Cemented and Cementless Total Hip Replacement

Critical Analysis and Comparison of Clinical and Radiological Results of 182 Cases Operated in Al Razi Hospital, Kuwait

Wieslaw Pospula    Tarek Abu Noor    Tarek Roshdy    Ali Al Mukaimi
Department of Orthopedics, Al Razi Hospital, Kuwait

Key Words
Total hip replacement, cemented and cementless · Total hip replacement, clinical and radiological results

Abstract
Objective: In this study we present the results of a series of cemented Exeter and cementless Zweymüller implants. Subject and Methods: Eighty-seven cemented and 95 cementless hip replacements for different hip pathologies were followed for an average period of 36 months for cementless and 60 months for cemented cases. Clinical results were calculated using the Merle d’Aubigne score. The orientation of the prosthetic components and the fixation of the cup and stem were analyzed. The clinical and radiological results were compared using statistical methods. Results: In the average period of 36 months in cementless and 60 months in cemented hip replacements the clinical results improved significantly when compared with the preoperative score (p < 0.05). Sixty-seven cemented acetabular cups (77.1%) were in the desired position (30–50°) and 20 cemented cups (22.9%) were outside this range. Seventy-six cups (80%) were in the desired degree of abduction and 19 (20%) were outside this range. All cups except 1 were anteverted or neutral. Of the femoral stems, 173 were in the neutral position, 5 in the valgus and 4 in the varus position. Cemented cups were more commonly loose and cemented and cementless stems did equally well. No significant differences in rate of complications were found. Conclusion: Cementless acetabular implants had better clinical results and a lower loosening rate at 3 years of follow-up compared to cemented implants at 5 years of follow-up. The cemented femoral implants were equally stable compared to the cementless ones.

Introduction

Total hip replacement has been a well-established treatment method for a spectrum of hip problems including primary and secondary osteoarthritis, avascular necrosis and hip fracture [1]. Although there is general belief that cementless prosthesis has a better outcome and long-term prognosis, especially in young active patients, it has not been proved by longitudinal studies of results comparing new-generation cemented with cementless implants [2, 3]. In the published series cemented, cementless and hybrid implants have been discussed [4, 5]. The objective of this study is to evaluate and compare short-term clinical and radiological results of cemented Exeter total hip replacement with cementless Zweymüller implants.

Patients and Methods

Between 1994 and 2004 there were 185 total hip replacements done by the senior author (W.P.) in Al Razi Hospital, Kuwait. Three patients were lost to follow-up, so the remaining 182 cases were clinically and radiologically followed up: 87 cemented Ex-
The average preoperative Merle d’Aubigne clinical score was 10.2 points for the cemented group and 11.5 for the cementless group, indicating that the patients with cementless implant had a better average preoperative clinical score. At the final follow-up of 60 months patients with cemented implants had an average score of 16.6 points, compared to those who had cementless implants with an average score of 17.3 points at 36 months. The difference between preoperative and final clinical scores was statistically significant in both groups of patients with p < 0.05.

The radiological results are given in table 2. The abduction angle of the acetabular component was within the desired angle (between 30 and 50°) in 67 cemented cases (76%) compared to 76 cases (80.5%) in cementless group. It was below 30° of abduction in 16 cemented cases (13.5%) and in 8 cementless cases (8%). Similarly the cup was implanted above 50° of abduction in 8 (9.1%) and in 11 (11.5%), respectively. The components were anteverted in 85 (97.8%) and 83 (87.4%) in the cemented and cementless groups, respectively. The femoral stem was in the neutral position in the anteroposterior plane in 81 cemented cases (93.1%) and in 83 (87.5%) of the cementless cases.

### Results

The average preoperative Merle d’Aubigne clinical score was 10.2 points for the cemented group and 11.5 for the cementless group, indicating that the patients with cementless implant had a better average preoperative clinical score. At the final follow-up of 60 months patients with cemented implants had an average score of 16.6 points, compared to those who had cementless implants with an average score of 17.3 points at 36 months. The difference between preoperative and final clinical scores was statistically significant in both groups of patients with p < 0.05.

The radiological results are given in table 2. The abduction angle of the acetabular component was within the desired angle (between 30 and 50°) in 67 cemented cases (76%) compared to 76 cases (80.5%) in cementless group. It was below 30° of abduction in 12 cemented cases (13.5%) and in 8 cementless cases (8%). Similarly the cup was implanted above 50° of abduction in 8 (9.1%) and in 11 (11.5%), respectively. The components were anteverted in 85 (97.8%) and 83 (87.4%) in the cemented and cementless groups, respectively. The femoral stem was in the neutral position in the anteroposterior plane in 81 cases of cemented implants (93.1%) and in 83 (87.5%) of the cementless cases.

