Kinematic and Kinetic Components of Rope Skipping: A Pilot Study

Barbara A. Gowitzke and Lesley Brown
McMaster University
Hamilton, Ontario
Canada

Rationale:

Skipping has been a back-yard activity for many generations, and is universally accepted as an activity with high aerobic demand. Recently, skipping has been recognized as a competitive sport and is supported by the Canadian Skipping Association.

The action of skipping can be described as a reoccurring stationary vertical jump whereby both feet lose contact with the ground to allow a rotating rope to pass beneath them. The height of each jump varies according to the individual's objective, for example, to jump at maximum speed.

Scientific data available on this event are limited since the sport is in its infancy as a competitive event. With the increased interest at the recreational level as well as the rapid development at the competitive level, the need for scientifically based instruction and coaching methods is apparent.

Objective:

The primary objective of the present study was to provide a biomechanical analysis of speed-skipping as performed by novice and skilled individuals. A kinetic analysis determined the relative directions and magnitudes of forces (ground reaction forces) on the body at the point of impact. A kinematic analysis compared the performance styles and motor patterns of skilled and novice subjects.

Methods:

Six novice and six skilled skipping performances were tested. Their results provided all data for both kinematic and kinetic analyses.

Measurement of ground reaction forces were accomplished by collecting quantitative data using an AMTI force platform. In addition, each subject's performance was cinematographically recorded at a film speed of 200 frames per second by using two LOCAM cameras positioned so that filming angles were at right angles to each other. A planar analysis was performed of a "side view" of the performer while the "front view" was used qualitatively to register information regarding frontal plane movement and asymmetrical differences.

Results:

Preliminary results indicate that expert jumpers employ a minimum of displacement of both the upper and lower extermities, locate the centre of pressure at one spot with minimal deviation on successive jumps, and jump at higher frequencies than novice jumpers. The typical unweighting-weighting pattern seen in most jumps in order to gain force is not seen with the expert because the jumper is "punching" the platform. Novices typically rotate the hands in a larger arc, lift the feet higher by employing larger ranges of knee and hip flexion, and display high variability in the location of the centre of pressure with each successive jump.