Original article

Joint space wider than 2 mm is essential for an eccentric rotational acetabular osteotomy for adult hip dysplasia

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Abstract

Background. Satisfactory intermediate-term results after an eccentric rotational acetabular osteotomy (ERAO) for the treatment of early osteoarthritis secondary to developmental dysplasia of the hip (DDH) have been reported. The purpose of this study was to investigate whether a minimum joint space width (JSW) in patients with advanced osteoarthritis secondary to DDH influences intermediate-term clinical and radiographic outcomes after performing an ERAO.

Methods. A total of 113 patients (116 hips) with a JSW of ≤3 mm were consecutively treated by ERAO for advanced osteoarthritis of the hip and then were followed for more than 5 years. Based on the preoperative JSW, the patients were divided into three groups: minimum JSW of ≤1 mm (JS1 group); JSW >1 mm but ≤2 mm (JS2 group); JSW >2 mm but ≤3 mm (JS3 group). The average ages of the JS1, JS2, and JS3 patients were 40, 44, and 43 years, respectively. The average follow-up period was 10.6 years.

Results. Overall conversion to total hip arthroplasty (THA) was performed in 14 joints. According to a Kaplan-Meier survivorship analysis at 15 years after the index operation, 96% of the patients with a JSW of >2 mm (JS3 group) did not require conversion to THA.

Conclusions. A JSW of >2 mm before surgery is considered essential to obtain an excellent intermediate-term result following performance of an ERAO.

Introduction

Developmental dysplasia is one of the major causes of secondary osteoarthritis of the hip. 1 Total hip arthroplasty (THA) for young active patients with hip dysplasia has the problems associated with long-term longevity. 2–4 The optimal selection of periacetabular reorientation osteotomy for the patients with an advanced stage of osteoarthritis due to acetabular dysplasia should successfully delay the age at which THA is needed. Wagner’s spherical acetabular osteotomy, Eppright’s dial osteotomy, the rotational acetabular osteotomy by Ninomiya and Tagawa, Ganz’ periacetabular osteotomy, and the eccentric rotational acetabular osteotomy by Hasegawa for hip dysplasia have been reported to be successful in young and active patients. 5–14 We have previously reported excellent results using eccentric rotational acetabular osteotomy for patients <60 years old with hip dysplasia, with or without joint space narrowing. 11

One of the most important factors for a successful outcome is joint congruity. 11,15 Good or excellent congruity, young age, and prearthritis or early-stage arthritis were reported to be significantly favorable factors after periacetabular osteotomy. 5,10,12,16,17

The purpose of this investigation was to investigate the minimum joint space that is essential after eccentric rotational acetabular osteotomy (ERAO) to obtain excellent intermediate-term clinical and radiographic outcomes.

Patients and methods

The first indication for an index osteotomy in this study was pain lasting more than 6 months with conservative treatment. The ages of the patients ranged between 15 and 60 years.

The range of motion of the hip included flexion of more than 60° and abduction of more than 20°. The joint status including prearthritis and early-stage and advanced-stage arthritis with better congruence was assessed by an abduction anteroposterior radiographic study.

The surgery was performed in all patients by one surgeon (Y.H.). The indications and techniques were
described elsewhere. Briefly, the operative technique was as follows: The greater trochanter was detached with a bone saw and reflected proximally. The osteotomy site was approximately 20 mm from the joint space according to the preoperative planning. Coverage of the femoral head by the rotated acetabular fragment was verified with an image intensifier before fixation of the acetabular fragment with three PLLA screws. The greater trochanter was then fixed with two AO cancellous screws.

Postoperatively, the patient stood up from the bed the day after surgery, and 10-kg partial weight bearing was permitted with a walker. Six weeks after surgery full weight bearing was permitted with two crutches. Full weight bearing without crutches was permitted at 4 months after the index operation.

The study did not receive institutional review board approval because our institution does not require such approval for retrospective studies. A total of 310 patients (335 hips) were included who consecutively underwent ERAO in Nagoya University Hospital between 1989 and 2001. In all, 191 patients (212 hips) with a minimum joint space width >3 mm were excluded. Thus, a total of 119 patients (123 hips) with a minimum joint space width of ≤3 mm were included in this study. Five patients (five hips) were excluded because of a follow-up duration of less than 5 years, and one patient (two hips) with a neuromuscular disorder was excluded. These patients demonstrated good clinical and radiographic results at the latest follow-up, and no additional operation was performed except to remove the AO screws.

