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J. Troy Blackburn, Darin A. Padua (2009) Sagittal-Plane Trunk Position, Landing Forces, and Quadriceps Electromyographic Activity. *Journal of Athletic Training*: March/April 2009, Vol. 44, No. 2, pp. 174-179.

doi: 10.4085/1062-6050-44.2.174

Original Research

Sagittal-Plane Trunk Position, Landing Forces, and Quadriceps Electromyographic Activity

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Abstract

Context: Researchers have suggested that large landing forces, excessive quadriceps activity, and an erect posture during landing are risk factors for anterior cruciate ligament (ACL) injury. The influence of knee kinematics on these risk factors has been investigated extensively, but trunk positioning has received little attention.

Objective: To determine the effect of trunk flexion on landing forces and quadriceps activation during landing.

Design: Two (sex) × 2 (task) repeated-measures design.

Setting: Research laboratory.

Patients or Other Participants: Forty healthy, physically active volunteers (20 men, 20 women).

Intervention(s): Participants performed 2 drop-landing tasks. The first task represented the natural, or preferred, landing strategy. The second task was identical to the first except that participants flexed the trunk during landing.

Main Outcome Measure(s): We measured peak vertical and posterior ground reaction forces and mean quadriceps electromyographic amplitude during the loading phase of landing (ie, the interval from initial ground contact to peak knee flexion).

Results: Trunk flexion decreased the vertical ground reaction force ($P < .001$) and quadriceps electromyographic amplitude ($P < .001$). The effect of trunk flexion did not differ across sex for landing forces or quadriceps electromyographic activity.

Conclusions: We found that trunk flexion during landing reduced landing forces and quadriceps activity, thus potentially reducing the force imparted to the ACL. Research has indicated that trunk flexion during landing also increases knee and

Volume 44, Issue 2
(March/April 2009)

[◀ Previous](#) [Next ▶](#)



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Journal Information

Print ISSN 1062-6050

eISSN 1938-162X

Frequency Bimonthly:

January/February
March/April
May/June
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September/October
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hip flexion, resulting in a less erect landing posture. In combination, these findings support emphasis on trunk flexion during landing as part of ACL injury-prevention programs.

Keywords: [anterior cruciate ligament](#), [ground reaction forces](#), [injury prevention](#), [risk factors](#)

J. Troy Blackburn, PhD, ATC, contributed to conception and design; acquisition and analysis and interpretation of the data; and drafting, critical revision, and final approval of the article. Darin A. Padua, PhD, ATC, contributed to conception and design; analysis and interpretation of the data; and drafting, critical revision, and final approval of the article.

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[top](#) ▲