

# EFFECT OF HEEL LIFTS ON PATELLOFEMORAL JOINT STRESS DURING RUNNING

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## ABSTRACT

**Background:** Patellofemoral pain is a debilitating injury for many recreational runners. Excessive patellofemoral joint stress may be the underlying source of pain and interventions often focus on ways to reduce patellofemoral joint stress.

**Purpose:** Heel lifts have been used as an intervention within Achilles tendon rehabilitation programs and to address leg length discrepancies. The purpose of this study was to examine the effect of running with heel lifts on patellofemoral joint stress, patellofemoral stress impulse, quadriceps force, step length, cadence, and other related kinematic and spatiotemporal variables.

**Study Design:** A repeated-measures research design

**Methods:** Sixteen healthy female runners completed five running trials in a controlled laboratory setting with and without 11mm heel lifts inserted in a standard running shoe. Kinetic and kinematic data were used in combination with a static optimization technique to estimate individual muscle forces. These data were inserted into a patellofemoral joint model which was used to estimate patellofemoral joint stress and other variables during running.

**Results:** When running with heel lifts, peak patellofemoral joint stress and patellofemoral stress impulse were reduced by a 4.2% ( $p=0.049$ ) and 9.3% ( $p=0.002$ ). Initial center of pressure was shifted anteriorly 9.1% when running with heel lifts ( $p<0.001$ ) despite all runners utilizing a heel strike pattern. Dorsiflexion at initial contact was reduced 28% ( $p=0.016$ ) when heel lifts were donned. No differences in step length and cadence ( $p>0.05$ ) were shown between conditions.

**Conclusions:** Heel lift use resulted in decreased patellofemoral joint stress and impulse without associated changes in step length or frequency, or other variables shown to influence patellofemoral joint stress. The center of pressure at initial contact was also more anterior using heel lifts. The use of heel lifts may have therapeutic benefits for runners with patellofemoral pain if the primary goal is to reduce patellofemoral joint stress.

**Level of Evidence:** 3b

**Key words:** Heel lifts, knee, patellofemoral joint stress, rehabilitation, running

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