

Migration Patterns of Acetabular Cups: A Systematic Review and Meta-Analysis of RSA Studies

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INTRODUCTION: Radiostereometric analysis (RSA) is the most sensitive method to measure in vivo cup migration. Migration greater than 1mm in the first two years is a validated surrogate assessment method to predict future loosening. As most RSA studies only investigate one implant in a relatively small cohort, comparison of cup migration patterns and investigating the influence of implant factors is difficult. Therefore, a systematic review and meta-analysis of RSA studies was conducted to investigate the early- and long-term migration patterns of acetabular cups and the influence of implant factors on cup migration over time. The primary objective of this systematic review and meta-analysis was to investigate the early- and long-term migration patterns of acetabular cups using RSA. Secondary objective was to investigate whether implant factors influence early migration patterns of the acetabular cups.

METHODS: A systematic search of PubMed, Embase and Scopus databases was performed to identify all RSA studies of cup migration following primary total hip replacement (THR). Proximal migration at 3-and 6-months; 1-, 2-, 5- and 10-years were considered for analysis. Implant factors investigated included fixation type, head size, bearing surface, uncemented coating design and the decade of RSA introduction. A random effects model was used to pool the proximal migration of individual study cohort in order to estimate the overall proximal migration for each follow-up and its associated 95% confidence interval.

RESULTS: There were 47 studies that reported the proximal migration of 83 cohorts (2338 cups). No implant factor investigated was found to significantly influence proximal migration. The mean pooled 2-year proximal migration of cemented cups 0.14 mm [95CI 0.08-0.20] was not significantly different to uncemented cups 0.12 mm [95CI 0.04-0.19]. The mean pooled proximal migration at 6-months was 0.11 mm [95CI 0.06-0.16] and there was no significant increase between 6-months and 2-years (0.015mm, [95CI 0.000-0.030]). 27 of 75 cohorts (36%) reported mean proximal migration greater than 0.2mm at 2-years which has previously identified as implants at risk of long-term loosening. Essential results, including data, sample size and statistics.

DISCUSSION: This meta-analysis suggests that the majority of the proximal migration of acetabular cups used at primary THR occurs within the first 6-months. Besides higher migration of one threaded cup design, no implant factors influenced the 2-year proximal migration of acetabular cups. Pooled analysis of acetabular cup migration beyond 5-years was not possible due to the limited amount of RSA studies. Further investigation and comparison against long-term survivorship data is required to determine if 6-month and/or 1-year proximal migration measurements may be used as a predictor of long-term loosening.

SIGNIFICANCE/CLINICAL RELEVANCE: (1-2 sentences): As majority of migration occurs within the first 6-months, with further research timepoints earlier than 2-years could be used to predict long-term loosening of acetabular implants. Earlier assessment of new implant designs can minimize the risk of patients receiving poor performing implants whilst also promoting continuous development of new implant designs.

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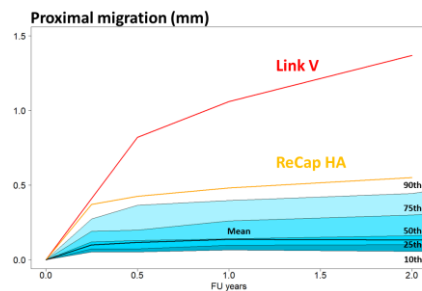


Figure 1. Early migration in percentiles of 83 study cohorts, 2,338 cups. The migration of two known acetabular cup failures are also plotted as they were outliers: the Link V cup and the ReCap hydroxyapatite coated cup

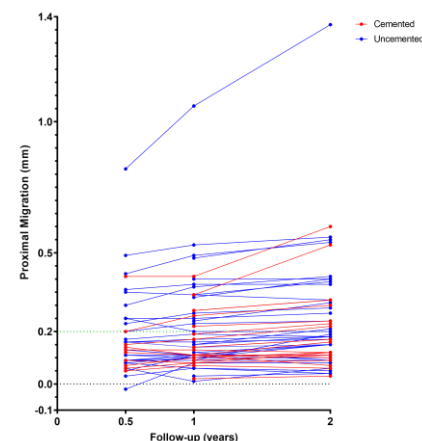


Figure 2. The reported mean proximal migration from RSA studies that reported proximal migration at 6-months, 1-year, and 2-years. The green dashed line represents the 0.2mm threshold.