Males with Chronic Ankle Instability Exhibit Sex-Specific Force Sense Deficits

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Summary

This study examined sex differences in sensorimotor function in individuals with and without chronic ankle instability (CAI). Results showed a significant interaction for force sense in dorsiflexion direction, males with CAI showed greater impairments than females with CAI, while there was no such difference in healthy control (HC).

Introduction

Ankle sprains are common sports injuries, with up to 40% progressing into CAI, which can lead to sensorimotor deficits (ankle muscle strength, proprioception, and balance control). Although females are more likely to experience ankle sprains [1], males have a higher incidence of developing CAI [2]. Such a remarkable difference in incidence suggests that sex-specific factors could influence the progression of CAI. Therefore, this study aims to investigate whether sensorimotor functions differ by sex in individuals with and without CAI. We hypothesize that males with CAI have worse sensorimotor function than females with CAI.

Methods

Ankle muscle strength and proprioception (force sense and joint position sense) were assessed using an isokinetic dynamometer, and static balance test was performed using a balance testing system, the dynamic balance was tested via Y Balance Test (YBT). The maximum voluntary contraction, the absolute error (AE) of force sense and joint position sense, the sway velocity of the center of pressure and the reaching distance of the YBT were used to assess the sensorimotor function of participants. Data were analyzed using ANCOVA, with BMI as a covariate, to evaluate the effects of group (CAI vs. HC) and sex (male vs. female). The level of significance was $\alpha = 0.05$.

Results and Discussion

50 (26 males/24 females) and 40 (17 males/23 females) participants were recruited in the CAI and HC groups, respectively. Compared with HC, individuals with CAI exhibited worse ankle proprioception and balance control ($p < 0.05$), but no difference in ankle muscle strength. A significant group and sex interaction effect was observed for force sense in the dorsiflexion direction ($F = 5.14$, $p = 0.026$, $\eta_p^2 = 0.057$). *Post-hoc* analysis showed that the AE of males was significantly larger than females in the CAI group ($p < 0.001$), while there was no difference in the HC ($p = 0.536$). This is the first study to show that males with CAI have worse force sense in dorsiflexion than females with CAI. While neuromuscular control is generally better in females, and tibialis anterior muscle has demonstrated pronounced impairments in neuromuscular control in individuals with CAI, we speculate that the superior ability of force control in dorsiflexion direction within females may be amplified in individuals with CAI.

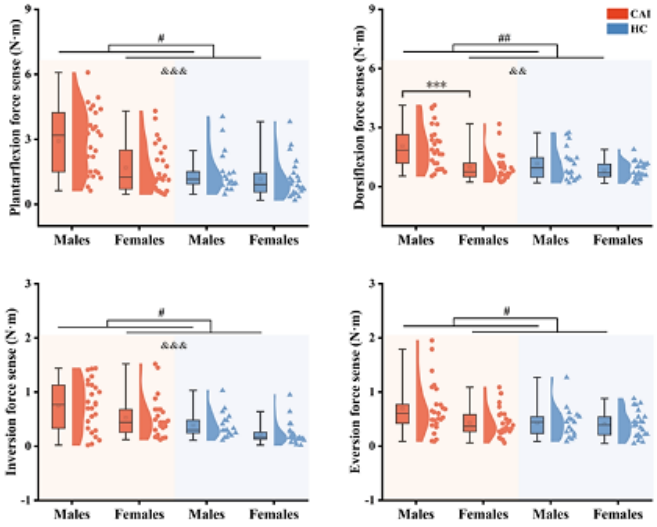

Figure 1: Sex differences in force sense between CAI (red) and HC (blue).

Conclusions

Individuals with CAI have impaired proprioception and balance control. In the CAI group, males had markedly worse force sense in the dorsiflexion direction than females did; while no difference was observed in the HC group. Future rehabilitation programs for CAI should consider targeted proprioceptive interventions for males to address this deficit effectively.

Acknowledgments

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References

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