



The relationship between ankle eversion to inversion strength ratio and postural balance control in healthy individuals



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1. Introduction

The distal part of the lower extremity, foot and ankle joint, has an essential role to control postural balance through coordinated movements. The role of co-contraction between ankle dorsiflexor and plantar flexor muscles in maintaining postural balance has been mostly focused on previous researches [1,2]. However, the ankle strategy for postural control primarily occurs through eversion and inversion effort to keep the foot stable on the ground [3]. The current study aimed to investigate the relationship between isometric muscle strength ratio of eversion/inversion (E/I) and postural balance control which is firstly corrected by ankle joint strategy.

2. Research question

Is there any relationship between the ratio of eversion to inversion isometric muscle strength and postural balance control?

3. Methods

30 healthy individuals (15 Female, 15 Male; 18–29 age; 25 Right and 5 Left dominant) who had no any musculoskeletal problems including pain participated in the study. Eversion and inversion isometric muscle strength testing was performed by using Biodex Dynamometer (Biodex Medical Systems, Inc., Shirley, NY, USA). All participants were asked to perform their maximum voluntarily isometric contractions for both eversion and inversion three times and data were normalized to body weights. Peak values were used to calculate E/I ratios.

Limits of Stability (LOS) test mostly dominated by ankle joint and Unilateral Stance (US) test with eyes open (EO) and closed (EC) conditions were performed among balance tests in the Neurocom Smart Balance Master® system. Reaction time (RT), Movement velocity (MV), Endpoint excursions (EPE), Maximum excursions (MPE), and Directional control (DCL) parameters were assessed within the LOS test. 10-

second US test performed three times for both test conditions. The mean postural sway velocity was calculated by the system. Spearman correlation test was performed to figure out the relationship between E/I ratios and obtained data from balance tests.

4. Results

The mean E/I ratio was found 121 for right-side (min:0,70-max:2,30) and 119 for left-side (min:0,40-max:2,10). The right foot E/I ratio was found to be related with both left direction EPE score ($p:0.021$; $r:0.421$) and right-side EO-US postural sway velocity ($p:0.027$; $r:0.403$). The left foot E/I ratio was moderately correlated with left-side EO-US ($p:0.027$; $r:0.403$) and left-side EC-US ($p:0.002$; $r:0.539$), respectively.

5. Discussion

The findings of the current study suggest that postural sway worsened by an increase in E/I ratios of the same side. Since the external loads applied on the ankle usually everts, strong invertor muscles are required to produce contra-force. EPE scores indicate the distance of the first smooth movement to target and the right-side E/I ratios were related with left side EPE. The increase in the E/I ratio of the right ankle leads to unstable control which can disturb smooth left side movement laterally. To get further knowledge future studies can include EMG data and more challenging postural conditions.

References

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