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

Chan Hee Cho1, Bart G. Pijs2, John M. Abrahams1,3, Anne Roerink2, Raissa Katembwe1, Andrew Baker1, Lucian B. Solomon1,3, Stuart A. Callary1,3

1Centre for Orthopaedic and Trauma Research, Faculty of Health and Medical Sciences, The University of Adelaide, Adelaide, SA, Australia
2Department of Orthopaedics, Leiden University Medical Centre, Leiden, Netherlands
3Department of Orthopaedics and Trauma Royal Adelaide Hospital, Adelaide, SA, Australia

stuart.callary@adelaide.edu.au

Disclosures: Chan Hee Cho (N), John M. Abrahams (N), Anne Roerink (N), Raissa Katembwe (N), Andrew Baker (N), Lucian B. Solomon (N), Stuart A. Callary (N)

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.

ACKNOWLEDGEMENTS: Stuart Callary held a Fellowship funded by The Hospital Research Foundation Group during this study.

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.

ORS 2024 Annual Meeting Paper No. 1879