EFFECT OF GENDER ON KNEE ABDUCTION AND FLEXION DURING MEDIAL AND LATERAL LANDINGS

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INTRODUCTION

Females who participate in pivoting and jumping sports suffer anterior cruciate ligament (ACL) injuries at a 4 to 6-fold greater rate than males participating in the same sports. ACL injuries often occur during single leg landings or quick changes of direction from either the medial or lateral direction[1]. The purpose of this study was to compare the knee joint kinematics during two types of single leg landings in male and female collegiate athletes. The hypothesis was that females would demonstrate greater knee abduction, but similar levels of knee flexion compared to male athletes.

METHODS

Eleven female and 11 male collegiate athletes were height (female 176±8cm, male 176±8cm) and weight (female 73±7kg, male 74±6kg) matched. Informed written consent was obtained from each subject. Each subject was instructed to balance on one leg on a 13.5 cm block positioned adjacent to the force plate. They were then randomly instructed to drop off the block medially or laterally and land on the same leg and balance for approximately 2 seconds.

An 8 camera motion analysis system (Eagle, Motion Analysis Corp.) with two force platforms (AMTI) were used for data collection. Video and force data were time synchronized and collected at 240 Hz and 1200 Hz, respectively. 37 retroreflective markers were secured to each subject in predetermined anatomical locations. A kinematic model was defined from a standing static trial using Mocap Solver (Motion Analysis Corp.)[2]. Joint rotations in the hip, knee, and ankle were expressed relative to a neutral position where all segment axes are aligned. The data were low-pass filtered with a cubic smoothing spline at a 15 Hz cut-off frequency. A mixed ANOVA was utilized to test for the main effects of gender, task and side with alpha level of 0.05.

RESULTS AND DISCUSSION

Mean and standard deviations for each variable are presented in Table 1. The data are presented as averaged between the two sides as there were no side main effects or interactions. Female subjects had significantly greater knee abduction angles at IC (P<0.001) and maximum (P<0.001) compared to males (Figure 1). In contrast males displayed greater knee adduction maximum during the landings (P=0.005). There were no gender effects on knee flexion angle at either IC or maximum (Figure 2). During the lateral landings both male and female subjects had greater knee flexion and abduction angles at IC (P<0.001)(Table 1). There were no task*gender interactions.

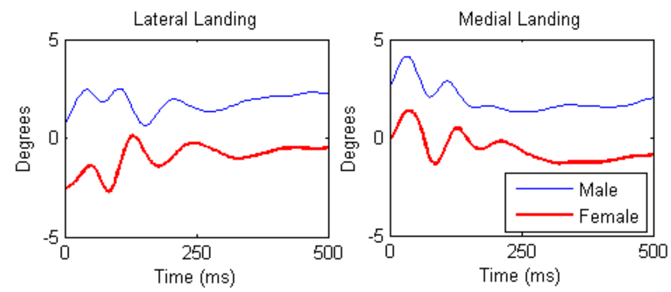

Figure 1. Knee abduction (-) angle in male (thin blue line) and female (bold red line) during the lateral and medial landings.

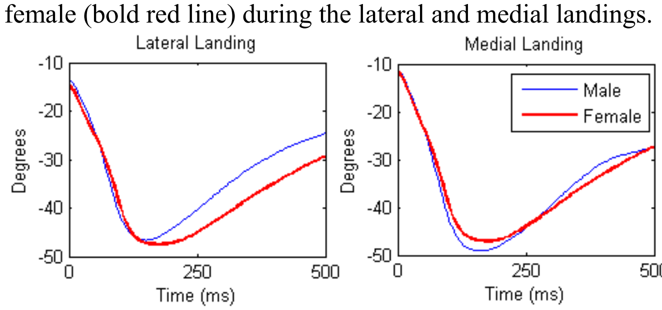

Figure 2. Knee flexion (-) angle in male (thin blue line) and female (bold red line) during the lateral and medial landings.

CONCLUSIONS

Increased knee abduction angles has been previously shown to be predictive of ACL injury risk in female athletes [3]. In the current study females landed with increased knee abduction angles compared to males. Although further research is needed, a higher occurrence of ACL injuries may result from lateral landings as compared to medial landings.

REFERENCES

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Table 1. Knee joint flexion and ab/adduction angles during each landing (mean ± SD).

Knee Angles (degrees)	Lateral		Medial		Main Effects	
	Female	Male	Female	Male	Gender	Task
Flexion Initial Contact	-13.6 ± 3.9	-13.5 ± 4.1	-10.8 ± 3.8	-11.2 ± 3.7	F=0.01, P=0.9	**F=43.8, P<0.001†**
Flexion Maximum (-)	-49.2 ± 6.9	-49.0 ± 4.7	-49.0 ± 7.2	-48.9 ± 4.0	F=0.004, P=0.95	F=0.04, P=0.8
Ab/Adduction Initial Contact	-2.4 ± 2.0	1.7 ± 2.3	-0.5 ± 2.2	3.0 ± 2.8	**F=20.0, P<0.001‡**	**F=62.3, P<0.001†**
Adduction Maximum (+)	1.1 ± 3.4	5.0 ± 2.9	2.4 ± 3.2	5.6 ± 3.1	**F=10.0, P=0.005‡**	**F=11.1, P=0.003†**
Abduction Maximum (-)	-4.9 ± 3.1	0.1 ± 3.1	-4.2 ± 3.9	0.5 ± 3.9	**F=14.5, P<0.001‡**	F=4.2, P=0.054