The Impact of Foot Posture on Postural Stability Measures

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Summary

This study investigated the effect of foot posture on postural stability. A total of 100 legs from 50 participants, including 25 individuals with patellofemoral pain (PFP) and 25 healthy controls, were assessed using the Foot Posture Index (FPI). Postural stability was evaluated with K-Plates during single-leg (SLS) and bipodal stances (BS). Results showed weak or low correlations between FPI and SLS measures, indicating that greater foot pronation leads to increased postural sway in SLS. No significant correlations were found for BS. The findings suggest that foot posture should be addressed in rehabilitation programs targeting balance improvement.

Introduction

The foot, as a support surface, is important for postural stability and is associated with balance-related deficiencies. Increased foot pronation has been reported to affect both static and dynamic balance [1]. It has been stated that individuals with a flatfeet have greater postural sway compared to individuals with a normal foot, but the level of fall in the foot arch is not related to postural sway [2]. Thus, the purpose of this study was to investigate the impact of foot posture on postural stability parameters.

Methods

A total of 100 legs were evaluated for the study, comprising 25 subjects with PFP (6 males, 19 females; 38 legs with PFP) and 25 healthy subjects (8 males, 17 females; 50 legs). After collecting demographic data such as age and body mass index (BMI) from each subject, foot postures were assessed using Foot Posture Index (FPI). Greater number in the analysis of FPI indicates that the foot is pronated.

K-Plates from Kinvent (Kinvent Inc., Montpellier, France) were utilized to evaluate postural stability. Each subject performed a single leg-stance (SLS) and bipodal stance (BS) for 50 seconds with three repetitions, and the mean scores were analysed. Measures collected included ellipse area in mm^2, anteroposterior (AP) and mediolateral (ML) amplitudes in mm, and AP, ML, and center of pressure (CoP) path lengths and velocity measures in mm and mm/s, respectively.

Spearman correlation coefficient was calculated to assess correlation between variables and values were considered as little or no (0–.25), weak (.26–.49), moderate (.50 and .69), strong (.70 and .89), very strong (.90 and 1.00).

Results and Discussion

SLB values demonstrated low or weak correlations with FPI, while BS values showed no significant correlations (Table 1). These findings suggest that increased foot pronation is associated with greater postural sway during single-leg stance. This effect was not observed during bipodal stance, likely because single-leg stance requires greater effort and stability control. Although studies conducted on elderly and young sample groups have stated that no relationship was found between foot posture and stability [3], the results of our research indicate that there may be a relationship as in similar results [2]. The low correlation coefficients indicate the need for further in-depth analysis with a greater number of participants to understand whether our result is coincidental.

Conclusions

Foot posture influences postural stability in single-leg stance. Therefore, incorporating foot-specific interventions in rehabilitation programs may help address balance impairments effectively.

Acknowledgments

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References

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Table 1: Correlation results of FPI with SLB and BS postural stability values.

FPI		Ellipse Area	AP CoP	ML CoP	AP Amplitude	ML Amplitude	AP Path Length	ML Path Length	CoP Path Length	AP Velocity	ML Velocity	CoP Velocity
SLS	R	0.283*	0.261*	0.293*	0.306*	0.207*	0.337*	0.298*	0.350*	0.330*	0.285*	0.343*
	p	0.004	0.009	0.003	0.002	0.039	0.001	0.003	0.000	0.001	0.004	0.000
BS	R	0.068	0.043	0.126	0.072	0.109	0.006	0.094	0.033	-0.009	0.087	-0.001
	p	0.503	0.768	0.385	0.618	0.451	0.967	0.514	0.819	0.952	0.549	0.997

FPI: Foot Posture Index; SLS: single-leg stance; BS: bipodal stance; R: correlation coefficient, AP: anteroposterior; ML: mediolateral; CoP: center of pressure; *: Spearman test.