Comparison of cemented and uncemented fixation in total hip replacement: a meta-analysis

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CRD summary
This review compared cemented and uncemented fixation for total hip replacement. The authors concluded that, despite improvements in uncemented fixation, cemented fixation still has advantages in implant survival without revision surgery for large patient subgroups. This conclusion does not reflect the evidence presented in the review and may not be reliable.

Authors' objectives
To compare cemented and uncemented fixation in total hip replacement (THR).

Searching
MEDLINE (from 1966), EMBASE (from 1993), Web of Science (from 1990), BIOSIS Previews (from 1990) and the Cochrane Library (Issue 5, 2005) were searched up to 2005. The references of included studies were checked and experts in the field and manufacturers of implants were contacted.

Study selection
Eligible studies were randomised controlled trials (RCTs) and observational studies with a control group that compared cemented and uncemented fixation in THR. The included studies used a wide range of implant types. Studies of patients undergoing THR for any reason except acute fracture were eligible for inclusion, although those which included patients with cancer or tumours were excluded from the review. The mean age of patients in the included study groups ranged from less than 47.3 to 75.3 years. To be included in the review, studies were required to report the primary outcome of survival to time of revision surgery for any reason. Studies which did not report any revision events were excluded from the review. Implant failure was defined as any revision surgery for removal or replacement of either or both the cup or the stem of the implant, or of any specific component. The duration of follow-up in the included studies ranged from 1 to 15 years.

After an initial assessment by one reviewer, two reviewers independently assessed studies for inclusion in the review. Any disagreements were resolved through consensus.

Assessment of study quality
The authors did not state that they assessed validity.

Data extraction
Data were extracted on implants, methods of fixation, outcome definitions, stratification of patients, survival estimates, follow-up, and withdrawal or censorship data. Differences in proportion of implant survival and their standard error were derived from reported survival analysis estimates or differences in the proportion of revised THRs.

One reviewer extracted the data and a second reviewer checked the extraction.

Methods of synthesis
The studies were combined in meta-analyses using both fixed-effect and random-effects models. Statistical heterogeneity was assessed using the chi-squared statistic. Where a study made multiple comparisons, adjustments were made to the study weighting to compensate for the loss of independence of comparisons by conservatively increasing variance estimates. A priori-defined subgroup analyses were undertaken for the following factors: randomisation, whether a study was based at a single site, component followed (cup versus stem) and patient age range (≤55 years versus over 55 years). Sensitivity analyses were undertaken to determine the impact of poorly performing components (titanium stems, screw-fit cups, macro-ingrowth cups) and to determine the contribution of individual studies to the summary estimate. The associations between results and year of publication, duration of follow-up and population
characteristics were assessed using meta-regression. Publication bias was assessed using Egger's test.

**Results of the review**

Twenty studies comprising 24 comparisons were included in the review (n at least 112,094; 2 studies did not report the sample size). Three studies were RCTs and 16 were cohort studies, of which five were multi-centre, seven were single-centre, two were matched pair and two were bilaterally controlled. The design of one study was not reported.

There was no statistically significant difference in the survivorship proportion between cemented and uncemented fixation groups in the main analysis of all 24 comparisons: the pooled difference was -0.005 (95% confidence interval, CI: -0.031, 0.022). Subgroup analysis of the RCTs (4 comparisons) also showed no significant difference between the groups (difference 0.016, 95% CI: -0.054, 0.086), and the results of randomised and non-randomised studies did not differ significantly (p=0.30). None of the other reported a priori subgroup analyses showed a significant difference between the groups. However, the analysis of specific components showed that comparisons using a threaded or macrogrowth implant favoured cemented fixation (difference in survivorship -0.054, 95% CI: -0.090, -0.018; 2 comparisons), whilst those using a micro-ingrowth or ongrowth cup showed no significant difference (0.031, 95% CI: -0.056, 0.12; 2 comparisons); the difference between the subgroups was significant (p=0.02). A similar effect was found when stainless steel or cobalt chrome cemented stems (difference -0.051, 95% CI: -0.098, -0.004 favouring cemented fixation; 5 comparisons) were contrasted with titanium cemented stems (difference 0.12, 95% CI: 0.051, 0.19 favouring uncemented designs; 2 comparisons); the difference between the subgroups was significant (p<0.001).

Meta-regression found that year of publication was associated with improvements in the survival of uncemented implants compared with cemented implants.

No evidence of publication bias was detected (p=0.50).

**Authors' conclusions**

Cemented implants continue to outperform uncemented implants in large subsets of patient populations, despite improvement in uncemented implants over time.

**CRD commentary**

The review question and the inclusion criteria were clear. The authors searched a number of relevant databases, used no language restrictions, and attempted to identify unpublished studies. This reduces the likelihood that relevant studies were excluded from the review. The authors used appropriate methods to minimise bias and error in the selection of studies for the review and in the extraction of data. They did not report assessing the validity of the included studies, although some aspects of validity were discussed for the RCTs. The use of meta-analysis to combine statistically randomised and non-randomised studies is rarely appropriate, even where a subgroup analysis of RCTs is provided. In none of the primary analyses was a significant difference found between groups; this was also the case with the majority of subgroup analyses. The authors’ conclusions therefore do not reflect the flawed synthesis of the review and cannot be considered reliable.

**Implications of the review for practice and research**

Practice: The authors did not state any implications for practice.

Research: The authors stated that further research and improved methods, specifically the use of optimal control groups, are required to define the subgroups of patients in whom the relative benefits of cemented and uncemented implants can be determined.

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