EFFECTS OF KNEE AND HIP JOINT MOTIONS DURING THE LANDING OF A STOP-JUMP TASK

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INTRODUCTION

Performance of landing tasks in sports is important for the prevention of lower extremity injuries. Literatures have shown that stiff landing characterized by great impact forces may be a risk factor for knee injuries [1, 2]. Increased hip extensor and knee flexor moments at the initial contact have been found in stiff landing in which the knee flexion angle is less than 90 degree [3]. Female recreational athletes also showed increased knee resultants forces and decreased knee flexion angle during landing compared to the male [1]. However, five degrees increased did not significantly affect the magnitudes of ground reaction forces in stop-jump task [4]. This presentation will show that how the motions of knee and hip affect the ground reaction force.

METHODS

Thirty male and thirty female healthy college students without known history of knee disorder were recruited for this study. Up to five steps approach run followed by stop-jump task was collected. Reflective markers were placed on bilaterally on ASIS, lateral malleolus, upper and lower anterior aspect of tibia. One marker was placed between the lumber vertebrae 4 and 5. The videographic and ground reaction force (Bertec Corporation, Worthington, OH) signals were recorded by the Peak Performance Motus videographic and analog data acquisition system (Peak Performance Technology, Inc., Englewood, CO). The collected 3-D coordinates of the markers during each stop-jump trials were filtered through a Butterworth lower-pass digital filter at estimated optimum cutoff frequencies. All signal processing and data reduction were performed using MotionSoft 3-D motion data reduction program package version 5.5 (MoitonSoft, Inc., Chapel Hill, NC).

Linear regression analysis was performed to determine the relationships of knee and hip kinematics with the ground reaction forces. A type I error rate of 0.05 was chosen to indicate statistical significance in each analysis. A stepwise selection procedure was used to determine the best regression equation for each couple of dependent and independent variables. All statistical analyses were performed using the SYSTAT computer program package, version 5.0 (SYSTAT, Inc., Evanston, IL).

RESULTS AND DISCUSSION

The results are shown in the Table 1. These results indicate that what affect the landing stiffness of the stop-jump task was hip and knee joint motions instead of configurations. A large hip and knee flexion angles at the initial foot contact with the ground do not necessarily make the landing soft, but active hip and knee flexion motions do. Hip joint motion at the initial foot contact with the ground mainly affects the ground reaction force and in the anterior-posterior direction during landing of the stop-jump task. Knee joint motion at the initial foot contact with the ground mainly affects the ground reaction force in vertical direction during landing of the stop-jump task. Hip joint motion at the initial foot contact with the ground appears to be an important technical factor that affects ACL loading during the landing of the stop-jump task.

REFERENCES

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Table 1. Pearson correlation coefficients (p-values) of hip and knee joint kinematics with peak ground reaction forces during the landing of the stop-jump task.

	Peak posterior ground reaction force	Peak vertical ground reaction force
Hip flexion angle at initial foot contact with ground	-0.104 (0.429)	-0.150 (0.251)
Hip flexion angular velocity at initial foot contact with ground	-0.630 (0.000)	-0.477 (0.000)
Hip maximum flexion angle during landing	-0.191 (0.144)	-0.123 (0.349)
Knee flexion angle at initial foot contact with ground	-0.102 (0.439)	-0.040 (0.763)
Knee flexion angular velocity in initial contact with ground	-0.490 (0.000)	-0.597 (0.000)
Knee maximum flexion angle during landing	-0.234 (0.072)	-0.381 (0.003)