MIDDLE-TERM RESULTS OF THREADED ACETABULAR CUPS
HIGH FAILURE RATES FIVE YEARS AFTER SURGERY

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We report our results using three different threaded acetabular components (Mecring A, Mecring B and Weill) in 715 hips with a follow-up of between one and ten years (median: 99.1, 56.5, 38.3 months, respectively). All cups were implanted with one type of cementless stem.

The clinical results were good or acceptable in about 70% of the hips, but signs of loosening with radiolucency and/or migration were found in 10.1%. Radiological evidence of loosening did not correlate significantly with the clinical outcome. Pain was not a reliable indicator of loosening and its absence sometimes allowed severe osteolysis to develop. Twenty-five hips were revised (3.5%) for aseptic loosening of the acetabular component. Kaplan-Meier estimates of the cumulative rate of failure showed a rapid increase five years after the initial operation, but no significant correlation with gender, age or weight.

The high rate of failure indicates that further use of these acetabular components cannot be recommended. Annual radiographs are required to assess osteolysis even if the patients are free from pain.

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Aseptic loosening is a major problem in all types of total hip arthroplasty (THA). The advantages of cementless fixation include easy removal after failure and the preservation of bone stock. The rate of loosening seems to be acceptable for femoral uncemented components, but high rates of failure have been reported for acetabular components, especially those of the threaded design. This has led to changes in the design of threaded cups.

PATIENTS AND METHODS

From 1984 to 1994 we used 881 consecutive cementless acetabular components in THAs performed in 770 patients in the Department of Orthopaedic Surgery in the University of Heidelberg. In a retrospective study all available patients were invited to attend for clinical and radiological examination and to complete a questionnaire, or be interviewed by telephone. Of the 770 patients, 669 (86.9%) with a total of 779 THAs, were studied; 72 patients had moved, 18 had died, three refused to participate and eight records were not retrieved.

Three types of acetabular threaded cup had been used: the Mecring (Mec) A, the Mecring (Mec) B (Mecron Med Produkte GmbH, Berlin, Germany) and the Weill (Protek AG, Berne, Switzerland). Other types of acetabular component were used in 30 hips. The Mecring cups were of titanium alloy and the Weill cups of pure titanium. The surface of the Weill cup is smooth, whereas that of the threaded Mec cup is matte. The outer form of the Mec cup is hemispherical and the Weill cup is conical. The width of the thread of the MecA cup is narrow whereas in the MecB cup it is broad and designed for implantation in cancellous bone. All the cups use an interchangeable polyethylene inlay.

Nineteen hips were excluded because the threaded cup had been used with a cemented stem. In four other hips the stem had to be revised but the cup was not loose. Other exclusions included eight with septic loosening, two with traumatic loosening and one with recurrent luxation. This left 715 hips in 612 patients which were reviewed. There...
were 293 men (337 hips) and 319 women (378 hips). The mean age at operation was 56.8 years (SD 10.1), the mean weight was 75.7 kg (SD 13.8) and the mean Broca index 1.1 (SD 0.16). There were no significant differences in gender, age and Broca index between patients treated with different types of threaded cup, and between those included in the study and those who were excluded. Table I gives the reasons for hip replacement.

We performed the operations using a lateral transgluteal or anterolateral approach. Complete capsulectomy was used to expose the acetabular rim fully. The acetabulum was reamed, but the subchondral layer was preserved, except when MecB cups were used and the cancellous bone was exposed. The self-tapping cups were inserted as advised by the manufacturers and checked for stability. The patients were mobilised on the day after operation with partial weight-bearing for six weeks. Anteroposterior and lateral radiographs were taken after operation and at intervals subsequently.

Loosening of the cup was defined as radiolucency of at least 1 mm in zones 1 or 3 of DeLee and Charnley. To determine migration of the cup two lines were drawn on the standard radiographs: a transverse line through the bottom of the teardrop and a second line vertical to the bottom of the teardrop through its medial edge. These allowed determination of a change in the position of the cup. Migration was defined as a definite change of position compared with that in the postoperative radiograph (see Figs 4 and 5), and accepted as a definite sign of loosening.

The survival time was recorded as the period between operation and follow-up or revision and the ‘loosening time’ as the interval between operation and the first visible evidence of radiological migration and/or loosening. Heterotopic ossification was recorded and graded according to the system of Brooker et al.

For clinical assessment the Merle d’Aubigné and Postel score was obtained at follow-up from the questionnaire or the telephone interview. Kaplan-Meier statistical analysis was used to assess the survival and loosening times.

RESULTS

The median time for follow-up of the patients with Weill rings was 99.1 months (interquartile range (IQR) 91.5 to 109.2), of those with MecA cups 56.5 months (IQR 41.2 to 74.3) and with MecB prostheses 38.3 months (IQR 24.9 to 53.8), respectively.

Twenty-five hips (3.5%) required revision for aseptic loosening of the acetabular component (Table II); the probability for revision was time-dependent (Fig. 1).

