Hemi-resurfacing versus total resurfacing for osteonecrosis of the femoral head

Tamon Kabata,1 Toru Maeda,1 Kazunori Tanaka,1 Hironori Yoshida,1 Yoshitomo Kajino,1 Takeshi Horii,2 Shin-ichi Yagishita,3 Hiroyuki Tsuchiya1

1 Department of Orthopaedic Surgery, Kanazawa University Graduate School of Medical Science, Kanazawa, Japan
2 Department of Orthopaedic Surgery, Ishikawa Prefectural Central Hospital, Kanazawa, Japan
3 Department of Orthopaedic Surgery, Tsuruga Municipal Hospital, Tsuruga, Japan

ABSTRACT

Purpose. To compare mid-term outcomes of hemi-resurfacing arthroplasty (HRA) and total resurfacing arthroplasty (TRA).

Methods. Seven men and 5 women (16 hips) aged 33 to 72 (mean, 50) years underwent HRA, whereas 7 men and 3 women (16 hips) aged 23 to 52 (mean, 40) years underwent metal-on-metal TRA; all were for osteonecrosis of the femoral head. In the HRA and TRA groups respectively, 10 and 8 hips were steroid-induced, whereas 6 and 8 hips were related to alcohol abuse. Surgery for 12 and 4 hips entailed the posterolateral approach, whereas 4 and 12 hips entailed the Hardinge approach. Usually, HRA was performed for early stages of the disease, and TRA for more advanced stages. 12 and 6 hips were classified as JOA stages 1 to 3A, whereas 4 and 10 hips as stages 3B to 4. All the hips were JOA types C1 or C2.

Results. In the HRA and TRA groups respectively, the mean follow-up period were 6.5 and 5.5 years. The mean total JOA hip scores were 57 and 54 preoperatively, 93 and 97 at one year, and 84 and 96 at the final follow-up (p<0.01). The higher score in the TRA patients was mainly attributed to improvement in the pain score. In the HRA group, 12 hips developed groin pain or groin discomfort while walking, though only 4 of them showed apparent joint-space narrowing. Five patients underwent revision surgeries (conversion to total hip arthroplasty) owing to a femoral neck fracture, acetabular protrusio, osteoarthritic change, and severe groin pain. Patients having TRA had no revision surgery and did not complain of groin pain. Implants in both groups were radiographically stable.

Conclusion. TRA were superior to HRA in terms of pain relief and implant survival, even though the former procedure was used for more advanced cases.

Key words: femur head; osteonecrosis

INTRODUCTION

Surgical treatments for osteonecrosis of the femoral head include core decompression, vascularised bone
grafting, osteotomy, and prosthetic replacement. In Japan, joint preservation by osteotomy remains the standard treatment for younger adults. In patients with a large necrotic area, joint preservation is not indicated and prosthetic replacement is preferred. In theory, a conservative prosthesis design such as hip resurfacing arthroplasty is desirable, as future revision is relatively simple. Hemi-resurfacing arthroplasty (HRA) replaces only the femoral head side, whereas total resurfacing arthroplasty (TRA) replaces the acetabular side as well. Only one study compared HRA with metal-on-metal TRA in western patients. We compared mid-term outcome of HRA and TRA in Asian patients.

MATERIALS AND METHODS

Records of 22 patients who underwent HRA or TRA during October 2002 to July 2006 for osteonecrosis of the femoral head were reviewed (Fig. and Table 1). Among these, 7 men and 5 women (16 hips) aged 33 to 72 (mean, 50) years who had no degenerative change on the acetabular side underwent HRA using the Conserve hemi-resurfacing system (Wright Medical Technology, Arlington [TN], USA). The remaining 7 men and 3 women (16 hips) aged 23 to 52 (mean, 40) years who had more advanced disease (or by request) underwent metal-on-metal TRA using the Birmingham hip resurfacing system (Smith & Nephew Orthopaedics, Warwick, UK).

In the HRA and TRA groups respectively, 10 and 8 hips were steroid-induced, whereas 6 and 8 hips were related to alcohol abuse. Surgery in 12 and 4 hips entailed the posterolateral approach, whereas 4 and 12 hips entailed the Hardinge approach. Stage and type of osteonecrosis of the femoral head were classified on radiographs, according to the system of the Japanese Orthopaedic Association (JOA). Only 12 and 6 hips were classified as JOA stages 1 to 3A, whereas 4 and 10 hips as stages 3B to 4. All the hips were JOA types C1 or C2.

The femoral component was placed without creating a notch on the femoral neck. The stem of the femoral component was placed somewhat closer to the valgus than to the original femoral neck-shaft angle. Only the unstable portion of any necrotic bone was removed; the stable part was left intact with multiple small diameter (2 mm) drillings to the healthy bone. The femoral component was fixed with cement.

JOA hip scores of both groups were compared using the Mann-Whitney U test.

RESULTS

In the HRA and TRA groups respectively, the mean follow-up period were 6.5 (range, 5.3–7.3) and 5.5 (4.1–6.9) years (Table 1).

