

Establishing a Reference Range of Standing Foot Pressure with Foot Scan in Young Healthy Adults

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Introduction

The foot pressure scan is a widely used technology that quantifies and schematizes individual's distribution of pressure. It detects the location of center of pressure (COP) by using person's weight distribution while standing or walking. Such data can be used to detect balance problem or gait pathologies in various diseases or conditions. Furthermore, it can provide valuable information in manufacturing customized therapeutic insoles and other ambulatory devices. However, there is no consensus regarding normal quantitative values for the distribution of pressure and other parameters. In this study, we investigated the normal range of balance for healthy individuals in static posture.

Methods

45 healthy individuals were recruited for this study. General physical information, including height, age, weight, shoe size and dominant foot were obtained. The Footscan® system, consisted of 8,192 sensors in approximately 1m plate, was applied to the participants. Video recording was taken simultaneously to compare the scan results with actual posture. Each person was instructed to stand on the sensor with their legs spread shoulder-wide and were asked to stay as comfortable as possible. When the participant was ready, scanner recorded their COP in 2,000 frames per second, for 10 seconds. The program tracked the movement of

COP based on pressure shift obtained from the sensor. It was measured by the range of X and Y-axis. Total travel distance was also measured. Finally, weight distribution was calculated in accordance to four quadrants; right, left, front, and rear.

Results

The average range of COP in X-axis and Y-axis were $2.6 \pm 1.15\text{mm}$ and $6.1 \pm 3.03\text{mm}$, respectively. The average travel distance of COP was $18.9 \pm 7.97\text{mm}$. In the survey of dominant foot, 17.8% were right-footed(N=8) and 82.2%(N=37) were left-footed. The average pressure distribution between left and right side were $45.8 \pm 2.03\%$ and $54.2 \pm 2.03\%$. The average pressure distribution between front and rear side were $45.5 \pm 8.63\%$ and $54.5 \pm 8.63\%$. When divided in quadrants, the pressure in Q1(left-frontal quadrant), Q2(right-frontal quadrant), Q3(left-rear quadrant), and Q4(right-rear quadrant) were $23.8 \pm 4.62\%$, $21.7 \pm 4.65\%$, $22.0 \pm 4.73\%$, $32.5 \pm 5.29\%$, respectively.

Conclusion

Movement of COP is detected even when individuals are in static posture. Confirming the range of such COP shift and weight distribution can be helpful in assessing patients with gait problem or balance problem. Further study with bigger sample size is needed for more accurate generalization. In the future, we plan to compare the pressure distribution and COP by applying various factors such as age, sex, and a person with a history of foot-related diseases.