Effects of increased contralateral pelvic drop on iliotibial band strain during running

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Summary

This study examines the impact of increased contralateral pelvic drop (CPD) on iliotibial band (ITB) strain, a factor associated with iliotibial band syndrome (ITBS). Sixteen runners modified their CPD using real-time visual feedback while running. Kinematic and force data were collected to analyze ITB strain with normal and increased CPD. Increasing CPD significantly increased the ITB strain in the passive and tensor fascia latae (TFL) strands. No significant changes were observed in gluteus maximus (GM) ITB strands. These findings provide biomechanical evidence to further support the association of CPD to ITBS and emphasize the importance of frontal plane stability in injury prevention.

Introduction

Musculoskeletal injuries affect over 50% of runners annually [1]. Increased CPD is a biomechanical risk factor that has been associated with a variety of lower extremity overuse injuries, including ITBS [2]. CPD refers to the frontal plane pelvis angle, specifically the maximum downward tilt of the pelvis on the swing leg during gait. With attachments into the GM and TFL, the ITB plays a key role in stabilizing the hip during dynamic gait movements, like walking and running. Increases in CPD may result in increases in ITB strain due to its role in maintaining pelvic stability. Excessive strain and repetitive use of the (ITB) during running may result in ITBS. The purpose of this study is to investigate the effects of increasing peak CPD on ITB strain. It is hypothesized that an increase in pelvic drop will result in an increase in ITB strain.

Methods

Sixteen healthy runners (10M/6F; age: 20.9 ± 2.9 yrs) completed this study. Kinematic data were collected using 12 Qualisys infrared cameras and ground reaction forces were captured using AMTI force platforms. The data collection consisted of two sessions. Reflective markers were placed on the pelvis and right lower extremity during both sessions. During the first session participants completed a practice gait modification training using visual real-time feedback of their frontal plane pelvic angle. This was provided by a custom program utilizing MATLAB Connect and Qualisys. Participants used this feedback to increase their CPD by 5 degrees. During the second session, following a static trial, participants completed two dynamic overground running conditions. The conditions consisted of their normal running gait and an increased CPD gait. Participants were asked to run within ±5% of their reported 10k training pace (3.2 ± 0.3m/s). The sacral marker was used to calculate running velocity.

A rigid body model and a musculoskeletal model with a 4-strand iliotibial band were implemented with MATLAB to analyze the data. Muscle forces were estimated using an optimization function that minimized the sum of muscle stresses squared. The ITB model used insertions of the GM and TFL muscles from Eng et al. [3], while still incorporating a passive strand used by other researchers [4].

The iliotibial band strain was averaged across trials and participants during the stance phase for both conditions. A dependent paired t-test was used to test the maximum iliotibial band strain between the two conditions (normal and increased pelvic drop). Effect sizes were calculated using Cohen's d. Statistical significance was set at $p < 0.05$.

Results and Discussion

The participants' normal average maximum CPD was -5.99° and increased CPD was -9.96°. The average maximum peak strains for the four strands of the ITB are shown below (Figure 1). The passive strain significantly increased from 4.19% to 4.68% ($p < .001$, *d=-1.47*) with the increase in CPD and the TFL strand strain increased from 6.54% to 7.74% ($p < .005$, *d=-.83*) with a 4° increase in CPD. There were no significant differences in the GM12 or GM34 strands. This suggests that increasing CPD increases ITBS risk, by increasing ITB strain passively, and through the TFL.

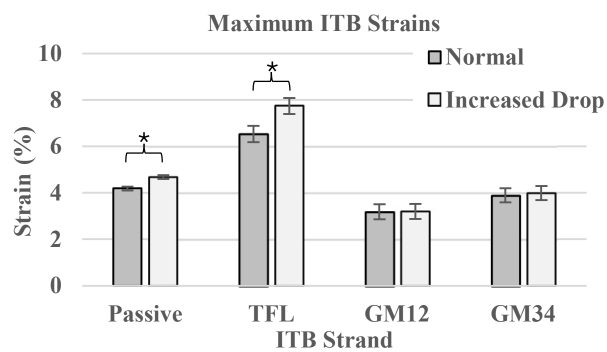

Figure 1: Average maximum iliotibial band strain (%) ± 95% within-subject CIs. *indicates significant difference

Conclusions

Previous research has identified increased CPD as a risk factor for ITBS. Our findings provide biomechanical evidence that CPD increases the loading on the ITB, supporting this association**.** The findings highlight the importance of frontal plane stability in injury prevention and suggest that interventions targeting CPD reduction may help mitigate ITBS risk.

References

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