

COMPARISON OF LANDING BIOMECHANICS BETWEEN MALE AND FEMALE PROFESSIONAL DANCERS

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INTRODUCTION

The gender disparity in the incidence of non-contact anterior cruciate ligament (ACL) injuries among athletes has been well documented. (Ireland, 1999) Studies of landing activities have revealed gender differences in lower extremity biomechanics that may place female athletes at increased relative risk. (Hewett et al, 2005) By contrast, the gender disparity in the incidence of ACL injuries among elite ballet and modern dancers is much less apparent, even though the activity is laden with jumping and landing activities. (Liederbach, in press) The low incidence of ACL injuries in dancers of both sexes coupled with the fact that they receive intensive training in jumping and landing from a young age seems to suggest that technique and training may play a more prominent role in the commonly-reported disparity in ACL injuries than gender-specific anatomical or hormonal factors. There is little research comparing landing biomechanics of male and female dancers. The purpose of this study was to compare lower extremity kinematics and kinetics during single-leg drop-landings between male and female professional dancers. Our hypothesis was that no difference in lower extremity biomechanics would exist between men and women dancers.

METHODS AND PROCEDURES

Twenty-nine professional dancers (14M, 15F) performed single-leg drop-landings from a 30

cm platform onto a force plate. Each landing was defined from initial contact with the force plate to peak knee flexion achieved during each trial. Kinematic data were recorded using eight Eagle cameras (Motion Analysis Corp.) and 22 reflective markers. Ground reaction forces were recorded with an OR6-5 force platform (AMTI). Sagittal and frontal plane angles and moments (internal) were calculated for the ankle, knee and hip. Total support moment (TSM) was calculated by adding sagittal plane moments at each joint throughout each trial. (Winter, 1980) Two separate MANOVAs were used to compare joint kinematics and kinetics between men and women. A t-test was used for TSM. The α level was set a priori at 0.05.

RESULTS

There were no gender differences in joint kinetics ($p=0.462$) (Table 1), kinematics ($p=0.056$) (Table 2), or TSM ($p=0.618$) (Figure 1).

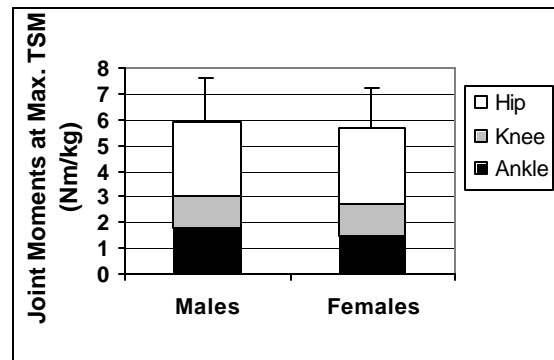


Figure 1. Joint contributions to maximum total support moment

DISCUSSION

Lower extremity kinematics and kinetics were not different between male and female dancers during this landing task. Maximum TSM and distribution of that moment among joints were also not different, indicating the demands placed on the lower extremity were similar between genders. These results are in contrast to previous studies indicating that landing biomechanics between male and female athletes are different. (Ford et al, 2006; Kernozek et al, 2005) We speculate that the extensive landing training provided to both male and female dancers from an early age may contribute to the lack of gender related landing differences.

SUMMARY

In contrast to previous research comparing landing biomechanics between male and

female athletes of similar training background and skill level, our study found no difference in lower extremity kinetics and kinematics between male and female professional dancers. These results indicate that the gender disparity among athletes in the incidence of ACL injuries may be the result of an experience and training disparity rather than purely gender.

REFERENCES

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Table 1. Comparison of knee and hip kinematics between male and female dancers

Joint Angles (?)	Knee Flexion (+)	Knee Abduction (+)	Hip Flexion (+)	Hip Adduction (+)
Initial Contact				
<i>Males</i>	1.5 (6.3)	- 0.2 (2.4)	- 3.6 (10.0)	- 10.3 (4.9)
<i>Females</i>	4.2 (4.0)	- 1.7 (3.8)	8.1 (7.9)	- 13.9 (5.1)
Max. Knee Flexion				
<i>Males</i>	61.8 (10.3)	- 2.8 (5.0)	21.3 (15.0)	3.9 (5.6)
<i>Females</i>	60.5 (5.8)	-3.4 (11.2)	32.2 (10.3)	1.2 (5.2)
Range of Motion				
<i>Males</i>	60.3 (6.8)	8.5 (4.4)	25.4 (7.4)	15.5 (4.2)
<i>Females</i>	56.3 (4.8)	11.3 (5.8)	24.3 (5.8)	16.2 (5.1)

Table 2. Comparison of knee and hip kinetics between male and female dancers

Joint Moments (Nm/kg)	Knee Extension (+)	Knee Adduction (+)	Hip Extension (+)	Hip Abduction (+)
Initial Contact				
<i>Males</i>	- 0.4 (0.1)	0.02 (0.09)	- 2.8 (3.4)	- 0.2 (0.1)
<i>Females</i>	- 0.5 (0.2)	- 0.01 (0.14)	- 2.4 (3.5)	- 0.3 (0.5)
Max. Knee Flexion				
<i>Males</i>	1.7 (0.4)	- 0.5 (0.3)	0.9 (0.6)	1.2 (0.4)
<i>Females</i>	1.4 (0.5)	- 0.4 (0.3)	1.2 (0.8)	0.9 (0.5)
Maximum during Landing				
<i>Males</i>	3.1 (0.7)	- 1.8 (0.4)	4.0 (1.2)	3.1 (0.9)
<i>Females</i>	3.3 (0.8)	- 1.6 (0.4)	4.3 (1.5)	3.0 (1.0)