

Long-Term Results of Cemented Total Hip Arthroplasty in Developmental Dysplasia With Acetabular Bulk Bone Grafts After Improving Operative Techniques

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Abstract: We present the long-term results (mean follow-up, 11.8 years; range, 6.3-15.4 years) of cemented total hip arthroplasty with acetabular bulk bone grafting in 147 dysplastic hips using improved surgical techniques. Operations were performed through a direct lateral approach with partial trochanteric osteotomy to avoid nonunion of the greater trochanter. Bioresorbable poly(L-lactide) screws were used for fixation of the acetabular bone grafts to prevent any possible delayed remodeling. Preoperative planning using computer simulation was performed to estimate the optimal size and position of the acetabular component. Analysis predicted rates of survival of the acetabular component of 96% and 91% at 15 years, with revision for aseptic loosening and radiologic loosening as the end points, respectively. Our results indicate excellent long-term clinical and radiographic survivorship of a cemented acetabular component with bulk autograft for acetabular dysplasia. **Keywords:** total hip arthroplasty, long-term results, acetabular autogenous bulk bone graft, improved operative techniques.
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Total hip arthroplasty (THA) is a successful procedure for the restoration of hip joint function and the relief of pain for patients with osteoarthritis. Many midterm and long-term follow-up evaluations of THA have been reported, leading to several improvements in operative techniques [1-5].

Total hip arthroplasty in patients who have developmental dysplasia of the hip often requires autogenous bulk bone grafting to augment the acetabular bone defect when the acetabular component is placed at the level of the true acetabulum. This procedure is satisfactory in the short-term, but the results in the long-term have been much more variable [6,7]. We previously reported the long-term results of cemented THA with acetabular bulk bone grafting for developmental dysplasia performed between 1974 and 1988 [8]. Kaplan-Meier analysis

predicted a rate of survival of the acetabular component at 15 years of 96% with revision for aseptic loosening as the end point and 75% with radiologic loosening as the end point. We identified the risk factors that were responsible for loosening of the acetabular component as follows: trochanteric nonunion, lateral placement of the acetabular component, and delayed trabecular reorientation of the grafted bone.

To improve the long-term results, we used a direct lateral approach, instead of a transtrochanteric approach, to prevent nonunion of the reattached greater trochanter and used bioresorbable poly(L-lactide) screws to fix the acetabular grafts, instead of crystalline alumina ceramic screws. Furthermore, we performed preoperative planning using computer simulation, which is valuable for placing the acetabular component more accurately at the level of the true acetabulum. In this study, we show the long-term success of cemented THAs with acetabular bulk bone grafting for developmental dysplasia of the hip using this improved surgical protocol.

Patients and Methods

Between 1991 and 1997, we performed 254 primary cemented THAs using the PHS KC prosthesis (Japan Medical Materials Corp, Osaka, Japan) with a 22-mm alumina ceramic head (Fig. 1A). During this period, 119

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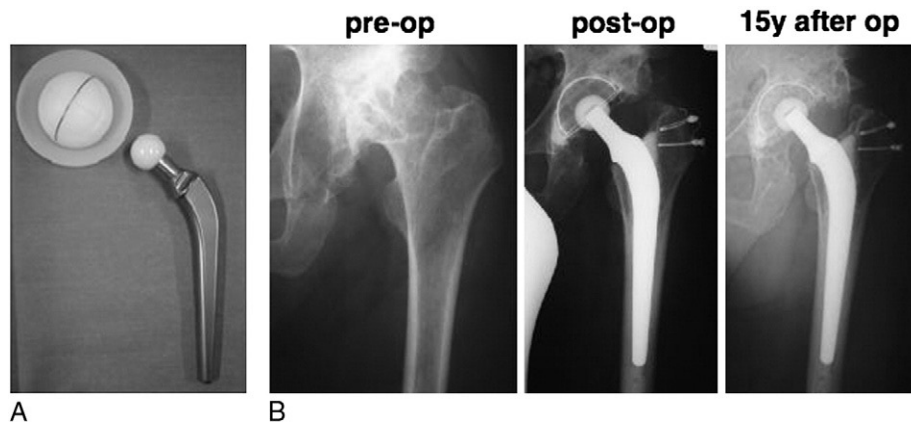


