Biomechanical Characterization of Comfort Footwear using Gait Analysis

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Introduction

Comfort footwear has unique characteristics fundamental to people looking for this type of shoe, namely foot support, flexibility, stability, lightweight, cushioning, traction, etc. [1]. They are usually preferred mainly by elder, overweighed or people with feet problems [2]. It is known that the shoe can modify gait behavior [3]. The purpose of this study was to evaluate posture and gait by comparing barefoot and shoe wearing circumstances to assess the real effect of the comfort footwear under study.

Methods

Twenty-nine healthy subjects (11 women and 18 men), aging from 21 to 51 years old, with no apparent foot pathologies, participated in the study to evaluate different parameters including gait analysis, ground reaction forces and pedobarographic measurements during the stance phase. The trials protocol was established considering the two conditions referred previously. For the barefoot condition, plantar pressures were measured using a pressure walkway measuring system.

Results

The footwear biomechanics analysis showed some differences compared with barefoot condition, namely plantar pressure distribution, mainly due to a high arch support of the shoe model under test (Arcopédico). Gait analysis showed that, in relation to barefoot condition, the footwear promote higher force in the first and final contact with the ground, predominantly at vertical component. When comparing the two conditions, the medio-lateral force presented some discrepancy due to the shoe model itself. The results showed an increase in stance time with footwear and in the stride length, which leads to an increase in gait velocity.

Regarding pressure distribution, differences were also found between shoe and barefoot conditions, which are in agreement with the results from the ground reaction forces. During gait, a decrease of maximum pressures and an increase of mean pressures during stance phase were obtained. These results are explained due to shock absorption provided by the footwear but also due to this particular shoe internal morphology (medial arch support). On the other hand, the increase in the mean pressures indicates there is a promotion of pressure redistribution across the plantar surface.

Conclusions

Comfort footwear is increasingly being thought for all age groups. This concept begins to be adopted by young sports people. However comfort shoes present some aspects that should be considered according to type of foot or footwear purpose. As this work supports, medial-lateral instability and higher impact forces with footwear were observed when analyzing ground reaction forces. Also, the increase of the contact area provided by the shoe, led to a release of maximum and mean pressures in the medial region of the foot. Thus, the main characteristic evidenced by the shoe under test was being appropriate to people slightly overweighed people with certain tendency for flatfoot.

This dynamic biomechanical characterization, if completed with a static analysis, which could include diffusion diagrams and posture assessment using motion capture systems, could provide a complete methodology to define footwear performance and its adequacy to certain types of foot and wearing purposes.

References

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