INFLUENCE OF SPRINT START POSTURE CHANGES ON THE FORWARD GROUND REACTION FORCE

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Summary

This study investigates the impact of sprint start posture on ground reaction force (GRF). Twenty-five healthy young men performed sprint starts in three postures: maximum anterior pelvic tilt, natural posture, and maximum posterior pelvic tilt. During sprint starts, GRF was measured, and the horizontal component of GRF relative to total GRF was calculated. The results showed that the anterior pelvic tilt posture had significantly higher values compared to the natural and posterior pelvic tilt postures. These findings suggest that an anterior pelvic tilt posture may optimize sprint starts by enhancing the use of ground reaction force. Therefore, adopting an anterior pelvic tilt is crucial for forward sprint performance, while a posterior tilt may hinder acceleration.

Introduction

GRF is closely related to instantaneous power generation. Among the various components of GRF, the ratio of force is regarded as particularly critical for sprint performance. The force represents the ratio of the horizontal component to the resultant force derived from the horizontal and vertical components. Previous research reported that a positive correlation has been observed between the force and maximum speeds during a 50-meter sprint [1]. Additionally, sagittal supine posture is considered to play a significant role in sports performance in sports settings. However, the specific relationship between the posture at the splint start and GRF has not been thoroughly examined. This study aims to clarify the impact of sprint start posture on ground reaction force.

Methods

Twenty-five healthy young men participated in this experiment. All participants performed sprint starts with three different postures in a randomized order: maximum anterior pelvic tilt posture, natural posture and maximum posterior pelvic tilt posture (Figure 1). They were instructed to sprint at full speed toward a mark 2.5 meters ahead from the start line. GRF was measured for each posture, and the horizontal component of the GRF relative to total GRF was calculated. The larger value indicates greater utilization of GRF in the forward direction.

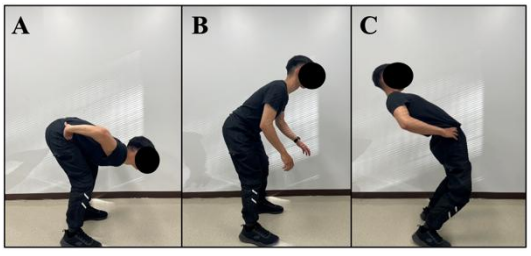

Figure 1 Three Different Sprint Start Postures

A: Maximum anterior pelvic tilt posture, B: Natural posture,

C: Maximum posterior pelvic tilt posture

Results and Discussion

Regarding the horizontal component of GRF / total GRF, the anterior pelvic tilt posture showed significantly higher values compared to the natural and posterior pelvic tilt postures ($p < 0.05$, $p < 0.01$, respectively) (Figure 2). Additionally, the natural posture demonstrated significantly higher values than the posterior pelvic tilt ($p < 0.01$). These results suggest that a posture with an anterior pelvic tilt may be optimal for a forward sprint start. Previous research has also identified an increase in the sacrolumbar spine inclination angle positively related to speed abilities such as time in the 20 m linear speed and agility t-test[2] and our present results support the previous research. The maximally anterior pelvis tilt may be suitable for forward sprinting but may not be optimal for lateral or backward movements. Therefore, further investigation is needed.

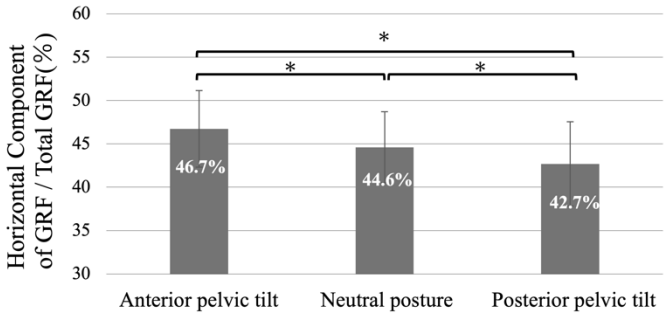

Figure 2 Forward Ground Reaction Force at Sprint Start with Three Different Postures. GRF: ground reaction force, ∗ $p < 0.05$

Conclusions

The findings indicate that an anterior pelvic tilt can generate a higher ground reaction force in the forward direction during the sprint start, optimizing acceleration.

References

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[2]Koźlenia D et al.(2023). *J Phys Fit Sports Med*,**63**:89