

WHAT IN THE “HEEL” DO THEY FEEL? 15303

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INTRODUCTION

A typical gait pattern includes a heel strike, followed by a smooth transition to foot flat through loading response. Children with poor postural control and related gait deficits often present with anterior weight lines, which result in loss of first rocker and/or a fast transition from initial contact to foot flat. The foot has many important jobs, including providing proprioceptive feedback. There are 104 cutaneous mechanoreceptors on the plantar surface of the foot.¹ While most of the sensors are in the metatarsal/tarsal and toe regions, we cannot forget the role of the mechanoreceptors in the heel.



Figure 1. Location of mechanoreceptors in the foot

Standard orthotic designs typically encompass the heel with plastic. This may accelerate 1st rocker and result in more inclined tibia during mid-stance. This design can also reduce typical sensory input a child receives through his or her heels. When providing orthotic solutions, we should consider the patient’s postural control and weight lines as well as ensure we are not hindering the foot’s natural ability to “feel” and provide feedback to the rest of the body. The ability to feel changes in terrain to adjust and build a repertoire of motor and postural strategies is a vital part of typical development.^{2,3} A new modification, the open heel, was designed and evaluated for function. The hypothesis was that the open heel modification would restore 1st rocker timing by slowing the transition from initial contact to foot flat, slow down overall gait velocity and increase integrated pressure.

METHODS

11 children (4.4 ± 1.8 years old) were included in this retrospective study. Each participant presented with anterior weight lines and poor postural control. Primary diagnoses included Down syndrome, Autism and toe walking. Each was fit with an orthosis with an open heel modification. Four patients (Group 1) had also previously been fit with the same orthosis (i.e. SMO or

AFO) with a standard heel post and had direct comparison data with the open heel modification. Seven patients (Group 2) were fit only with an orthosis with the open heel modification.

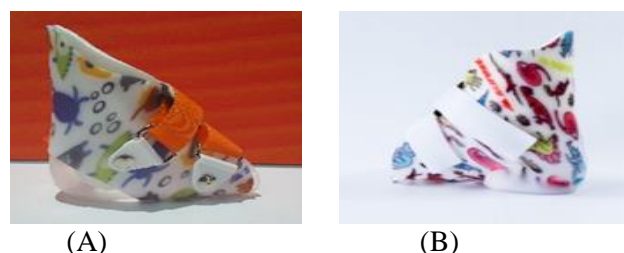


Figure 2. (A) Open Heel modification and (B) Standard Heel Post design⁴.

Data from the Zeno Walkway and Protokinetics software⁵ was analyzed to assess changes in velocity, integrated pressure and time from initial contact to footflat (IC – FF). For time to footflat, 4 right footfalls were analyzed.

RESULTS

Group 1: Data from the standard heel post (HP) design and open heel (OH) modification were compared. Secondly, data from the OH modification and Barefoot (BF) were compared for reference for Group 2 data. Data is reported as percent change between conditions. Velocity decreased and integrated pressure and IC-FF time increased in both comparisons. Group 2: Percent changes from the OH modification and BF were calculated and compared to Group 1 data. Velocity decreased and integrated pressure and IC-FF time increased. Changes in Group 2 were similar to changes in Group 1 (OH:BF).

Table 1. Percent changes in data for Group 1 and Group 2

	Group 1		Group 2
	OH:HP % change (SD)	OH:BF % change (SD)	OH:BF % change (SD)
Velocity	-19% (0.14)	-10% (0.26)	-7% (0.16)
Integrated Pressure	25% (0.16)	29% (0.19)	37% (0.27)
IC – FF	26% (0.24)	103% (0.54)	84% (0.47)

DISCUSSION

When children have anterior weight lines, velocity tends to be increased – they are essentially falling down with each step. In order to work on postural control, slowing down is important. The comparison of the open heel data to Barefoot of the children in Group 1 and Group 2 were very similar. This suggests that the OH modification in their orthoses had positive changes compared to barefoot and heel post designs. The open heel modification dampens the ground reaction forces at initial contact and slows 1st rocker compared to orthoses with a heel post and barefoot conditions. The increase in amount of pressure over the time spent in stance suggests that the participants put more pressure through the orthosis and may be feeling more input back from the ground. The open heel modification should be considered for patients with sensory deficits and/or anterior weight lines.

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