

# Metal on Metal Large-Head Total Hip Arthroplasty versus Hip Resurfacing: A Systematic Review and Meta-Analysis of Clinical Outcomes and Metal Ion Exposure

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**INTRODUCTION:** Large-diameter head total hip arthroplasty (LDH-THA) was introduced in the late 1990s as a stemmed alternative to hip resurfacing arthroplasty (HRA), offering similar biomechanical advantages for patients with compromised femoral bone stock. Both use metal-on-metal (MoM) bearings to allow larger femoral heads, reducing dislocation risk and improving function in younger, active patients. Concerns over metal ion release and adverse local tissue reactions have sharply reduced MoM use, yet long-term follow-up is vital for the many patients with these implants. This systematic review/meta-analysis compares LDH-THA and HRA in terms of clinical outcomes, metal ion levels, and revision rates to inform long-term management, revision decisions, and future implant design.

**METHODS:** A literature search was conducted using PubMed, Embase, and Scopus databases with specific search terms related to HRA and large diameter head THA. Studies were included if they reported postoperative PROMs, metal ion levels, or revision rates for both LDH-THA and HRA. The risk of bias was assessed using the MINORS score. A random-effects meta-analysis was performed to compare the odds of revision, as well as mean cobalt and chromium blood levels, UCLA activity scores, Harris Hip Scores (HHS), Oxford Hip Scores (OHS), and WOMAC scores between patients undergoing MoM LDH THA vs HRA.

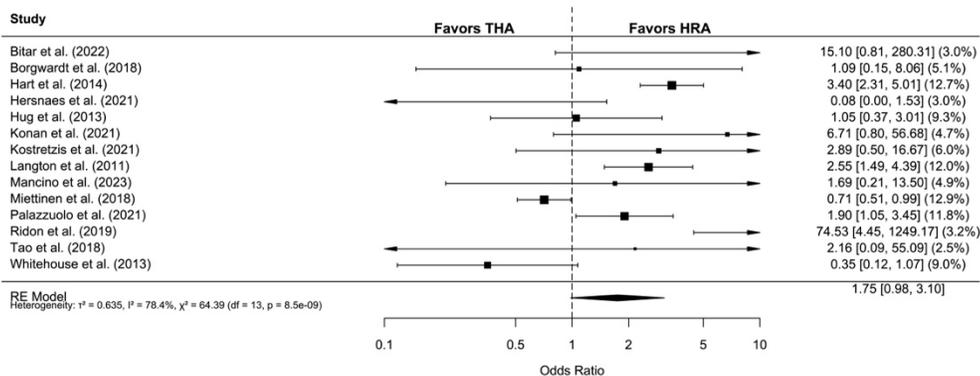
**RESULTS:** From an initial pool of 221 articles, 21 met inclusion criteria, encompassing a total of 5,580 MoM LDH THAs and 3,162 MoM HRAs. Among studies reporting gender distribution, the THA cohort included 2,579 male and 2,280 female hips, while the HRA cohort included 2,289 male and 1,732 female hips. The unweighted pooled revision rate was 16% for THA and 7.8% for HRA. The meta-analysis demonstrated that patients who received MoM THA had significantly higher blood cobalt (SMD 1.07, 95% CI: 0.52–1.62) and chromium (SMD 0.53, 95% CI: 0.14–0.92) levels than those who underwent HRA. The risk of revision (OR 1.75, 95% CI: 0.98–3.10), mean UCLA (SMD -0.44, 95% CI: -0.88 to 0), and mean HHS (SMD -0.32, 95% CI: -0.73 to 0.09) trended towards significance in favor of HRA, however were non-significant.

**DISCUSSION:** Although large-head MoM THA is now largely of historical interest, our findings indicate that MoM hip resurfacing arthroplasty offers a more favorable outcomes profile with lower systemic metal ion exposure, supporting its durability and safety in active patients with good bone quality.

**SIGNIFICANCE/CLINICAL RELEVANCE:** The elevated revision risk and higher systemic metal ion levels of LDH-THA, without clear functional benefits, suggest it no longer has a role in contemporary arthroplasty. HRA remains a durable, bone-conserving option for active patients with good bone quality. Future efforts should focus on refining resurfacing techniques and developing non-metal-on-metal bearings that preserve HRA's biomechanical advantages while minimizing metal ion-related risks.

## IMAGES AND TABLES:

a. Forest plot of the revision odds ratio



b. Forest plots of mean cobalt (left) and chromium (right) ion blood levels

