Influence of Trunk Flexion on Lower Extremity Kinematics During a Drop Vertical Jump Task

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ABSTRACT

Objective: To investigate the effect of trunk flexion on hip and knee kinematics in male and female recreational athletes during a drop vertical jump task.

Introduction: Non-contact anterior cruciate ligament (ACL) injury in female athletes is up to eight times the rate for male athletes. Neuromuscular factors are the likely cause of this gender bias. Trunk flexion has been previously cited as an important variable to consider for ACL injury prevention; however, there is little evidence currently available on how altered trunk flexion may affect distal joint function.

Methods: Subjects included male (n=10, age=26.1±2.9yrs, ht=1.8±.06m, wt=75.7±9.7kg) and female (n=7, age=26.8±2.0yrs, ht=1.67±.08m, wt=61.1±11.2kg) healthy recreational athletes. Data was collected using an electromagnetic motion tracking system during a drop-vertical jump task using three conditions: a trunk-extended (TE) position (0-10 degrees), a trunk-flexed (TF) position (40-50 degrees), and the subjects' preferred (P) trunk flexion. Dependent variables included knee and hip flexion, knee valgus, hip abduction, and trunk flexion angles sampled at initial contact. A 3 [condition] X 2 [gender] ANOVA using Tukey's HSD with alpha set a priori at .05 was employed to determine statistical significance.

Results: Significant increases in trunk, hip, and knee flexion angles were observed for the TF condition compared to the TE and P conditions, respectively.

	Task Condition			Significance	
	TF	TE	P	P Value, TF vs. TE	P Value, TF vs. P
Trunk Flexion	43.8±4.2^o	1.2±5.3^o	17.9±10.8^o	p<.001	p<.001
Hip Flexion	53.2±19.9^o	28.5±14.8^o	34.9±16.3^o	p=.004	p=.042
Knee Flexion	34.4±9.9^o	21.5±9.8^o	24.7±7.5^o	p<.001	p=.009

Males demonstrated significantly greater trunk flexion in the P condition compared to females; however, no significant differences in distal joint kinematics with respect to gender were present.

	Gender		Significance
	Males	Females	P Value, M vs. F
Trunk Flexion	22.8 ± 9.7^{o}	14.5 ± 10.6^{o}	p=.04

No significance differences were observed in the frontal plane with respect to task or gender.

Conclusions: Increasing trunk flexion angle from the TE and P conditions to the TF condition resulted in alterations at the knee and the hip which have been shown to decrease ACL loading. The lack of distal kinematic alterations in the P condition between genders may indicate that trunk flexion differences need to be of a relatively large magnitude in order to induce distal alterations. These new findings my ultimately help to provide clinicians with a scientific foundation on which to design effective ACL injury prevention protocols.