Mobile- vs. Fixed-Bearing Total Ankle Prostheses: A Systematic Review and Meta-Analysis
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Introduction/Purpose: Total ankle replacement (TAR) is a well-accepted treatment option in patients with end-stage ankle osteoarthritis. In general, TAR designs can be classified based on their number of components: 2-components (fixed-bearing) vs. 3-components (mobile-bearing). In the U.S. the STAR prosthesis is the only one mobile-bearing TAR with FDA approval. It remains unclear whether 3-component TAR designs have superior clinical outcomes including prosthesis survivorship. Therefore we performed a systematic review and meta-analysis of the available TAR designs to determine prosthesis survivorship and whether there is a statistically significant difference between mobile- and fixed-bearing TAR designs.

Methods: We reviewed literature using common data bases. All searches were unlimited. For the search we used the subject heading terms: “ankle”, “replacement”, “arthroplasty”, and “prosthesis”. For meta-analysis a checklist was used as described by Meta-analysis Of Observational Studies in Epidemiology (MOOSE) Group. The quality of included studies was assessed using Coleman’s Methodology Score. The following parameters were reviewed: type of study, inventor bias, number of patients/ankles, mean age with range, gender, etiology of underlying ankle osteoarthritis, average and maximum follow-up, number of TAR failures, and total exposure time. For each study, failure rate was estimated as the number of failures/total exposure years. N-year (here, 5 or 10 years) failure rate was calculated as $1 - \exp(-N \times \text{failure rate})$. The pooled estimate of failure rate was a weighted average across studies using the inverse variance weighting method. The test for heterogeneity was not significant so fixed effects models were used.

Results: In total, 32 studies with 3968 ankles were included into the analysis. Nine studies included 844 fixed-bearing TARs and 23 studies included 3124 mobile-bearing TARs. Patient characteristics were comparable in both study groups. For fixed-bearing TAR, the 5-year and 10-year failure rate was 0.077 and 0.149 with an average annual failure rate of 0.016 (95%CI 0.008-0.025). For mobile-bearing TAR, the 5-year and 10-year failure rate was 0.074 and 0.142 with an annual failure rate of 0.015 (95%CI 0.011-0.020). Two studies with fixed-bearing TAR and six studies with mobile-bearing TAR had inventor bias. The average annual failure rate was comparable in both groups ($P = 0.88$), with and without inventor bias, 0.013 vs. 0.018 ($P = 0.87$).

Conclusion: We have shown that TAR has an overall failure rate of 0.149 and 0.142 at 10 years in patients with fixed-bearing and mobile-bearing TAR design, respectively. No superiority of one implant design over another can be supported by the available data.

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