

THE EFFECTS OF MORTON'S EXTENSION INSERTS ON PLANTAR LOADING PATTERNS, PAIN, AND FUNCTION IN INDIVIDUALS WITH HALLUX RIGIDUS

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INTRODUCTION

Hallux rigidus (HR) is characterized by a progressive loss of motion at the first metatarsophalangeal (MTP) joint secondary to osteoarthritic changes and proliferative bony response. Hallux rigidus is the second most common disorder of the great toe and affects one in 45 people over the age of 50[1]. Aside from osteoarthritic changes and a loss of motion, patients with hallux rigidus demonstrate altered kinematics and plantar loading patterns, increased pain, and decreased function [2-4]. While surgical outcomes have been favorable, conservative care is the first line of treatment. Conservative care may include steroid injections, non-steroidal anti-inflammatory drugs, modalities, and activity modification, shoe adjustments, and most often orthoses [5]. Although the most common of interventions, the mechanisms by which orthoses are effective have not been well documented. Morton's extension inserts are one type of orthosis that include a characteristic rigid extension of the footplate beneath the great toe, which purportedly reduces pain and inflammation by altering motion and plantar loading patterns.

The first purpose of this study is to determine what loading patterns are characteristic of subjects with HR when compared to age and BMI matched controls. The second purpose is to determine the effect of a Morton's extension insert on plantar loading patterns, pain, and function in persons with hallux rigidus.

METHODS

All procedures were approved by Ithaca College and University of Rochester Institutional Review Boards. Thirty-two subjects participated in this study; 16 patients diagnosed with stages I-III HR (age 57.2 ± 7.7 years, BMI 25.8 ± 4.2) were

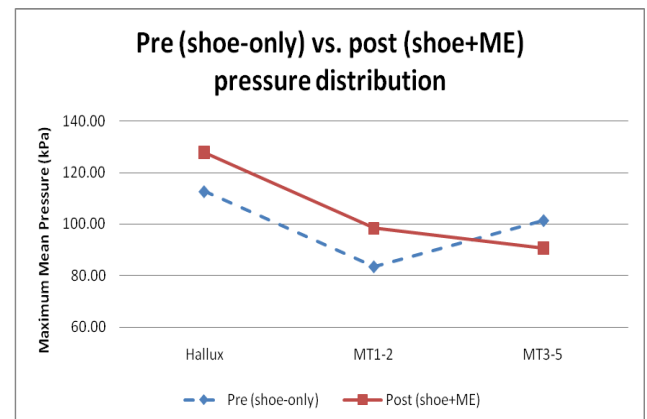


Figure 1: Demonstrates shift of maximum mean pressure (MMP) medially after six week intervention. ME=Morton's extension

recruited from the Foot and Ankle Clinic at Strong Orthopaedics and matched for age and BMI with 16 control subjects without foot pathology. Maximum mean pressure (MMP) and pressure time integrals (PTI) were collected with the Pedar® in-shoe pressure measurement device as subjects walked in his/her personal footwear. For the subjects with HR, the Foot Function Index- Revised (FFI-R) was used to document pain and function before and after a six week intervention wearing the Morton's extension. Repeated collection of pressure data was performed at the six week follow up. Appropriate t-tests and ANOVA with Bonferroni adjustment were used to compare regional loading patterns between controls and subject with HR, as well as to assess the effect of the orthotic condition on regional loading distribution between lateral metatarsals (MT3-5) relative to medial metatarsals (MT1-2), as well as the hallux relative to MT1-2 for each of the dependent variables.

RESULTS AND DISCUSSION

Significant differences in plantar loading patterns were found between subjects with HR and matched controls. Subjects with HR demonstrated reductions in MMP under MT1-2 (83.5 and 102.3 kPa, HR and control respectively, $p=.03$); additionally, MMP was increased under the lateral metatarsals in relationship to the medial metatarsals (MT3-5:MT1-2) when compared to the control group (1.3 and 0.9 HR and control respectively, $p<.01$). No significant differences were seen under the hallux ($p=.56$).

The 6-week intervention with the Morton's inserts resulted in significant changes in FFI-R scores. Subjects with HR reported a reduction in the pain subscale (pre 37.9, post 28.6, $p<.01$), disability subscale (pre 40.1, post 31, $p=.02$), and total score (pre 32.8, post 26.7, $p<.05$) of the FFI-R. Plantar loading patterns indicated a medial shift after wearing the insert when compared to pre intervention, shoe-only condition (Table 1). MMP and PTI were significantly increased under MT1-2 and hallux regions. Although the magnitude of reduction of the MMP under MT3-5 was not significant ($p=.07$), the loading distribution between adjacent forefoot regions MT3-5:MT1-2 indicated a significant shift of pressures to MT1-2 ($P<.001$) (Figure 1). It is interesting to note that the pressure distribution shifted medially to resemble that of the control group.

The alteration of loading patterns that appear to normalize following use of the Morton's extension insert may be helpful in preventing secondary complications of the knee and hip frequently observed in this patient population.

CONCLUSIONS

When compared to control subjects, subjects with HR demonstrate a loading pattern of decreased

medial and increased lateral forefoot pressure. This finding is similar to that found in a study by Van Geluwe, who examined individuals with asymptomatic static and functional hallux limitus [4]. However, unlike their subjects, ours with symptomatic HR did not demonstrate an increase in loading of the hallux relative to the medial forefoot. After using the Morton's extension insert, our subjects demonstrated a medial shift of plantar pressures. They also showed improvements of approximately 25% in FFI-R pain and disability subscales, which may be secondary to differences in loading patterns seen after intervention with the Morton's extension.

To our knowledge, this is the first case series to evaluate the plantar loading and functional changes following use of an orthotic intervention for subjects with HR. The Morton's extension is an inexpensive, over-the-counter intervention, and therefore may be a viable conservative treatment alternative to surgical intervention. Further studies are under way to assess the longer term benefits of this intervention.

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Table 1: Group mean \pm standard deviation in each region. $P<.05$ significant. ME=Morton's extension

	MMP (kPa)			PTI [(kPa)*s]		
	Pre (shoe-only)	Post (shoe+ME)	P value	Pre (shoe-only)	Post (shoe+ME)	P value
MT1-2	83.5 \pm 21.1	98.4 \pm 24.3	0.00	43.1 \pm 15.9	53.8 \pm 16.7	0.00
MT3-5	101.4 \pm 24.7	90.7 \pm 18.2	0.07	63.1 \pm 19.2	56.9 \pm 16.1	0.04
Hallux	112.6 \pm 35.9	127.9 \pm 39.7	0.01	49.2 \pm 15.6	65.1 \pm 26.5	0.00
MT3-5:MT1-2	1.3 \pm 0.3	1.0 \pm 0.2	0.00	1.6 \pm 0.6	1.1 \pm 0.1	0.00
Hallux:MT1-2	1.4 \pm 0.5	1.4 \pm 0.8	0.82	1.2 \pm 0.5	1.3 \pm 0.6	0.73