



# The Effect of Solid Ankle AFO Foot Plate Length on Third Rocker Function

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## INTRODUCTION

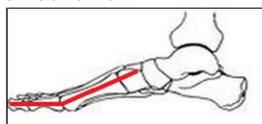
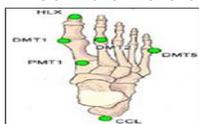
Third rocker function is theorized to be limited by longer foot plate lengths (distal to metatarsophalangeal joint). A standardized clinical approach is desired for making clinical foot plate length decisions for populations whose pathologies do not dictate a specific foot plate length. A non-AFO condition will serve as the control trial for each patient against full, sulcus and proximal to the metatarsal heads footplate length conditions. This study will focus on hallux angle and temporospatial parameters including step and stride length, cadence, and velocity.

## METHOD

**Subjects:** Subjects were recruited via flyers from the UT Southwestern School of Health Professions and must be at least 18 years of age. Subjects were excluded if they have less than 5/5 MMT or 80% normal ROM values for the lower extremity.

**Apparatus:** This study was completed through the use of an 8 camera OptiTrack Motive motion capture camera system to capture hallux joint angle motion, and a GAITRite mat and software to obtain temporospatial parameters.

**Procedures:** Subjects were evaluated and casted by the same CPO to gain a consistent, accurate impression for unilateral AFO fabrication. AFO's were pulled with 3/16" polypropylene and trimmed to solid ankle AFO trimlines. AFOs were fit by the same CPO and put in an appropriate shoe size with marker placement at the first and fifth metatarsal heads, distal lateral hallux, posterior calcaneus, and base of the first metatarsal to capture the hallux angle, following a modified Heidelberg method<sup>3</sup> (fig. 1). A five minute acclimation time was given prior to testing each foot plate length. Trials were done in the following order: no AFO, full, sulcus and then proximal to metatarsal heads plate lengths. The motion capture and GAITRite trials were completed simultaneously. Three trials were done for each condition.



**Data Analysis:** This study used OptiTrack Motive motion capture and MATLAB to obtain hallux angle data, Microsoft Excel was used for statistical analysis for all tests. One way ANOVA was used to determine significance at  $p < .05$  and if found significant, pairwise comparisons would be done using paired t-tests.

## RESULTS

Four subjects were initially tested with inadequate camera configuration and were not tested again. Two subjects were unable to complete testing due to small foot size, leading to cameras identifying one marker cluster opposed to individual markers. 4 subjects' data were captured and analyzed. GAITRite (table 2). Trumper determined that temporospatial parameters alone are not indicators of third rocker function.<sup>4</sup> He

also determined that stride length, step length, cadence and velocity were primary indicators of gait which were not found to be significant in this study.

	Full	Sulcus	Mets		Footplates
None	0.044	0.047	0.097	Stride length (cm)	0.80
Full	--	0.583	0.866	Step length (cm)	0.97
Sulcus	--	--	0.859	Cadence (steps/min)	0.65
				Velocity (cm/min)	0.71

GAITRite (table 3): One way ANOVA was conducted for the hallux angle and determined to be significant at  $p=0.015$ . Paired t-tests were performed and found to be significant for full plate versus no AFO and Sulcus versus no AFO. Figure 3 shows the hallux angle average over each of the 4 conditions.

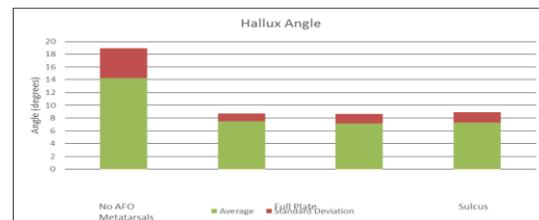


Figure 3. Average of 4 subjects at each foot plate condition.

## DISCUSSION

Hullin and Robb<sup>4</sup> determined that temporospatial parameters could not be used as the sole determinants of third rocker function. Owen discussed that people with no weakness or gait deviations were able to compensate AFO effects as in the GAITRite results which were not significant.<sup>2</sup> Motion capture results were significant specifically in the full versus no AFO and sulcus versus no AFO conditions. There was slight motion due to the use of tall, active males who overcame some of the effects of the full and sulcus plates. The metatarsal late was least significant; meaning it most closely mimicked normal walking and least hallux angle impact.

## CONCLUSION

This study determined that shorter foot plate lengths impact hallux angle less than longer foot plate lengths. Limitations include the use of only healthy, normal male subjects. Inherent motion exists between skin, AFO, shoes and markers. The motion capture system has insufficient resolution, leading to inaccuracy and inability to differentiate between closely placed forefoot markers.

## CLINICAL APPLICATIONS

This study does not offer conclusions that warrant the alteration of footplate lengths in clinical practice. The results do provide significant quantitative proof of the benefits in various footplate lengths and justify the need for continued research.

## REFERENCES

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