

THE INFLUENCE OF THE FIREMEN BOOTS ON THE HEEL STRIKE TRANSIENT DURING WALKING

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INTRODUCTION

The shape of the first part of the vertical ground reaction force depends on many factors such as the footwear characteristics [1-4, 6], the walking velocity [1, 4], the gait pattern [1], the foot morphology [4, 5] and the sampling rate of the force platforms [1]. These factors have an influence on the presence and magnitude of the heel strike transient (HST). The term “heel strike transient” refers to the impact between the foot and the ground, when a spike of force is superimposed on the upslope of the vertical ground reaction force [5]. We considered the presence of the HST when the spike of force descended 20N. before its final ascending up to the first trust maximum. This force transient is thought to be deleterious [5, 6] The objective of this study was to analyze the influence of different walking conditions on the HST.

METHODS

Fourty five firemen took part in the study. It took place at the Human Motion Analysis Research Laboratory in the Basurto’s Hospital. One force platform was installed flush with the ground in the centre of a 10 meters walkway. The subjects undertook several practice to ensure that they were familiar with the laboratory dimensions and the placement of the force platform. Five trials were conducted under each condition; barefoot (B), with their own runners (R) and with their firemen boots (F). Subjects were asked to walk at self selected speed over the force platform. Trials would be accepted if the speed showed a consistency between conditions, there were no visible alteration of the stride as the subjects walked across the platform and the entire right foot landed on the platform. The vertical ground reaction force was collected at a sampling frequency of 500Hz. Forces were normalized to the subjects’ bodyweight.

RESULTS AND DISCUSSION

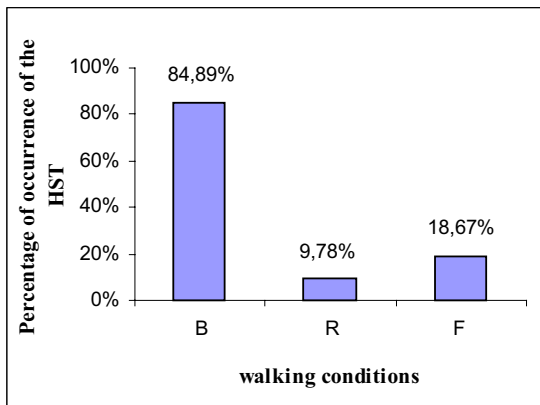


Figure 1: Descriptive statistics of the occurrence of the HST in the three different condicions.

Table 1: Heel strike transient mean magnitudes in each condition.

Numbers in parenthesis are standard deviations.

* indicates a significant difference between groups (P<0.01).

Conditions	Mean		
	B	R	F
HST (Bw)	1.00* (0.16)	0.41 (0.32)	0.59 (0.12)

In barefoot walking (B) the HST showed a higher presence (Figure 1) and magnitude (Table 1) than when subjects walked in runners (R) and in firemen boots (F). No significant differences were found between walking in runners and in firemen boots. These results indicate that barefoot walking implies the highest impact of the foot with the ground , whereas walking with runners and with firemen boots reduces significantly the impact of the foot with the ground. This corroborates the statement of Whittle who mentioned that when footwear is used, it provides a line of defense [5] against transient forces. As the walking velocity, the foot morfology and the sampling rate of the force platform did not change among the three walking conditions, the highest presence and magnitude of the heel strike transient during barefoot walking are explained by the differences in the gait pattern and/or by the absence of shoes.

CONCLUSION

Barefoot walking showed a higher presence and magnitude of the heel strike transient than when subjects walked with runners and with firemen boots.

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