

Effect of Ankle Sprain History on Ankle Inversion Biomechanics in High School Football Players

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Summary

Ankle sprains occur at a high rate in high school football. Three-dimensional analyses of football related tasks were performed in players with and without history of ankle sprain. Playing position influenced the magnitude of inversion load that football players with a history of ankle sprain exhibit.

Introduction

The most common injury in high school sports is an ankle sprain [1]. The rate of ankle sprains is greater in high school football competitions compared to other high school sports [1]. A lateral ankle sprain is the primary classification in 85% of all ankle sprains [2]. The most common mechanism of injury is excessive and rapid ankle inversion, producing high levels of tensile force through the anterior talofibular ligament. Greater ankle inversion motion, joint velocity and moment have been reported to be related to increased ankle injury risk [3]. Therefore, risk of recurrent ankle injury in football may be reduced if these potential risk factors can be modified. The purpose of the study was to examine ankle biomechanics during football related tasks in players with a history of ankle sprain.

Methods

93 high school American football players (age: 15.6 ± 1.6 yrs; height: 174.7 ± 8.6 cm; weight: 79.5 ± 19.8 kg) volunteered to participate in the study. Each participant gave written informed consent prior to testing. Participants were instrumented with retroreflective markers on the trunk, pelvis, arms, legs, and cleats for motion capture. Participants wore standardized football cleats (adidas crazyquick 2.0) and performed several football related tasks on synthetic turf with two embedded force platforms. During data collection, each participant completed a weighted sled push (75% of body weight) and a jump-stop unanticipated cut. Peak ankle inversion angle, peak ankle inversion angular velocity, and peak external inversion ankle moment were calculated (Visual3D) during each movement. Participants were classified based on self-reported history of ankle sprain (AS n=35) or no history of an ankle sprain (NAS

n=58) and by playing position (backs/receivers n=59; linemen n=34). A mixed-model ANOVA was used to determine the effects of previous ankle sprain history, playing position, and type of movement (cut, weighted sled push) ($p < 0.05$). Effect sizes (bias corrected Hedges) were calculated to determine the magnitude of differences between study groups.

Results and Discussion

A statistically significant interaction (injury, position) was found for peak ankle inversion moment (Table 1). During the cutting task, the backs/receivers with history of ankle sprain exhibited significantly greater ankle inversion moment compared to linemen with history of injury (large effect size $d = 0.90$ [95% CI 0.17, 1.63]). Similar results were found for the weighted sled push (Table 1 moderate effect size $d = 0.45$ [95% CI -0.26, 1.15]). Differences between injury groups were not found for peak inversion angle and peak inversion angular velocity, Table 1).

The cutting task had significantly larger peak inversion angle and peak inversion angular velocity (Table 1, main effect of movement) compared to the weighted sled push. Additionally, a main effect of playing position was found for peak inversion angular velocity indicating backs/receivers had larger velocity compared to linemen

Conclusions

Playing position influenced the magnitude of inversion load that football players with a history of ankle sprain exhibited during an unanticipated cut task. Technique and footwear modifications should be considered in backs/receivers (skilled positions) at high risk of recurrent ankle sprains.

Acknowledgments

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References

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Table 1: Ankle Inversion Kinematic and Kinetics during Cutting and Sled Pushing Tasks.

		Unanticipated Cut		Weighted Sled Push	
		Linemen	Backs/Receivers	Linemen	Backs/Receivers
Peak Ankle Inversion Angle (deg) †	NAS	17.2 ± 4.7	17.5 ± 4.6	7.5 ± 6.5	5.7 ± 3.9
	AS	18.0 ± 4.7	17.8 ± 4.8	9.6 ± 6.4	7.4 ± 5.3
Peak Ankle Inversion Angular Velocity (deg/s) †§	NAS	285.0 ± 116.9	319.3 ± 135.3	234.5 ± 68.4	284.8 ± 62.9
	AS	264.5 ± 153.2	347.1 ± 120.0	174.1 ± 136.2	284.9 ± 180.5
Peak Ankle Inversion Moment (Nm/kg) *§†‡	NAS	0.414 ± 0.215	0.444 ± 0.217	0.055 ± 0.073	0.043 ± 0.047
	AS	0.296 ± 0.158	0.501 ± 0.247	0.011 ± 0.051	0.046 ± 0.086

No History of Ankle Sprain (NAS), History of Ankle Sprain (AS), * Injury and Position Interaction $p < 0.05$, ‡ Movement and Position Interaction $p < 0.05$, † Movement Main Effect $p < 0.05$, § Position Main Effect $p < 0.05$