Grant Information Summary:

Non-Contact ACL Injuries in Females: Possible Mechanisms From a Developmental Perspective

Practical Significance:

This study revealed biomechanical differences in landing strategies between pre- and post- pubescent subjects. Therefore, acquisition of motor skills in adolescents, especially landing strategies, may become a variable of interest in understanding increased injury rates following puberty.

Background

Female participation in sport has increased over the last two decades bringing with it a high incidence of anterior cruciate ligament (ACL) injuries, the prevention of which is a high priority. Many have investigated potential causes, predictability, and means of preventing ACL injury to the female athlete. Landing from a jump is recognized as a common activity during which ACL injuries occur, and is an activity that may be biomechanically different between males and females. If this biomechanical difference develops along with physical maturation, there is the possibility of gender-related developmental differences associated with ACL injury risk.

Objective

To determine if neuromuscular and biomechanical differences exist between pre-pubertal and post-pubertal males and females during landing

Design and Setting

Subjects jumped for a ball set at 50% of their maximum vertical jump in straight and offset conditions. Subjects jumped from the same self-selected position and landed facing forward on both feet, with only their dominant foot on the force plate.

Subjects completed four successful trials of each condition.

Subjects

Fifty-nine subjects were divided into age and gender groupings (15 girls, age=9.19 ±1.00, 16 boys, age=9.63 ±0.95, 14 women, age=24.22 ±2.27, and 14 men, age=23.57 ±3.23).

Measurements

Multivariate statistics (*a* = .05) were used to compare ankle, knee, hip and trunk angles at initial contact (IC) and 250 milliseconds (ms) following IC, maximum vertical ground reaction force (GRFz), mean GRFz from IC through 250 ms, and mean normalized EMG activity from IC through 250 ms. T-tests (*a* = .05) were performed to compare vastus medialis and medial hamstring onset timing prior to IC for the men and women.

Results

Girls exhibited significantly less knee flexion during landing compared to men and women and reached maximum knee flexion earlier than men and women. Girls and boys had less hip flexion at initial contact compared to women. However, initial analysis of peak vertical forces between gender and developmental age revealed no differences. (Tables 1 and 2)

Conclusions

These findings lend support to developmental differences in hip and knee kinematics during landing from a vertical jump, but may not support gender differences. Further research investigating the effect of gender and developmental level upon a functional task is warranted.

Table 1: Straight Jump Group Means

Group		Knee flexion impact	Max knee flexion	Time to max knee flexion	Hip flexion impact	Max GRFz (bw)
Girls	Mean	10.7	67.26∂	.16*	7.12◊	1.45
	SD	7.18	10.81	.04	5.22	0.29
Boys	Mean	10.25	72.60	.21	6.51◊	1.57
	SD	5.73	9.86	.08	6.22	0.42
Women	Mean	11.56	80.75	.24	14.09	1.31
	SD	6.24	15.72	.09	5.12	0.29
Men	Mean	13.75	82.94	.25	11.11	1.54
	SD	5.11	23.13	.11	9.61	0.44

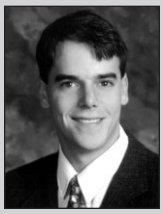
*Significantly different vs women & men. ◊ Significantly different vs women. ∂ Significantly different vs men.

Table 2: Offset Jump Group Means

Group		Knee flexion impact	Max knee flexion	Time to max knee flexion	Hip flexion impact	Max GRFz (bw)
Girls	Mean	9.88	67.59	.17*	11.46◊	1.94
	SD	7.87	10.39	.03	7.18	0.29
Boys	Mean	8.81	71.38	.21	10.33◊	1.87
	SD	4.58	7.88	.09	6.21	0.47
Women	Mean	9.88	76.60	.29	18.47	1.77
	SD	7.00	10.83	.11	4.21	0.27
Men	Mean	12.29	78.06	.26	13.20	1.90
	SD	3.87	16.04	.10	5.96	0.33

*Significantly different vs women & men. ◊ Significantly different vs women. ∂ Significantly different vs men.

Primary Investigator:



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