The clinical and radiological outcomes of hip resurfacing versus total hip arthroplasty: a meta-analysis and systematic review

Smith TO, Nichols R, Donell ST, Hing CB

CRD summary
This well-conducted review concluded that hip resurfacing may have better functional outcomes than total hip arthroplasty, but increased risks of heterotopic ossification, aseptic loosening and revision surgery following hip resurfacing indicated that total hip arthroplasty was superior in terms of implant survival. The variable quality of the evidence presented means the authors’ conclusions should be interpreted with some caution.

Authors' objectives
To compare the effectiveness of hip resurfacing and conventional total hip arthroplasty in patients with hip pathology.

Searching
MEDLINE, CINAHL, AMED and EMBASE were searched for studies in any language; search dates spanned 1950 to January 2010. SIGLE, NTIS, NRR, British Library Integrated Catalogue and Current Controlled Trials were searched for unpublished literature. Conference proceedings of the British Orthopaedic Association Annual Congress, European Federation of National Associations of Orthopaedics and Traumatology and British Hip Society were searched to January 2010. Search terms were reported for the electronic searches. Reference lists of relevant papers and reviews were examined for further studies. The corresponding author of primary papers was contacted for additional citations.

Study selection
Randomised controlled trials (RCTs) and non-RCTs that compared hip resurfacing and total hip arthroplasty implants in patients with hip pathology were eligible for inclusion. The primary outcome of interest was frequency of revision surgery. Secondary outcome measures included incision length, last acetabular reamer size, operation duration, blood loss and frequency of blood transfusion, length of hospital stay, pain, function, quality of life and hip range of motion, radiological outcomes and complications (further details reported in the paper).

The included studies were of various hip resurfacing and total hip arthroplasty prostheses; the most commonly used hip resurfacing system was Birmingham hip resurfacing. The included studies reported more men than women and mean ages of 51 years in the hip resurfacing group and 54 in the total hip arthroplasty group. A range of functional, clinical and radiological outcomes were reported.

Two reviewers independently selected studies for inclusion. Disagreements were resolved through discussion.

Assessment of study quality
Study quality was assessed with a modified CASP (Critical Appraisal Skills Programme) assessment tool. The tool consisted of 17 items that evaluated methodological quality (including randomisation, blinding, drop-outs), presentation of results, external validity and generalisability to clinical practice. Disagreements were resolved through discussion.

The assessment was carried out independently by two reviewers.

Data extraction
Data were extracted onto a data extraction form. Mean differences (MD) or risk ratios (RR) and associated 95% confidence intervals (CIs) calculated. The corresponding author of primary studies was contacted for missing data where needed.

Data were extracted by one reviewer and checked by another. Disagreements were resolved through discussion.

Methods of synthesis
Where there was no observed substantial heterogeneity between studies in terms of populations, interventions or outcomes studies were pooled using meta-analyses. Mean differences and risk ratios, and associated 95% CIs, were
pooled using a fixed-effect method where there was no statistical heterogeneity; otherwise a random-effect model was used. Statistical heterogeneity was assessed using $X^2$ and $I^2$. Heterogeneity was indicated by $I^2$ greater than 20%. Publication bias was assessed with a funnel plot.

**Results of the review**
Forty-six studies were included in the review (6,189 participants): 10 RCTs (1,313 participants), 28 prospective observational studies (4,009 participants) and eight retrospective studies (867 participants). Nine studies described an adequate method of randomisation. Assessors were blinded in four studies and patients were blinded in two. Groups were comparable at baseline in 25 studies. Intention-to-treat analyses were used in 16 studies. Overall quality scores were zero to 3 in one study, 4 to 7 in 16 studies, 8 to 11 in 23 studies and 12 to 15 in five studies. Mean follow-up was 25 months.

**Functional outcomes:** Hip resurfacing was associated with better functional outcomes than total hip arthroplasty, including WOMAC score (MD -2.4, 95% CI -3.9 to -0.9), range of motion component of Harris hip score (MD -0.05, 95% CI -0.1 to -0.03) and overall Harris hip score (MD 2.5, 95% CI 1.2 to 3.8). Total hip arthroplasty was associated with greater difficulty in undertaking a step test task than hip resurfacing (RR 0.3, 95% CI 0.1 to 0.6). Overall Harris hip score was associated with some heterogeneity ($I^2$=28%). There was no significant difference between treatment groups in terms of the Merle d'Aubigne index, Oxford hip score or hop test results.

**Radiological outcomes:** There was a significantly greater number of incidences of heterotopic ossification (RR 1.6, 95% CI 1.2 to 2.1) with hip resurfacing compared with total hip arthroplasty; statistical heterogeneity was not present. There was no significant difference between groups in acetabular or femoral offset, leg length, cup height or presence of specific acetabular or femoral radiolucency.

**Complications:** There was a significantly greater number of incidences of aseptic loosening (RR 3.1, 95% CI 1.1 to 8.5; 10 studies) and revision surgery (RR 1.7, 95% CI 1.2 to 2.5; 18 studies) with hip resurfacing than with total hip arthroplasty. These outcomes were associated with statistical heterogeneity ($I^2$=52% and $I^2$=30%). Hip resurfacing was associated with reduced incidence of dislocation (RR 0.2, 95% CI 0.1 to 0.5) and was not associated with heterogeneity. There was no significant difference between groups in other complications.

The funnel plot did not provide evidence of publication bias.

Further results were reported for other clinical outcomes and quality of life.

**Authors' conclusions**
Hip resurfacing may have had better functional outcomes than total hip arthroplasty, but the increased risks of heterotopic ossification, aseptic loosening and revision surgery following hip resurfacing indicated that total hip arthroplasty was superior in terms of implant survival.

**CRD commentary**
The research question was supported by well-defined inclusion criteria. Comprehensive searches for published and unpublished data were conducted and any language was included, which reduced risks of language and publication biases. The review process was conducted by two reviewers, which minimised risks of reviewer error and bias. Study quality was assessed with relevant criteria, but individual study quality results were not presented. The largely poor quality of the included studies was acknowledged by the authors and further limitations of the evidence base were discussed. Clinical and statistical heterogeneity were assessed, but sources of statistical heterogeneity were not investigated. No details of the number of studies and events that contributed to the meta-analyses were reported for most analyses.

The variable quality of the evidence presented means that the authors' conclusions should be interpreted with some caution.

**Implications of the review for practice and research**
**Practice:** The authors did not state any implications for practice.

**Research:** The authors stated a need for continuous research to assess long-term revision of hip resurfacing. Further
studies to assess bone mineral density were needed and possible confounding variables needed to be investigated.

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