Measures of Gait Before and After Ankle Arthroplasty
Michael Civitello*, Laura Tomayko*, Stephen Aitken*,
Stephen F. Conti†, Mark Carl Miller*†

*Duquesne University, Pittsburgh PA
†University of Pittsburgh, Pittsburgh, PA

Introduction: Joint replacement is performed routinely on patients with arthritic
degeneration and loss of function of the knees and hips. Ankle replacement, however, is far
less common and has only recently become clinically viable. The purpose of this study was to
compare the pre-operative gait of patients scheduled to undergo total ankle arthroplasty to
those of patients who have previously had this procedure. The results will quantify functional
improvement due to ankle replacement, which has seen limited study [2,3].

Statement of Clinical Significance: Currently, arthrodesis is the standard treatment
procedure for patients with arthritic ankle degeneration. While pain relief is an expected
outcome of arthrodesis, restoration of normal function is not. This can be attributed primarily
to a loss of ankle motion. Patients commonly compensate for the loss of ankle joint motion
and thereby place greater stresses on the lower kinetic chain, primarily at the subtalar and
midtarsal joints. This increased stress can result in degeneration of these joints over time,
causing further loss of function. Ankle arthroplasty should be considered a desirable
treatment option for arthritic degeneration of the ankle if it can relieve pain as well as restore
normal gait patterns, preventing compensatory movements and the stresses that result.

Methodology: A total of 51 patients, 29 pre-operatively and 22 post-operatively, were
included in the study. The post-operative group had undergone unilateral ankle arthroplasty
performed by the clinical co-investigator (SFC), using a non-cemented prosthesis (Agility
Ankle, DePuy, Inc). The pre-operative group was comprised of patients scheduled to undergo
the same procedure and was tested in a period ranging from 1-7 days before surgery. The
patients in the post-operative group were tested once in a period of 11-19 months after
surgery. All of the patients were tested in the gait analysis laboratory at Duquesne University.
Patients’ lower extremity bony landmarks were indicated with reflective markers, as follows:
greater trochanter, lateral femoral epicondyle, fibular head, lateral malleolus, lateral
calcaneous, and fifth metatarsal. Patients were then asked to walk at a normal pace back and
forth across a 25-foot runway. A force plate (Bertec) measured all foot-floor forces. Subjects
walked until there were three distinct foot strikes on the force plate with each foot. Gait
pattern data was gathered using a video-based motion analysis system (Peak-5, Peak
Performance, Inc.)

Results: Using a paired t-test (p < 0.05), a statistically significant difference in step length
was found between the two groups. The step length increased from 51.5 mm (5.7) to 68.4
mm (2.6) on the operated side and from 56.8 mm (4.5) to 70.8 mm (2.9) on the unoperated
side. There was also a statistically significant deficit in the vertical foot-floor force at the
second weight-bearing peak (push-off phase) for the post-operative group when comparing
the unoperated to the operated side (p < 0.05). Normalized by body weight, the pre-operative
vertical force was 1.02 and post-operative force was 1.10. Only one patient in the post-operative group reported any pain during normal walking. Eight reported stiffness and mild pain at the end of the day.

**Discussion:** The goal of surgical and therapeutic interventions should be the restoration of function and relief of pain. The results of this study indicate that ankle arthroplasty is an effective treatment for the relief of pain as well as restoration of function. Gait patterns of patients following ankle arthroplasty were significantly improved when compared to pre-operative gait patterns, as evidenced by the increased step length for both the affected and non-affected side. The post-operative weight-bearing deficit is similar to one occurring in arthrodesis patients as reported by Wu et al [1]. The significance of this similarity is unknown at this time, but warrants further investigation.

### References:


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