A total of 113 patients (116 hips) with the minimum joint space width (JSW) of ≤3 mm who were followed up for more than 5 years were included in this study. The patients were then divided into three groups based on their preoperative minimum joint space width: (1) ≤1 mm (JS1 group); (2) >1 mm but ≤2 mm (JS2 group); (3) >2 mm but ≤3 mm (JS3 group). The JS1, JS2, and JS3 groups were comprised of 18, 49, and 49 joints, respectively (Table 1). The number of female/male joints in the JS1, JS2, and JS3 groups were 18/0, 44/5, and 46/3, respectively. The average patient ages for the JS1, JS2, and JS3 groups were 39.7, 43.6, and 43.2 years respectively. The average follow-up period was 10.6 years (5–17 years).

An anteroposterior (AP) radiographic image was produced, centered at the pubic symphysis, from a 1.0 m distance. The radiographic measurement of the minimum joint space width was made by caliper (Mitsutoyo, Tokyo, Japan). The measurement limitation of the caliper was 0.01 mm.

A single doctor (T.S.) who was blinded to the clinical results performed the radiographic measurements. No correction for magnification was made. The mean (SD) difference between the two observers with respect to joint space width measurement was performed using 20 films between the senior author (Y.H.) and one other doctor (T.S.). The mean difference (SD) between the two observers was 0.28 (0.41) mm. The intraobserver mean difference following a 3-month interval was 0.20 (0.32) mm.

The hip joint was clinically evaluated using the Harris hip score (HHS) before the index surgery and then annually. The minimum joint space width was measured before the index operation and then annually. The odds ratio of the conversion to THA was calculated between the JS1+JS2 groups and the JS3 group adjusting for age and sex. A Kaplan-Meier survivorship analysis was performed between the JS1+JS2 groups and the JS3 group for the endpoints of HHS <80 points and conversion to THA.

Table 1. Patients demographics and minimum joint space width before ERAO

<table>
<thead>
<tr>
<th>Demographics</th>
<th>JS ≤ 1.0 mm*</th>
<th>JS ≥ 1.1 but &lt;2.0 mm*</th>
<th>JS ≥ 2.1 but &lt;3.0 mm*</th>
</tr>
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<tbody>
<tr>
<td>No. of hips</td>
<td>18</td>
<td>49</td>
<td>49</td>
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<tr>
<td>Age (years)</td>
<td>39.7 (8.3)</td>
<td>43.6 (7.7)</td>
<td>43.2 (10.0)</td>
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<tr>
<td>Sex (female/male) (no.)</td>
<td>18/0</td>
<td>44/5</td>
<td>46/3</td>
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<tr>
<td>Body weight (kg)</td>
<td>51.4 (6.3)</td>
<td>53.6 (9.0)</td>
<td>54.0 (5.7)</td>
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<tr>
<td>Height (cm)</td>
<td>155.9 (5.8)</td>
<td>154.7 (5.5)</td>
<td>155.5 (4.5)</td>
</tr>
<tr>
<td>CE angle (°)</td>
<td>-1.4 (9.7)</td>
<td>1.3 (8.2)</td>
<td>0.9 (10.9)</td>
</tr>
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<td>AHII (%)</td>
<td>49.6 (5.9)</td>
<td>51.5 (6.2)</td>
<td>51.9 (10.4)</td>
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<td>Harris hip score</td>
<td>65.8 (11.2)</td>
<td>67.7 (7.1)</td>
<td>68.9 (9.2)</td>
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<td>Incongruence/congruence (no.)</td>
<td>16/2</td>
<td>42/7</td>
<td>40/9</td>
</tr>
<tr>
<td>Follow-up (years)</td>
<td>10.1 (3.2)</td>
<td>10.7 (3.2)</td>
<td>10.7 (4.0)</td>
</tr>
</tbody>
</table>

Unless otherwise stated, the results are given as the mean and SD
ERAO, eccentric rotational acetabular osteotomy; JSW, joint space width; CE, center edge angle of Wiberg18; AHII, acetabular head index19
*Minimum JSW
1None of the demographic data was significant in the three groups except those with minimum joint space width