Radiological findings. Sufficient radiographs were available...
able of 703 hips for full assessment. Signs of loosening of the cup were seen in 46 hips (6.5%) and of migration in 60 hips (8.5%) (Table III). Signs of definite loosening were present in 71 hips (10.1%). Table IV shows the complication rate (surgical revision or loosening). The risk of loosening increased with time and increased rapidly after five years (Fig. 2). The gender, age and weight (Broca index) of the patients did not influence loosening.

**Ectopic ossification** (Fig. 3). Signs of heterotopic ossification were seen in 27% of patients, but severe ossification was present in only four. There was no significant difference in heterotopic ossification between the different threaded cups (chi-squared test).

**Clinical assessment** (Tables V and VI). About 70% of our patients had good or acceptable results as measured by the hip score. No significant difference was found in pain and ability to walk between patients with or without signs of loosening, except for pain in the MecA group.

**DISCUSSION**

Aseptic loosening of endoprostheses presents a major challenge at revision, especially in cement removal and loss of bone stock. Cementless THAs were developed to overcome some of these problems, but worse results have been reported in comparison with 'traditional' cemented endoprostheses. In our experience cementless fixation of the femoral component gives good middle-term results, but the acetabular component may produce problems. The threaded fixation of the acetabular component gives good primary stability with only a small variation due to differences in design. The short-term results were encouraging, but in more recent studies with a maximum follow-up of seven years high rates of failure have been reported.

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**Table V.** Hip score according to Merle d’Aubigné and Postel\(^{10}\) (maximum 12 points) in the three groups by percentage

<table>
<thead>
<tr>
<th></th>
<th>Poor (&lt;8)</th>
<th>Middle (8 to 9)</th>
<th>Good (&gt;10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MecA</td>
<td>25.4</td>
<td>15.5</td>
<td>59.1</td>
</tr>
<tr>
<td>MecB</td>
<td>35.1</td>
<td>15.3</td>
<td>49.5</td>
</tr>
<tr>
<td>Weill</td>
<td>24.6</td>
<td>16.4</td>
<td>59.0</td>
</tr>
</tbody>
</table>

**Table VI.** Mean (sd) Merle d’Aubigné and Postel\(^{10}\) hip score related to loosening in all three groups

<table>
<thead>
<tr>
<th></th>
<th>Stable</th>
<th>Loose</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MecA</td>
<td>4.86 (1.76)</td>
<td>3.82 (2.5)</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>MecB</td>
<td>4.31 (2.15)</td>
<td>4.09 (2.21)</td>
<td>NS</td>
</tr>
<tr>
<td>Weill</td>
<td>4.81 (1.91)</td>
<td>4.71 (2.22)</td>
<td>NS</td>
</tr>
<tr>
<td>Ability to walk</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MecA</td>
<td>4.43 (1.43)</td>
<td>3.78 (1.48)</td>
<td>0.06</td>
</tr>
<tr>
<td>MecB</td>
<td>4.23 (1.50)</td>
<td>3.56 (1.33)</td>
<td>NS</td>
</tr>
<tr>
<td>Weill</td>
<td>4.05 (1.63)</td>
<td>4.2 (1.48)</td>
<td>NS</td>
</tr>
</tbody>
</table>
We report our middle-term results. High rates of loosening and failure were found for all three threaded cups, increasing rapidly at five years after operation (Figs 1 and 2). Our cups did not have a porous surface. The Weill prosthesis is smooth and the MecA and B implants have a matte surface, and this may give insufficient secondary stability. Tooke et al.\textsuperscript{16} have shown a higher incidence of loosening in threaded cups than in porous-coated prostheses. Porous threaded acetabular components have been shown to give better results than smooth threaded sockets.\textsuperscript{17}

The differences in the results between the hemispherical MecA cup and the conical Weill prosthesis were small and indicate that the design of the threaded cup is of minor importance\textsuperscript{11} although conical cups showed slightly superior long-term results than the hemispherical design. The MecB cup, with broad threads, is designed for implantation into cancellous bone; it showed the highest failure rate,
probably because deep reaming destroyed the subchondral layer of bone.

The central opening in all these cups allows direct contact between polyethylene and bone. Micromovement caused by loading and unloading has been shown to occur between the threaded cup and the acetabulum. This may result in the production of debris from the polyethylene inlay giving rise to a foreign-body-type giant-cell reaction and may cause bone resorption followed by loosening of the cup.

About 70% of our patients had excellent, good or acceptable clinical results according to the Merle d’Aubigné hip score (Table V). Surprisingly, we found no significant difference in the hip score between hips with radiological signs of loosening and stable hips (Table VI). Fourteen patients with loose cups had good or excellent results and 24 with radiologically loose cups reported no pain at all (Figs 4 to 6). The absence of pain sometimes resulted in particularly severe but unnoticed osteolysis of the pelvis.

One of the postulated advantages of cementless THA is the preservation of bone stock, but our findings underline the need for annual radiography to detect osteolysis even in patients who are free from pain. They also show that bone stock is not preserved in all cases of cementless hip arthroplasty (Fig. 7).

The MecA, MecB and Weill threaded acetabular cups have an unacceptably high rate of failure, and continued use of these prostheses cannot be recommended. Annual radiographs are mandatory even in patients who are free from pain to limit the development of severe osteolysis.

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

REFERENCES