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**Table 1.** Cases, gender, age and follow-up period

<table>
<thead>
<tr>
<th></th>
<th>Cemented</th>
<th>Cementless</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients</td>
<td>76</td>
<td>89</td>
<td>165</td>
</tr>
<tr>
<td>Hips</td>
<td>87</td>
<td>95</td>
<td>182</td>
</tr>
<tr>
<td>Gender/hips</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>29/32</td>
<td>48/50</td>
<td>77/82</td>
</tr>
<tr>
<td>Females</td>
<td>47/55</td>
<td>41/45</td>
<td>88/100</td>
</tr>
<tr>
<td>Age, years</td>
<td>53.7 (22–104)*</td>
<td>46.7 (16–76)*</td>
<td>60 (24–156)</td>
</tr>
<tr>
<td>Follow-up, months</td>
<td>60 (24–156)</td>
<td>36 (24–84)</td>
<td></td>
</tr>
</tbody>
</table>

* p < 0.01.

**Table 2.** Radiological results

<table>
<thead>
<tr>
<th></th>
<th>Cemented</th>
<th>Cementless</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cup inclination (abduction)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;30°</td>
<td>12 (13.8)</td>
<td>8 (8)</td>
</tr>
<tr>
<td>30–50°</td>
<td>67 (77)</td>
<td>76 (80.5)</td>
</tr>
<tr>
<td>&gt;50°</td>
<td>8 (9.2)</td>
<td>11 (11.5)</td>
</tr>
<tr>
<td>Cup version</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anteversion</td>
<td>85 (97.8)</td>
<td>83 (87.4)</td>
</tr>
<tr>
<td>Neutral</td>
<td>1 (1.1)</td>
<td>12 (12.6)</td>
</tr>
<tr>
<td>Retroversion</td>
<td>1/1.1</td>
<td>0</td>
</tr>
<tr>
<td>Stem frontal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neutral</td>
<td>79 (89.9)</td>
<td>83 (87.5)</td>
</tr>
<tr>
<td>Varus</td>
<td>6 (10.1)</td>
<td>7 (7.3)</td>
</tr>
<tr>
<td>Valgus</td>
<td>0</td>
<td>5 (5.2)</td>
</tr>
</tbody>
</table>

Figures in parentheses are percentages.

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*[...]*
Analysis of implant/cement/bone and implant/bone interfaces resulted in the following assessment of implant stability: 77 cemented implants (88.5%) were stable. In 2 cases (2.2%) the stem and cup were possibly loose, in 5 cases (5.7%) there was definite isolated cup loosening and in 3 cases (3.4%) definite isolated stem loosening. The corresponding values in the cementless group were the following: 93 implants (97.8%) were stable, 1 isolated cup (1.1%) and 1 isolated stem (1.1%) were possibly loose and 1 isolated cup (1.1%) and 1 isolated stem (1.1%) were definitely loose (table 3). Different aspects of the clinical and radiological outcome of patients operated through the transgluteal approach were slightly better than in patients operated from the posterolateral approach (17.3 and 16.7, \( p < 0.05 \)). The cup inclination did not affect the cup integration in either group (\( p > 0.05 \); table 4). However when cemented and cementless cups were compared, the loosening rate of cemented cups was significantly higher than the same rate in cementless cups, with \( p < 0.05 \) (table 3). Statistical radioclinical correlations revealed that the varus position of the stem was significantly related to loosening of the stem. This applied to both cemented and cementless implants, with \( p < 0.01 \) in both groups (table 5).

Complications included infection in 5 cases (4 in cemented and 1 in cementless), dislocation in 7 cases (4 in cemented and 3 in cementless), intraoperative greater trochanter fracture in 9 cases (4 in cemented and 5 in cementless), postoperative periprosthetic fractures in 4 cases (only in cemented cases), femoral nerve palsy in 2 cases (1 in cemented and 1 in cementless) and sciatic nerve palsy in 1 cemented case. Statistical analysis did not reveal significant differences in type and frequency of complications between cemented and cementless cases (\( p > 0.05 \)).

