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Walking test to validate an equipped slipper for measurement of foot-to-ground pressure distribution

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1. Introduction

For many purposes in sport and medical areas, it is worth knowing the barefoot plantar pressure distribution during natural walk, over many steps, with a reliable, resistant and easily usable equipment.

Our laboratory has developed such an equipment. Two comfortable medical slippers are equipped with eight strain gauge sensors throughout the way of the normal roll of the foot during the stance phase: two sensors under the heel, two under the external edge of the foot, three under the metatarsal heads and one under the hallux (figure 1).

After our previous validation of the mechanical behavior of the sensor during tensile tests and during on foot-standing tests (Chedevergne *et al.* 2006), we present the second part of the clinical validation on healthy patient.

2. Materials and methods

One healthy 25 year-old men of 72.6 kg, who takes size 42 in European system (8.5 in US sizes; 8 in UK sizes) is asked to realize a 10 m return walk (figure 2).

The sensors strain is recorded (10 Hz) during all test long and then translated into the force exerted by the foot on the ground. The sum of these recorded data at each instant gives the vertical force exerted by the whole foot on the ground along the walk.

3. Results and discussion

To analyze more easily the spread of the vertical force over the whole foot, we observe four areas: the heel, the external foot side, the external metatarsal heads and

the hallux coupled with the first metatarsal head. Each of these areas is defined by two sensors. When observing one single stance phase, we obtain curves as in figure 3.

Figure 3 shows a normal roll of the foot during the stance phase, with normal force values: 130% of the body weight at the heel strike and the propulsion, and 90% at mid-stance. But over the thirty steps recorded, this normal

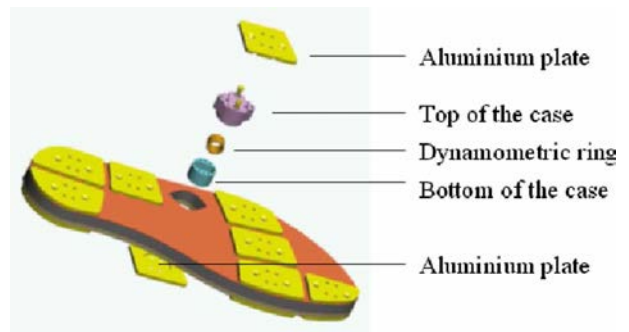


Figure 1. Location of the eight sensors used in an adult shoe and assembly of each sensor.



Figure 2. Ten metre return walk.

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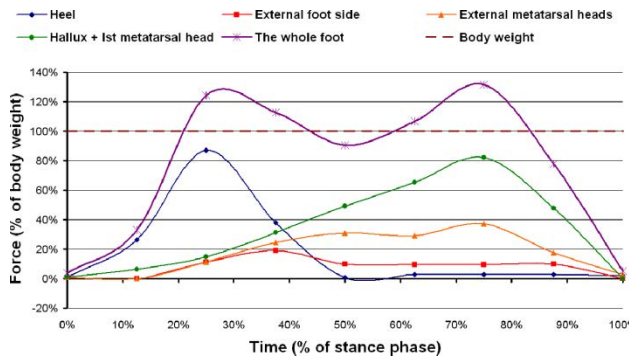


Figure 3. Force recorded by each area (expressed in percentage of body weight) over one stance phase.

shape of the vertical force curve was not often reproduced by our healthy subject (figure 4). This lack of consistency can provide from a dysfunction of the offset.

4. Conclusion

Our device allows to record barefoot pressure under the normal way of the foot roll. To confirm the reliability of

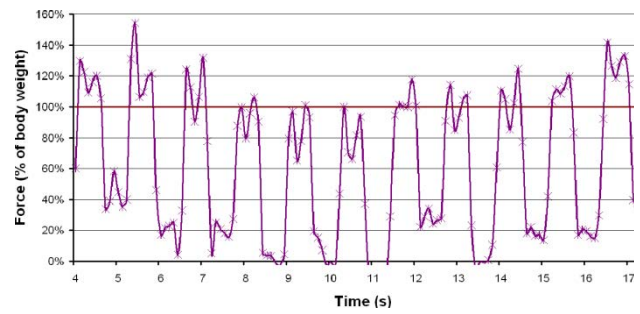


Figure 4. Vertical force recorded under the whole foot during several steps.

the recorded data, we must improve the offset. We also have to compare these results with those of a force-plate or another validated device.

Reference

F. Chedevigne, A. Faivre and M. Dahan, "Paper presented at the IEEE ICMA Meeting", Luoyang, Henan, China, 25–28 June 2006.