

SURGICAL RECESSON OF THE GASTROCNEMIUS DOES NOT INFLUENCE PLANTAR PRESSURE

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INTRODUCTION

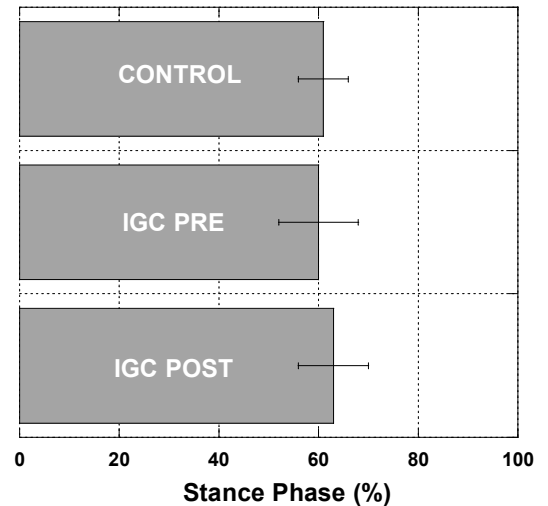
Isolated gastrocnemius contracture (IGC) has been defined as normal ankle dorsiflexion with the knee flexed and less than 5° of dorsiflexion with the knee fully extended [1]. Individuals with IGC can not attain sufficient gastrocnemius length for knee extension and ankle dorsiflexion to occur at the same time during mid-stance. A proposed compensatory strategy for IGC is early heel rise, which could result in increased pressure on the fore-foot [2]. Although the effect of this theory is unknown, early heel rise may increase cumulative fore-foot loading and thus result in foot pathology. Patients with IGC often present with disabling foot pathologies that impact their ability to perform activities of daily living without pain.

Gastrocnemius recession surgery is an infrequently used surgical option to treat painful overuse foot pathologies. Further surgical recession is a means to increase ankle joint range of motion, and therefore may normalize time to heel off [3]. This allows the vertical load to be distributed over a greater proportion of the foot and for a longer duration [2,4]. The purpose of this study was to evaluate the effect of IGC and subsequent gastrocnemius recession surgery on time to heel rise and peak fore-foot plantar pressure. We hypothesized that patients with IGC would exhibit early heel rise and have elevated fore-foot peak plantar pressure and fore-foot pressure time integral compared to control subjects, and that following surgery these values would normalize.

METHODS

7 legs clinically diagnosed with IGC were matched for gender, age, weight, and height with healthy control subjects from a database of 35 subjects recruited from the local area. IGC was defined as

Time to Heel Rise During Gait



Peak Fore-Foot Plantar Pressure During Gait

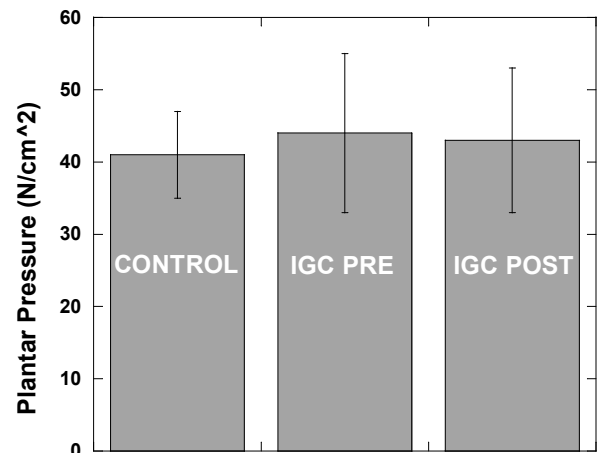


Figure 1: Time to heel rise and peak fore-foot plantar pressure for CONTROL and IGC subjects. There were no significant differences between or within groups.

less than 0° of passive ankle dorsiflexion with the knee in full extension. Control subjects had normal ankle range of motion. IGC subjects were tested prior to surgery and 3 months post-operatively. Control subjects were tested only once. A bi-plane goniometer was used to measure dorsiflexion range of motion.

The Tekscan HR Mat was used to assess plantar pressure during the stance phase of gait. Data were collected at 50 Hz. Five self-selected speed walking trials were collected. Walking speed was monitored using a photoelectric timing unit. A trial was not accepted if the subject altered their stride or visually targeted the pressure mat.

Data from the pressure mat was passed through a PC interface board to a desktop computer and stored for off-line analysis. Time to heel rise and peak fore-foot plantar pressure were obtained from the HR Mat System Software and used for comparison between groups. The fore-foot pressure time integral was exported and analyzed in a custom Lab View program.

Wilcoxon signed rank and Mann-Whitney U exact tests were used to compare between and within subjects, respectively. An alpha level of $p < 0.05$ was used to identify statistical significance for demographic variables, walking speed, time to heel rise, peak fore-foot plantar pressure, and fore-foot pressure time integral.

RESULTS AND DISCUSSION

There were no differences in group demographics or walking speed (Table 1). Time to heel rise, peak fore-foot plantar pressures (Figure 1), and the pressure time integral (11.3 ± 3.0 vs. 10.0 ± 1.2 N/cm²*s) were not different between IGC and control subjects. Further, gastrocnemius recession

surgery did not affect any of these plantar pressure measures.

CONCLUSIONS

In contrast to our hypotheses, subjects with IGC did not exhibit early heel rise or have elevated peak fore-foot plantar pressures or pressure time integrals compared to the control subjects. This was an unexpected finding and may be related to compensations occurring elsewhere along the kinetic chain. For example, the gastrocnemius is a bi-articulate muscle and therefore an alternate strategy could have been to increase knee flexion during mid-stance as suggested by Majacic et al. [5]. Although we had a limited number of subjects in our study, we suggest that patients with IGC do not exhibit early heel rise, elevated peak plantar pressure or pressure time integrals during natural cadence walking. Additional research is necessary to assess the lower extremity joint kinematics associated with IGC and is the focus of ongoing work.

REFERENCES

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Table 1: Average group demographics. There were no significant differences between or within groups.

	Gender	Age years (SD)	Height m (SD)	Weight kg (SD)	Speed m/s (SD)
IGC PRE	♀ = 6; ♂ = 1	50.6 (2.1)	1.7 (.07)	83.8 (6.8)	1.35 (.22)
IGC POST	SAME	51.3 (1.7)	SAME	83.6 (6.7)	1.36 (.07)
CONTROL	♀ = 6; ♂ = 1	49.4 (5.5)	1.7 (.11)	76.1 (10.5)	1.53 (.28)

SAME indicates IGC POST is unchanged from IGC PRE