

Comparison between first and second landing for different vertical drop jump tasks. Implication in injury risk prevention

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Introduction

First landing of vertical drop jumps (DJ) is usually used to screen injury risk and deficiencies in neuro-muscular control. Insufficient hip and knee flexion have been identified as mechanical factors contributing to injury risk in ACL lesion (Pollard et al., 2010). The second landing has largely been ignored in previous study and could provide new interesting informations. Indeed, second landing may be more closely related to a majority of non-contact ACL injuries (Powell et al., 2000).

Methods

Five sedentary men (age = 23 ±1) without lesion history of the lower limbs performed bipodal DJ from 2 initial heights: 20 and 40 cm. The kinematic and the kinetic of subjects were recorded using a 3D motion capture system and 2 force plates. The best performance from 3 trials was retained for analysis. We assessed hip and knee angles in the sagittal plane at initial contact (IC) as well as the peak force for the first and second landing.

Results

For DJ20, the second landing exhibits a statistically significant decrease flexion angle at IC for the dominant (D) and non-dominant (ND) legs: D ($22^{\circ}\pm 6^{\circ}$ vs $32^{\circ}\pm 8^{\circ}$), ND ($22^{\circ}\pm 5^{\circ}$ vs $34^{\circ}\pm 9^{\circ}$). Peak forces are not significantly different for both landings: (D=1692N, ND=1363N) (D=2022N, ND 1749N). For DJ40, the second landing shows a statistically significant decrease of the knee flexion: D (20° vs 32°), ND (18° vs 29°) and of the hip flexion: D (161° vs 153°), ND (161° vs 154°). Peak force is the same at first (D=1605N, ND=1512N) and second landing (D=1641N, ND=2142N). No significant differences of fall height (39 vs 40 cm), peak force or hip and knee angulation were found when comparing the second landing of DJ20 and DJ40.

Discussion

Previous investigations focusing on the first landing have identified insufficient hip and knee flexion as mechanical factors contributing to ACL injury (Pollard et al., 2010). For DJ20 and DJ40, subjects present a riskier posture during their second landing as they have a more erected position while the force peak remains similar.

Moreover, DJ20 has been shown to be less demanding than DJ40 during the first landing (Yeow et al., 2010). As both drop jumps leads to similar peak forces or hip and knee angulations for second landing, we would recommend to favor DJ20.

These preliminary results tends to demonstrate that the second landing of a 20 cm drop jump could be more relevant to assess the risk of injury than using the values obtained from a first landing

Reference

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