Table 1

<table>
<thead>
<tr>
<th>Variable</th>
<th>Hemi-resurfacing arthroplasty (n=16)</th>
<th>Total resurfacing arthroplasty (n=16)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean (range) patient age (years)</td>
<td>49 (33–72)</td>
<td>40 (23–52)</td>
</tr>
<tr>
<td>No. of male:female</td>
<td>7 (9 hips):5 (7 hips)</td>
<td>7 (13 hips):3 (3 hips)</td>
</tr>
<tr>
<td>Japanese Orthopaedic Association classification for osteonecrosis of the femoral head (No. of hips)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type A</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Type B</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Type C1</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Type C2</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Stage 1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Stage 2</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Stage 3A</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>Stage 3B</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Stage 4</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Aetiology (No. of hips)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steroid-induced</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>Alcohol abuse</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Surgical approach (No. of hips)</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>Posterior</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>Anterolateral</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (range) follow-up (years)</td>
<td>6.5 (5.6–7.4)</td>
<td>5.5 (4.1–6.9)</td>
</tr>
</tbody>
</table>
5.5 (range, 4.2–7.1) years. The mean total JOA hip scores were 57 (range, 35–67) and 54 (range, 38–76) preoperatively, 93 and 97 at one year, and 84 (range, 54–99) and 96 (range, 70–100) at the final follow-up (p<0.01, Table 2). The higher score in the TRA patients was mainly attributed to improvement in the pain score. There were no major complications immediately after surgery in both groups.

In the HRA group, 12 hips developed groin pain or groin discomfort while walking, though only 4 of them showed apparent joint-space narrowing. Five patients underwent revision surgery (conversion to total hip arthroplasty), owing to a femoral neck fracture at 3 years, acetabular protrusion of the implant at 3 years, progression of joint space narrowing to osteoarthritic change at 4 years, and groin pain while walking at 5 and 5.5 years. In the remaining patients, the implants were stable. There was no evidence of loosening, sinking, or apparent radiolucent lines around the stem.

In the TRA group, all patients returned to their original occupation except for one who had alcohol-dependence syndrome. All their implants were stable. There was no evidence of loosening; radiolucent lines around the metaphyseal stem were noted in most cases. Only one hip had a slight change in varus alignment, but there was no further deterioration over more than 3 years. A 33-year-old woman was noted to have an asymptomatic pseudotumour at 3 years.

**DISCUSSION**

Outcomes of prosthetic replacement for active adults with osteonecrosis of the femoral head are not always favourable. Conservative prostheses are used when joint preservation is not feasible. Hip resurfacing arthroplasty enables a highest amount of bone preservation. In our study, HRA was inferior to TRA in terms of pain relief and implant survival, even though TRA was offered for more advanced cases; some HRA patients complained of groin pain despite having no abnormality on radiographs. Mid-term outcomes of HRA for osteonecrosis of the femoral head have been reported to be satisfactory in 90% of cases over an average of 5 years, in 82% over an average of 6.2 years, and 79% over an average of 7 years. HRA is a relatively simple procedure involving a shorter operating time; its outcomes at 7 to 8 years were reportedly similar to those of conventional total hip arthroplasty. In other studies, 65% and 40% of patients underwent revision surgery for groin pain within 3 years on average. This dichotomy of opinion reflects different interpretations of groin pain. In some studies, outcome was acceptable as long as the implant was stable even if the patient had some groin pain. In others it was considered unacceptable if patient satisfaction was reduced owing to pain,

<table>
<thead>
<tr>
<th>JOA score</th>
<th>Hemi-resurfacing arthroplasty</th>
<th>Total resurfacing arthroplasty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preop</td>
<td>Postop</td>
<td>Preop</td>
</tr>
<tr>
<td>Pain</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td>Range of motion</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>Walking</td>
<td>12</td>
<td>17</td>
</tr>
<tr>
<td>Activity</td>
<td>12</td>
<td>19</td>
</tr>
<tr>
<td>Total</td>
<td>57</td>
<td>84</td>
</tr>
</tbody>
</table>
even if the implant was well fixed. In our study, if revision was set as the end point, the survival rate was 69% (11/16) in 6.5 years; if increase in groin pain was set as the end point, the survival rate was only 25% (4/16).

Regarding TRA, its outcomes were worse when it was used for treatment of osteonecrosis of the femoral head rather than osteoarthritis (because of the underlying diseases entailing glucocorticoid administration or alcohol abuse), but another study reported no such difference. The formation of inflammatory pseudotumours is a newly reported complication of metal-on-metal TRA. The aetiology of this soft-tissue reaction is unknown, but an association with increased wear owing to edge-loading has been suggested. Risk factors of pseudotumours were female gender, age under 40 years, and small components. These risk factors should be taken into account in patient selection. TRA is more appropriate for males because they are at low risk of pseudotumours and neck fractures. These risks may be decreased by making implant alignments better. TRA were superior to HRA in terms of pain relief and implant survival. Further study is needed to determine whether TRA is an appropriate treatment for osteonecrosis of the femoral head.

REFERENCES