Tibiopedal Motion following Tendo-Achilles Lengthening or Gastrocnemius Recession in Total Ankle Replacement: A Comparative Cohort Study

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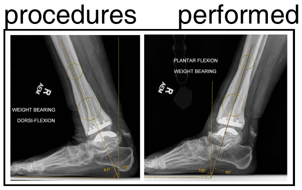
INTRODUCTION: End-stage ankle arthritis is a debilitating condition often necessitating total ankle replacement (TAR). Tendo-Achilles lengthening (TAL) and gastrocnemius recession (GR) are commonly performed with TAR to improve ankle dorsiflexion. The purpose of this study is to determine the effect of a TAL or GR during TAR on radiographic tibiopedal ROM.

METHODS: A retrospective review of a prospectively maintained database was conducted in 75 patients who underwent TAL (n = 40), GR (n = 35), or no lengthening procedure (n = 75). Inclusion criteria were a minimum of one-year ROM radiographic follow up. Exclusion criteria included 1) calcaneal osteotomies, 2) hindfoot or midfoot arthrodesis, 3) prior ankle arthrodesis, or 4) revision TAR. Demographic and clinical data were extracted from the TAR database. Radiographic assessment included tibiopedal dorsiflexion and plantarflexion (Figure 1).

RESULTS: Dorsiflexion significantly improved by 3.4° (p=0.0053) and by 6.7° (p < 0.0001) in the TAL and GR cohorts, respectively, with no significant difference in the control group (+1.3°, p=0.0857) (Figure 2). Plantarflexion was significantly decreased by 3.6° (p=0.0378) and by 6.6° (p=0.0002) in the TAL and GR cohorts respectively with no significant difference in the control group (+0.3°**,** p=0.7863) (Table 1). The total arc of motion did not change significantly for any of the three groups postoperative (control 1.63°, GR 0.05°, TAL -0.20°) with no significant between-group differences in overall arc of motion (p=0.3913) (Table 2). GR resulted in a greater increase in dorsiflexion (6.7° versus 3.4°**;** p=0.0459) with, albeit non-significant, greater decrease in plantarflexion (6.8° versus 3.6°**;** p=0.1598).

DISCUSSION AND CONCLUSION: Both TAL and GR significantly increased postoperative dorsiflexion; however, this was accompanied by a reciprocal significant loss in plantarflexion. The total arc of motion did not significantly change. Patients should be counseled that their preoperative ROM will dictate their postoperative ROM and concomitant procedures performed to increase dorsiflexion will do so at the expense of plantarflexion.



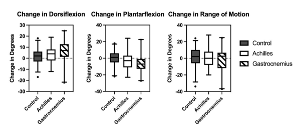


Table 1. Tibiopedal Range of Motion

	Preoperative			Postoperative			*Change in Motion		
	Dorsiflexion (°)	**Plantarflexion (°)**	**Total arc of motion (°)**	**Dorsiflexion (°)**	**Plantarflexion (°)**	**Total arc of motion (°)**	**Dorsiflexion (°)**	**Plantarflexion (°)**	**Total arc of motion (°)**
Control/ No lengthening cohort (n=75)	17.1 (7.0; 15.5-18.7)	24.1 (9.1; 22.0-26.2)	41.2 (12.2; 38.4-44.0)	18.5 (6.1; 17.1-19.9)	24.3 (9.0; 22.3-26.4)	42.8 (12.1; 40.0-45.6)	1.3 (6.7; -0.2-2.9)	0.3 (8.9; -1.8-2.3)	1.63
Gastrocnemius recession (n=40)	12.3 (7.7; 9.8-14.7)	21.7 (9.2; 18.7-24.6)	33.9 (12.7; 29.9-38.0)	19.6 (5.4; 17.9-21.4)	15.2 (8.4; 12.5-17.9)	34.0 (11.1; 30.4-37.5)	6.9 (8.2; 4.3-9.5)	-6.8 (10.0; -10.0- -3.6)	0.05
Tendo- Achilles lengthening (n=35)	14.7 (5.9; 12.6-16.7)	22.3 (7.1; 19.9-24.8)	37.0 (8.0; 34.3-39.7)	18.0 (6.4; 15.8-20.2)	18.8 (6.9; 16.4-21.1)	36.8 (10.1; 33.3-40.3)	3.4 (6.7; 1.1-5.7)	-3.6 (9.8; -6.0- -0.2)	-0.20

Values in mean (standard deviation; lower limit 95% CI- upper limit 95% CI).
* Difference between pre- and post-operative

Table 2. Tibiopedal Range of Motion Propensity Score Matched Analysis

	Change in Dorsiflexion (°)	**Change in Plantarflexion (°)**	**Change in Total arc of motion (°)**
Control/ No lengthening cohort (n=55)	0.7 (6.2; -0.9- 2.4)	-0.2 (8.8; -2.6-2.2)	0.5 (11.5; -2.6-3.6)
Gastrocnemius recession (n=29)	6.0 (8.2; 2.9-9.1)	-7.2 (8.4; -10.4 - -4.1)	-1.2 (12.0; -5.8-3.4)
Tendo- Achilles lengthening (n=26)	2.8 (6.2; 0.3-5.9)	-4.5 (8.8; -8.1- - 0.9)	-1.7 (9.7; -5.6-2.2)

Values in mean (standard deviation; lower limit 95% CI- upper limit 95% CI).

To estimate the propensity score, a multivariate logistic regression analysis was used based on the following covariates: age, sex, BMI, and prosthesis type. Propensity score matching was then performed using greedy nearest neighbor matching. This matching was performed without replacement and using a caliper width of 0.5 times the pooled estimate of the standard deviations of the logit of the estimated propensity score.