Fig. 1. (A) Photograph showing a PHS KC prosthesis and a 22-mm alumina ceramic head. (B) Radiographs taken preoperatively, postoperatively, and at 15 years after surgery.

patients (147 THAs) required acetabular bulk bone grafting and were observed for an average of 11.8 years (range, 6.3-15.4 years) forming the study group.

The patients consisted of 7 men and 112 women, with a mean age at the time of the operation of 56 years (range, 38-76), a height of 150.6 ± 5.7 cm, and a weight of 51.6 ± 7.9 kg. The diagnosis for all hips at the time of operation was secondary osteoarthritis caused by developmental dysplasia or congenital dislocation of the hip. The degree of subluxation was categorized according to Crowe et al [9] as shown in Table 1.

Before surgery, computer simulation for the planning was performed as described [10]. Briefly, images of hip joint computerized tomography with a line interval of 5 mm were entered into the computer using a digital camera. The level of the acetabular component center was decided from the original acetabulum. The diameter, the location of the component, the inclination angle, and the anteversion of the component were determined in relation to the anteroposterior diameter of the acetabulum and the thickness of its anterior and posterior lips. The area in need of a bone graft was shown by a line that represented the lateral half contour of the projected image of the component in the horizontal plane.

All operations were performed through a direct lateral approach with partial trochanteric osteotomy as reported by Dall [11]. The acetabular autogenous bone grafting using the resected femoral head was done as described by Wolfgang [5]. The grafts were fixed to the superolateral aspect of the acetabular roof with bioresorbable poly(L-lactide) screws in 113 hips, titanium screws in 17, and AO stainless steel cancellous screws in 7. All the acetabular components were fixed with CMW1 radiopaque cement (CMW Laboratories, Devon, United Kingdom), and all the femoral components were with CMW1 or CMW3 radiopaque cement. The cements were prepared by vacuum mixing and were applied into the femoral canal using a cement gun with autogenous bone chips packed into a femoral medullary canal as a bone plug.

Standard radiographs were taken after surgery and at 2, 4, 6, and 8 weeks; at 3, 6, and 12 months, and 6-monthly or yearly thereafter (Fig. 1B). The initial postoperative radiographs were used to measure the center and the degree of initial abduction of the acetabular components, the center-edge angle, and any lengthening of the limb. The presence of a radiolucent line around the acetabular components at the cement-bone interface in the 3 zones of DeLee and Charnley [12] was recorded. Loosening of the acetabular component was classified according to the criteria of Hodgkinson, Shelley, and Wroblewski [13]. The criteria of Harris, McCarthy, and O'Neill [14] were used to assess

Table 1. Details of the 147 THAs for Developmental Dysplasia of the Hip

Total patients	119 patients (males, 7; females, 112)
Total hip	147 hips
Mean (SD) age at operation (y)	56.3 ± 7.5
Mean (SD) height (cm)	150.6 ± 5.7
Mean (SD) weight (kg)	51.4 ± 7.9
Mean (SD) socket size (mm)	44.3 ± 2.4
Mean (SD) socket center-edge angle (deg)	5.6 ± 14.4
Mean (SD) initial abduction of the socket (deg)	40.9 ± 4.9
Mean (SD) horizontal positioning of the socket (mm)	22.1 ± 5.7
Mean (SD) limb lengthening (mm)	19.7 ± 9.6
Socket location	Superolateral, 3; superomedial, 5; inferolateral, 17; inferomedial, 122
Crowe type	
I	66
II	44
III	16
IV	21
Screw	
None	10
AO	7
Titanium	17
Poly(L-lactide)	113

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