Comparison of the Clinical Outcomes and Complications of Simultaneous vs Staged Bilateral Total Ankle Arthroplasty: A Single-Center Comparative Cohort Study

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Introduction/Purpose: The utilization of total ankle arthroplasty (TAA) has increased over the past decade to include bilateral TAAs. The risk-benefit profiles of simultaneous versus staged joint arthroplasty continues to be debated in the literature. There are limited case series reporting outcomes after bilateral TAA with no previous comparison of simultaneous versus staged TAA. It is important to study patients with bilateral pathology as they represent a unique population often with a differing arthritis etiology and an overall more debilitating condition. Thus, we aim to compare bilateral simultaneous versus staged TAAs including perioperative complications and patient reported outcome measures (PROMs).

Methods: We performed a comparative cohort study of patients who underwent primary TAA from 2007 to 2019 at a single academic center. Inclusion criteria were primary bilateral TAA performed in simultaneous or staged fashion in patients over 18 years of age. Exclusion criteria were patients with less than two-years follow-up and those with previous tibiotalar arthrodesis or infection. Patient demographics, comorbidities, perioperative complications, and PROMs were collected. PROMs included preoperative and postoperative visual analog scale (VAS) for pain, the Short Form-36 (SF-36) Health Survey, the American Orthopaedic Foot and Ankle Society (AOFAS) score, and the Short Musculoskeletal Function Assessment (SMFA) bother and function sub-scores. Bivariate tests of significance were used to compare variables between the two cohorts.

Results: Fifty patients were included with an average clinical follow-up was 52.2 (+-27.3; range 24-109) months. The mean time between staged TAA surgeries was 17.5 months (+-20.1, range 3-74). The mean age was 64.3 (+-10.6, range 21-76) years with 32 (64.0%) men. Many patients had primary osteoarthritis (n=28, 56.0%). Both cohorts experienced improvement in all PROMs at one year, which were maintained at final follow-up with no significant between-group differences (p >0.05). There were no differences in perioperative complication rates with similar overall complications (22.0% vs. 24.0%; p=0.7788) and reoperations (6.0% vs 5.0%; p=0.7354) between the simultaneous and staged cohorts, respectively. The two-year and five-year reoperation-free survival were 96.0% and 90.0% for the staged cohort and 94.0% and 88.0% for the simultaneous cohort, respectively (p=0.4612) Both cohorts had 100% failure-free survival up to eight-years postoperative. One patient in the simultaneous cohort required metal component revision at eight years postoperative.

Conclusion: The results of bilateral simultaneous TAA, including patient reported outcomes, perioperative complications, and component survival are comparable to patients undergoing staged TAA. When performed under surgeon expertise in appropriately selected patients, we advocate that simultaneous bilateral TAA is a safe and effective method for the treatment of bilateral end-stage ankle osteoarthritis. Potential benefits of simultaneous TAA warranting further investigation include decreased anesthesia events, surgery time, tourniquet time, length of hospitalization, recovery and rehabilitation time, and overall cost. Future investigations will include dedicated analyses of radiographic outcomes and cost comparisons between these two cohorts.
Table 1. Clinical Outcomes: Bonferroni Pairwise Comparisons

|                  | Mean Score (95% CI) | Improvement, P Value* | Operative Group Difference, P value** |
|------------------|---------------------|-----------------------|---------------------------------------|
|                  | Simultaneous (n = 26) | Staged (n = 25) | Simultaneous (n = 26) | Staged (n = 25) |                               |
| VAS              |                     |                      |                         |                  |                              |
| Preoperative     | 63.5 (54.8-72.3)    | 56.2 (45.1-67.3)     | <0.0001                 | <0.0001          | 0.2714                         |
| 1-yr follow-up   | 25.0 (14.6-35.5)    | 20.5 (14.1-26.9)     | <0.0006                  | <0.0001          | 0.0918                         |
| Final follow-up  | 20.0 (5.5-35.3)     | 10.6 (6.2-15.1)      |                         |                  |                                |
| SF-36 Total      |                     |                      |                         |                  |                                |
| Preoperative     | 51.7 (44.1-59.5)    | 52.4 (44.9-59.9)     | <0.0001                 | 0.0002           | 0.3682                         |
| 1-yr follow-up   | 79.3 (72.0-86.5)    | 72.5 (64.1-81.0)     | <0.0001                 | 0.0001           | 0.3303                         |
| Final follow-up  | 73.5 (66.1-80.8)    | 67.8 (56.1-79.5)     | <0.0001                 | 0.0091           |                                |
| SMFA Function*** |                     |                      |                         |                  |                                |
| Preoperative     | 34.7 (26.8-42.5)    | 33.7 (28.5-38.9)     | <0.0001                 | <0.0001          | 0.7512                         |
| 1-yr follow-up   | 14.2 (8.1-20.3)     | 16.3 (10.7-21.9)     | <0.0001                 | <0.0001          | 0.8829                         |
| Final follow-up  | 15.3 (7.9-22.7)     | 17.3 (9.4-25.2)      | <0.0001                 | 0.0002           |                                |
| SMFA Bother***   |                     |                      |                         |                  |                                |
| Preoperative     | 39.2 (31.1-47.4)    | 37.3 (29.9-44.7)     | <0.0001                 | <0.0001          | 0.7683                         |
| 1-yr follow-up   | 16.2 (6.7-26.1)     | 17.9 (11.5-24.2)     | <0.0001                 | <0.0001          | 0.5888                         |
| Final follow-up  | 21.1 (10.1-32.2)    | 21.4 (12.0-30.7)     | 0.0005                  | 0.0003           |                                |

Scores are reported as: mean score (95% CI)

Abbreviations: CI, confidence interval; SF-36, Short Form–36; SMFA, Short Musculoskeletal Function Assessment; VAS, visual analog scale for pain.

* Pairwise difference between most recent and preoperative time points within each cohort.
** Difference between simultaneous and staged cohorts’ improvement from preoperative to most recent follow-up.
*** With the SMFA and VAS, a lower value is a better score.

Patient Reported Outcome Scores
Bilateral Simultaneous versus Staged TAA