

Functional Parameters of Gait Following Total Ankle Arthroplasty: Is Preoperative Diagnosis Predictive of Outcome?

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Introduction/Purpose: Numerous studies have attempted to study outcomes after total ankle arthroplasty (TAA). The majority of these studies are clinical in nature. There have been some reports that rheumatoid patients have better outcomes after TAA although there are papers that are contradictory. Objective outcome studies of gait after TAA usually measure outcome against a control group or ankle arthrodesis. No studies have attempted to measure objective outcomes of TAA based upon the preoperative diagnosis. Without objectively studying outcomes for patients with osteoarthritis, rheumatoid arthritis, and post-traumatic arthritis, it is unclear whether a difference exists in outcomes after TAA. This study aims to answer the question: Is preoperative diagnosis predictive of outcome after total ankle arthroplasty?

Methods: A retrospective review of 75 patients who underwent isolated TAA with a minimum one-year follow-up, including patient demographics, pre-operative diagnosis, and pre and postoperative gait studies was conducted. Gait function was evaluated for postoperative improvement using multivariate analysis to determine the influence of patient variables on parameters of gait. ANOVA was conducted to compare improvement in gait based on preoperative diagnosis. P-values of < 0.05 were considered statistically significant.

Results: Outcomes/p-values are listed in table I. While not reaching statistical significance, a meaningful clinically important difference was seen across numerous parameters.

Temporal Spatial Parameters

Patients with RA had the slowest preoperative cadence the fastest postoperative cadence. They also had the greatest improvement in walking speed. Patients with osteoarthritis had the greatest increase in walking speed.

Kinematic Parameters

Patients with RA had the greatest improvement in maximum plantarflexion and the least improvement in maximum dorsiflexion. Patients with osteoarthritis had the least improvement in maximum plantarflexion and the most improvement in mean maximum dorsiflexion. Patients with osteoarthritis had the greatest improvement in total ROM.

Kinetic Parameters

Patients with RA had the greatest improvement in peak ankle power while patients with osteoarthritis had the greatest post-operative power.

Conclusion: There is a lack of data supporting the optimal candidate for TAA. While statistical significance was not reached across a number of the parameters of gait analysis, a number approached statistical significance. Given the relatively small sample size, it is possible that a larger cohort would reach statistical significance.

Patients with osteoarthritis generally had superior preoperative and postoperative parameters of gait while patients with RA had the greatest improvement in parameters of gait. Patients with post-traumatic arthritis consistently had less improvement than patients with either osteoarthritis or RA.

Table 1. Gait Parameters By Preoperative Diagnosis

	Osteoarthritis (N=26) Mean \pm SD	Rheumatoid (N=7) Mean \pm SD	Trauma (N=42) Mean \pm SD	P-Value
Age at Time of Surgery	60.99 \pm 7.97	62.89 \pm 6.60	61.04 \pm 12.01	0.9027
Temporal Spatial Parameters				
Cadence (steps/min)				
Preoperative	101.78 \pm 19.29	100.54 \pm 12.13	106.48 \pm 14.66	0.4203
Postoperative	108.35 \pm 13.39	112.20 \pm 13.80	111.28 \pm 11.66	0.5932
Postoperative - Preoperative	6.57 \pm 20.33	11.66 \pm 11.72	4.80 \pm 9.67	0.4979
Step Length (cm)				
Preoperative	52.51 \pm 13.05	44.93 \pm 10.08	52.23 \pm 10.05	0.2539
Postoperative	60.63 \pm 8.57	52.61 \pm 9.61	58.17 \pm 7.35	0.0642
Postoperative - Preoperative	8.12 \pm 11.51	7.69 \pm 9.37	5.94 \pm 7.23	0.6121
Walking Speed (m/s)				
Preoperative	0.89 \pm 0.25	0.76 \pm 0.21	0.92 \pm 0.26	0.3086
Postoperative	1.07 \pm 0.22	0.99 \pm 0.21	1.06 \pm 0.21	0.689
Postoperative - Preoperative	0.18 \pm 0.29	0.24 \pm 0.23	0.14 \pm 0.19	0.5042
Kinematic Parameters				
Initial Contact (Tibiotalar Angle)				
Preoperative	-1.73 \pm 4.50	-2.96 \pm 4.20	-2.79 \pm 3.70	0.5439
Postoperative	-3.17 \pm 3.21	-3.10 \pm 4.20	-3.40 \pm 2.74	0.9407
Postoperative - Preoperative	-1.43 \pm 4.18	-0.14 \pm 3.97	-0.61 \pm 4.11	0.6474
Total Range of Motion (Sagittal)				
Preoperative	16.18 \pm 5.26	12.90 \pm 3.88	15.11 \pm 4.57	0.2633
Postoperative	19.95 \pm 4.23	15.87 \pm 2.44	18.11 \pm 4.63	0.0618
Postoperative - Preoperative	3.77 \pm 4.76	2.97 \pm 3.69	3.00 \pm 3.47	0.727
Sagittal Angle at Toe Off				
Preoperative	-5.06 \pm 5.57	-4.93 \pm 4.22	-6.89 \pm 5.23	0.322
Postoperative	-8.00 \pm 5.19	-6.54 \pm 4.07	-9.64 \pm 4.93	0.1977
Postoperative - Preoperative	-2.95 \pm 5.78	-1.61 \pm 3.64	-2.75 \pm 5.25	0.8402
Mean Maximum Plantarflexion				
Preoperative	10.28 \pm 5.58	6.77 \pm 4.87	7.72 \pm 4.19	0.0654
Postoperative	10.66 \pm 3.93	8.84 \pm 3.11	7.96 \pm 3.21	0.0104
Postoperative - Preoperative	0.37 \pm 4.57	2.07 \pm 3.44	0.24 \pm 4.05	0.5617
Mean Maximum Dorsiflexion				
Preoperative	-5.89 \pm 5.29	-6.11 \pm 4.19	-7.39 \pm 4.95	0.4614
Postoperative	-9.29 \pm 4.62	-7.04 \pm 3.61	-10.15 \pm 4.43	0.2189
Postoperative - Preoperative	-3.40 \pm 5.12	-0.93 \pm 3.82	-2.76 \pm 4.67	0.4784
Kinetic Parameters				
Peak Ankle Power (Watts/kg)				
Preoperative	0.74 \pm 0.42	0.44 \pm 0.28	0.72 \pm 0.43	0.2234
Postoperative	1.11 \pm 0.43	0.96 \pm 0.46	1.03 \pm 0.46	0.666
Postoperative - Preoperative	0.37 \pm 0.50	0.52 \pm 0.51	0.31 \pm 0.43	0.5207