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Original Research

Lower Limb Joint Kinetics During Moderately Sloped Running

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Abstract

Context: Knowledge of the kinetic changes that occur during sloped running is important in understanding the adaptive gait-control mechanisms at work and can provide additional information about the poorly understood relationship between injury and changes in kinetic forces in the lower extremity. A study of these potential kinetic changes merits consideration, because training and return-to-activity programs are potentially modifiable factors for tissue stress and injury risk.

Objective: To contribute further to the understanding of hill running by quantifying the 3-dimensional alterations in joint kinetics during moderately sloped decline, level, and incline running in a group of healthy runners.

Design: Crossover study.

Setting: Three-dimensional motion analysis laboratory.

Patients or Other Participants: Nineteen healthy young runners/joggers (age = 25.3 ± 2.5 years).

Intervention(s): Participants ran at 3.13 m/s on a treadmill under the following 3 different running-surface slope conditions: 4° decline, level, and 4° incline.

Main Outcome Measure(s): Lower extremity joint moments and powers and the 3 components of the ground reaction force.

Results: Moderate changes in running-surface slope had a minimal effect on ankle, knee, and hip joint kinetics when velocity was held constant. Only changes in knee power absorption (increased with decline-slope running) and hip power (increased generation on incline-slope running and increased absorption on decline-slope running in early stance) were noted. We observed an increase only in the impact peak of the vertical ground reaction force component during decline-slope running, whereas the nonvertical components displayed no differences.

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Conclusions: Running style modifications associated with running on moderate slopes did not manifest as changes in 3-dimensional joint moments or in the active peaks of the ground reaction force. Our data indicate that running on level and moderately inclined slopes appears to be a safe component of training regimens and return-to-run protocols after injury.

Keywords: [biomechanics](#), [decline running](#), [incline running](#), [joint moments](#), [joint power](#)

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