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Results of mechanical analyses of running may be helpful in the search for the etiology of running injuries. In this study a mechanical analysis was made of the landing phase of three trained heel-toe runners, running at their preferred speed and style. The body was modeled as a system of seven linked rigid segments, and the positions of markers defining these segments were monitored using 200 Hz video analysis. Information about the ground reaction force vector was collected using a force plate. Segment kinematics were combined with ground reaction force data for calculation of the net intersegmental forces and moments.

The vertical component of the ground reaction force vector F_z was found to reach a first peak approximately 25ms after touch-down. This peak occurs because, in the support leg, the vertical acceleration of the knee joint is not reduced relative to that of the ankle joint by rotation of the lower leg, so that the support leg segments collide with the floor. Rotation of the support upper leg, however, reduces the vertical acceleration of the hip joint relative to that of the knee joint, and thereby plays an important role in limiting the vertical forces during the first 40 ms. Between 40 and 100 ms after touch-down, the vertical forces are mainly limited by rotation of the support lower leg.

At the instant that F_z reaches its first peak, net moments about ankle, knee and hip joints of the support leg are virtually zero. The net moment about the knee joint changed from -100 Nm (flexion) at touch-down to +200 Nm (extension) 50 ms after touch-down. These changes are too rapid to be explained by variations in the muscle activation levels and were ascribed to spring-like behavior of pre-activated knee flexor and knee extensor muscles. These results imply that the runners investigated had no opportunity to control the rotations of body segments during the first part of the contact phase, other than by selecting a certain geometry of the body and muscular (co-)activation levels prior to touch-down.