Sample Poster (Scientific)

A RADIOGRAPHIC EVALUATION OF IMPLANT MIGRATION ACROSS TIME AND BETWEEN TWO GENERATIONS OF AN IMPLANT

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STATEMENT OF PURPOSE

To compare the extent of implant migration across time and between two generations of the same total ankle replacement (TAR) system (INBONE® TAR, Wright Medical Technology, Inc., Arlington, TN).

LITERATURE REVIEW

Total ankle replacements were first introduced in the 1970s as an alternative to ankle arthrodesis. The initial results were encouraging, but subsequent reviews with long-term follow-up revealed unacceptable failure rates. Over the next several decades, areas of faulty implant design were modified, and over time, mid- to long-term survivorship improved (1-3).

As the final mid-sized, weight bearing joint, the ankle is inherently exposed to excessive stress. Following TAR, there are extreme compressive forces on the underlying cancellous bone and a small area for prosthetic support, which can result in aseptic loosening and implant migration; both of which have been shown to predict premature implant failure (4-7). Therefore, comparing implant migration as it relates to implant design is necessary to optimize the longevity and success of TAR.

Kärrholm and colleagues define implant migration as "the longitudinal movement of an implant with respect to the bone in which it is imbedded over time" (7). Although investigators recognize the need to better understand and quantify implant migration at the ankle, only preliminary reports have surfaced (8-12), and it remains unclear if specific implant designs are more prone to implant migration than others.

HYPOTHESIS

The authors hypothesized that implant migration would increase over and time and that this increase would be greater in the first generation implant.

METHODOLOGY & PROCEDURES

Level of Evidence: III

Study Design: Chart Review

A chart review was performed to identify consecutive patients that underwent TAR with either the first or second generation implant

Inclusion Criteria

- ≥18 years of age
- Diagnosed with end stage ankle arthritis
- Exhausted conservative treatments
- Elected to undergo TAR
- Either the first generation or second generation of a pre-identified TAR was implanted
- Minimum radiographic follow-up of 24 months

Outcomes

- Implant migration
  - Defined as the change from the immediate post-operative radiograph to the 24 month radiograph

Measurements

- Via anterior-posterior radiographs, the distance from the apex of the tibial component was measured to the most distal aspect at the center of the talar stem or the mid-saddle of the non-stemmed component
- Recorded from post-operative radiographs: the immediate post-operative and the 24 month

Statistical Analyses

- A repeated measure analysis of variance (ANOVA) with repeated measures for time (baseline, 24 months) and implant (first generation, second generation) was used to evaluate the dependent variable (implant migration).
- Statistical significance was set at the 5% level ($p \leq 0.05$)

RESULTS

Figure 1. Radiographic Measurements

A. First Generation Implant

B. Second Generation Implant

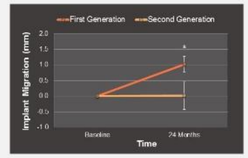
Table 1. Patient Demographics

Data presented as mean ± standard deviation or n (%).

Demographic	All Patients	First Generation Implant	Second Generation Implant
Patients	34 (100.0)	20 (58.8)	14 (41.2)
Age (years)	58.6 ± 12.0	59.3 ± 12.2	57.6 ± 12.1
Body Mass Index (kg/m^2)	31.9 ± 6.8	31.1 ± 7.3	32.3 ± 6.3
Gender			
Men	22 (64.7)	14 (70.0)	8 (57.1)
Women	12 (35.3)	6 (30.0)	6 (42.9)
Injury Side			
Left	15 (44.1)	10 (50.0)	5 (35.7)
Right	19 (55.9)	10 (50.0)	9 (64.3)

Figure 2. Implant Migration across Time by Implant

Data presented as mean ± standard error.



The repeated measures ANOVA revealed a main effect of time (p = 0.05), a main effect of implant (p = 0.03), and a time by implant interaction (p = 0.03). The time by implant interaction indicates that the rate of implant migration was significantly greater for the first generation implant (1.0 ± 1.1 mm) than the second generation implant (0.0 ± 1.6 mm).

*Statistically significant at the 5% level ($p \leq 0.05$).

DISCUSSION

Total ankle arthroplasty continues to gain popularity in the field of foot and ankle surgery. Despite improvements in implant design, implant migration continues to contribute to premature implant failure (4-7). Investigating the implant migration associated with various ankle implants may assist in identifying and filtering out inferior designs. The purpose of the present report was to compare implant migration between two generations of the same implant, two years after implantation. The present study demonstrated that implant migration increases over time and that the rate of implant migration was reduced with the newer generation implant.

While many features of the first generation implant were preserved, there were some substantial modifications (13). For example, the newer implant utilizes two talar pegs with an optional central stem, as opposed to a single talar stem. The two points of fixation are thought to increase axial stability (13). To increase stability in the coronal plane, the talar saddle design was replaced with a sulcus design. Additionally, the tibial base plate was elongated to increase coverage in the anteroposterior plane. Given the increased surface area, loads should be more evenly distributed throughout the tibial plafond (13).

A primary limitation of the present investigation was the small sample size (N = 34). To confirm that these generational modifications deter implant migration, additional studies with larger sample sizes are needed. Presumably, more appreciable differences in implant migration will exist between TAR systems with marked dissimilarities in design as opposed to generational modifications.

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