Independent Radiographic Review of Joint Space Following First Metatarsophalangeal Synthetic Cartilage Implantation: Is There an Association Between Joint Space and Outcomes?

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Introduction/Purpose: Synthetic cartilage implants for first metatarsophalangeal osteoarthritis have been used for nearly a decade with Level 1 clinical evidence showing 84.9% of implants remain in place at a mean follow-up of 5.8 years. In contradiction to these positive results, however, some recent publications have shown higher revision rates and attempted to correlate the need for revision with the postoperative joint space interval. Most of these studies performed assessments based off of routine anterior-posterior (AP) radiographs using hand drawn measurements without image calibration or scaling. The purpose of this independent radiographic review was to further explore any relationship between joint space integrity and the need for revision surgery.

Methods: An independent radiographic review by two board-certified, fellowship-trained, practicing musculoskeletal radiologists with no competing financial interests was conducted for 15 subjects from a previously concluded Level 1 clinical trial looking at outcomes of a synthetic cartilage implant. Ten (10) subjects with positive outcomes and 5 who required revision were selected at random for evaluation. Weight-bearing AP and lateral radiographs at baseline, 2 weeks, 6, 12, 24, and 60 months were reviewed. Using previously validated Quantitative Motion Analysis software, joint space was measured in the medial, central, and lateral locations on AP radiographs and dorsal, central, and plantar locations on lateral radiographs (Coughlin et al. 2003). Measurements were normalized to the proximal phalanx width in the relevant view (AP or lateral) to adjust for lack of image scaling or calibration. Normalized joint spaces at each interval and changes from the 2-week visit, the earliest with the implant in place, were evaluated.

Results: In this pilot study, no relationship between mean normalized joint space and implant removal was found at any time point over the 60-month follow-up. Scatterplots were used to determine if movement in different directions impacted mean values. There was significant overlap for the two groups in joint space at each subject’s final visit with the implant in place and the change from the 2-week visit to the final visit (Figure 1). The majority of subjects in both groups experienced changes in joint space of less than 10% across all measurements. The maximum change from the 2-week visit in the revision group was less than 15%, compared to over 25% for subjects in the retention group.

Conclusion: Neither joint space at final follow-up nor joint space change from initial postoperative assessment were associated with revision. The maximum observed decrease in the revision group was less than 15%, or 0.5 mm in a joint space of 3 mm. Both the clinical relevance of this minimal decrease and whether or not it can be reliably assessed remain unclear. Future studies could examine patient factors other than joint space to determine success or failure of this implant. These preliminary results suggest joint space integrity evaluated from plain film is a weak indicator of clinical efficacy with this synthetic cartilage implant.
Figure 1. Scatterplots showing a) the normalized joint space for each subject at the final visit with the implant in place and b) change from the 2-visit until the last visit with the implant in place for each subject, where positive values represent a reduction in joint space.