on average (range 43.2%–83.6%).