**Discussion**

In this retrospective comparative analysis we tried to answer the question which implant has a better result. The limitations of this study include the very fact that it is a retrospective study and that the 2 groups have different average follow-up periods; cemented: 60 months, and cementless: 36 months. Yet certain inferences can be made. The diagnostic characteristics of the presented material reveal significant differences when compared with similar groups of patients operated in Europe [12]. In the present study primary osteoarthritis occurred only in 12.6% of the cases compared to 61.5% in European studies. The incidence of primary and secondary avascular necrosis as a preoperative diagnosis was 33.2% in our study compared to 12.8% in European studies. Hip dysplasia was the diagnosis in 3% and rheumatoid disease in 16% in this study compared to 12.8 and 3% of the European cases, respectively. These variations may reflect genetic and lifestyle differences between European and Asian populations. Similar differences have been reported by other authors [2]. Comparisons of outcomes between cemented and cementless hip implants have been done previously. In 1 study the clinical and radiological results of cemented and cementless hip replacement in the same patient were compared using the same criteria and no differences were found at the last follow-up on average 7.8 years after surgery. In another prospective

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Cemented and Cementless Total Hip Replacement in Kuwait


241
proved in any of the presented studies. The most important risk factor in dislocation, it was not observed in longer follow-up series [15, 16] and this finding was confirmed in our study with a relatively high loosening rate. Improvement in the cementing technique is less likely to reduce the loosening rate of the cup when compared with the stem in historical series, due to the difficulty of pressurization of acetabular bone cement compared to the third-generation femoral cementing technique. Because of this fact cementless fixation of the acetabular component has been more frequent in our hospital during the last 5 years. The surgical approach slightly affected the results of our patients. Patients operated from the posterior approach had slightly inferior results compared to patients who had a direct lateral (or transgluteal) approach. In the study of Zimmerman et al. [4] a slight difference in results in favor of the direct lateral approach was observed, although this difference was not statistically significant. In our study a comparison of different aspects of clinical and radiological results revealed that cementless implants have a better outcome than the cemented implants regarding overall clinical scores and these differences were statistically significant. The loosening rate of the cementless cup was significantly lower than that of the cemented cups. There were no significant differences in rate of loosening of the stem. The dislocation rate was similar in the cemented (4 cases, 4.5%) and cementless (3 cases, 3.1%) groups and the prevalence of dislocation did not differ in relation to the surgical approach, i.e. there were 4 dislocations (4.5%) in the posterior approach and 3 dislocations (3.1%) in the transgluteal approach and these differences were not statistically significant. The reported incidence of dislocation after total hip replacement ranges from 1 to 15% [17]. Clinical and experimental studies indicate that dislocation after total hip replacement is a complex and multifactorial problem. Orientation of the implant, soft tissue tension, surgical approach and size of the head are among the most significant factors. Although there is common belief that the inclination and version of the cup are the most important risk factor in dislocation, it was not proved in any of the presented studies [18–21]. There was no definitive coincidence between cup position or surgical approach and dislocation in our patients. Infection is one of the most disastrous complications after total hip replacement. The incidence of infection after hip replacement in the last decade has been reported to be between 0.1 and 1% and up to 29% in earlier series [22–25]. In our series there were 4 cases (4.5%) of deep infection in cemented hip replacement necessitating surgical debridement in 2 cases and revision in 2 cases. In the cementless group there was 1 case (1.1%) of infection necessitating revision. This rate of infection is above the reported incidence in the recent literature. Infection after hip replacement is also a multifactorial problem including surgical technique, time of surgery, surgical environment and many other factors. Improvement in surgical technique and surgical environment has reduced the rate of infection below 1% according to many published studies. We believe that the higher rate of infection in our series was due to the suboptimal surgical environment. Peripheral nerve palsy, a third serious complication of total hip replacement, occurred in 3 cases (1.3%) compared to the reported incidence of this complication ranging from 0.3 to 3.7% [26]. In 2 cases of cementless implant there was a transient femoral nerve palsy. Both of these nerve palsies occurred in patients operated by transgluteal approach who had congenital hip dislocation and histories of multiple hip surgeries in childhood. Retraction of the non-elastic fibrous tissue containing the femoral nerve required to visualize the acetabulum may have contributed to this transient palsy as reported in similar cases [27]. In 1 case of cemented hip replacement performed through the posterolateral approach, a sciatic nerve palsy resulted from inadvertent entrapment of the nerve in the suture. In this patient the wound was explored early after the operation because of intractable neurogenic pain and the nerve was released, which resulted in gradual nearly complete recovery.

Conclusion

Our data showed that cementless implants had better clinical results and a lower loosening rate of the acetabular components at 3 years of follow-up compared to cemented implants at 5 years of follow-up. During the studied follow-up period cemented femoral implants were equally stable compared to cementless femoral implants. Further prospective follow-up is necessary to validate these results.
References