

THE RELATIONSHIP BETWEEN PEAK PLANTAR PRESSURE AND COMFORT USING THE ROCKER SHOES

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INTRODUCTION

Plantar pressure measurement is being increasingly used in both research and clinical practice to measure the effects of various footwear and physical therapy interventions [1]. Customized shoes such as rocker shoe types have been developed to prevent foot ulcers that are often caused by abnormal increase in the plantar pressures. It is believed that they can offer smooth gait while reducing reaction forces at clinically vulnerable locations [2]. The purpose of this study is to investigate out-sole design factors in relation to plantar pressure distributions. Particularly, relationship between the plantar pressures and the perception of comfort was studied.

METHODS

Four out-soles with different rocker axis locations and heel heights were fabricated by following the methodology in the literature [2]. The height of the outsole was held at 33-mm while the location of the rocker axis was varied from the tip of the heel along the long axis of the plantar surface from 55% to 70% with the increment of 5% (Figure 1). This reflects the rocker axis moving away from the center of the plantar foot toward the toes. All subjects (n=10, male, average age of 27.4 years) who wear 265-mm shoes walked at a comfortable pace during testing. The shoe selection was made at random and a trial was repeated 5 times. After each trial, they were asked to record the comfort level on a visual analog scale (VAS) that has a maximum of 50 points. Plantar pressures were evaluated at 4 different regions of interest - 1st metatarsals head (MTH), 2nd-3rd MTH, 4th-5th MTH, and the heel. These regions reflect high incidence of foot ulcers [3]. F-Scan system (Tekscan Inc., South Boston, USA) was used to record the pressure in real time.

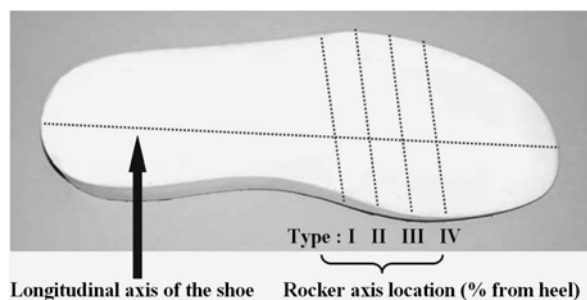


Figure 1: The specifications of the test specimen. The rocker axis was varied from 55% (Type I) to 70% (Type IV).

RESULTS AND DISCUSSION

The mean peak plantar pressure distribution is shown in relation to rocker axis location in Fig. 2A and the VAS score on comfort level in Fig. 2B. In all types, high pressures were noted in the medial regions (1st through 3rd MTH) and at the heel in comparison to the lateral aspects of the metatarsal (4-5th MTH), which suggested that high percentage of load-bearing by these regions during walk. In Type I whose rocker axis was closest to the center of the foot at 55% location, the highest peak pressure was shown at the heel, followed by 1st MTH. In Type II, The peak pressures were more evenly distributed

among the heel, the 1st, and 3-4th MTH than in any other types. This corresponded with relatively high VAS score although no statistical difference was observed among the different types of shoe. The peak stresses at the medial MTHs increased with rocker axis as opposed to those at the heel as shown in Types III and IV. This suggested a change in load-bearing from the heel to the medial regions as rocker axis moved toward the toes. The perceived comfort level displayed a similar trend with the plantar pressures in medial MTHs while the opposite with the heel. It appears that relief of peak pressure at the heel may be related to the increase in comfort perception with the footwear.

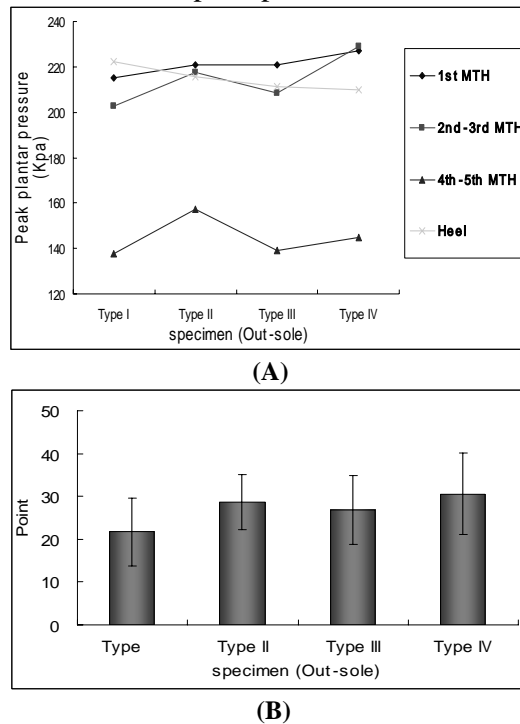


Figure 2: Experimental results, (A) mean peak plantar pressure, (B) VAS scores on the comfort level.

CONCLUSIONS

The perceived comfort level related well with the peak pressure measurements on the plantar surface although results were not statistically significant. Particularly, in cases where pressures were evenly distributed with low heel stress scored the high level of comfort. It appears that relief of peak pressure at the heel may be related to the increase in comfort perception with the rocker shoes.

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