EFFECTS OF DIFFERENT JUMP-LANDING DIRECTIONS ON LOWER EXTREMITY MUSCLE ACTIVATIONS

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INTRODUCTION: When performing a jump-landing task in sports, we may jump and land at different directions instead of one direction. During landing period, single-leg landing is generally considered at a higher risk of injury than double-leg landing. However, there were few studies on discussing about musculoskeletal responses when landed at different directions. Therefore, the purpose of this study was to analyze the effects of different jump-landing directions on lower extremity muscle activations when performing single-leg landing.

METHODS: Six healthy subjects [3 males/3 females (24 ±3.3 years old; 63.5 ±12 kg; 168 ±7.3 cm)] were recruited for this study. All subjects required to jump with double-leg at three different directions (forward, diagonal and lateral) and land with single-leg (dominant leg only). During jump-landing task, subjects were asked to touch an object which was placed at 50% of their maximum jumping height with both hands. When landed with single-leg, subjects were asked to maintain their balance for 3 seconds. If the trial which subject was unable to perform requirements above, it would be considered as 'failed trial'. EMG data were collected by BIOPAC MP150 system with surface electrodes. Target muscles for EMG measurements were vastus lateralis (VL), biceps femoris (BF), tibialis anterior (TA) and medial portion of gastrocnemius (MG) on the dominant leg. All EMG data were normalized by signals collected during MVC. One way ANOVA within repeated measures were used to compare muscle activations at different jump-landing directions.

RESULTS: There were no significant differences of muscle activation among three directions. However, forward jump-landing protocol had higher lower extremity muscle activations than diagonal and lateral directions during initial landing (0-1s)(Figure 1). During stability period (1-3s), all lower extremity muscle activations dropped significantly than initial landing(Figure 2).

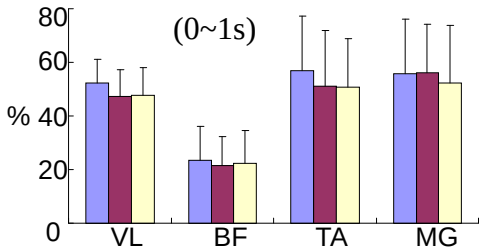

Figure 1

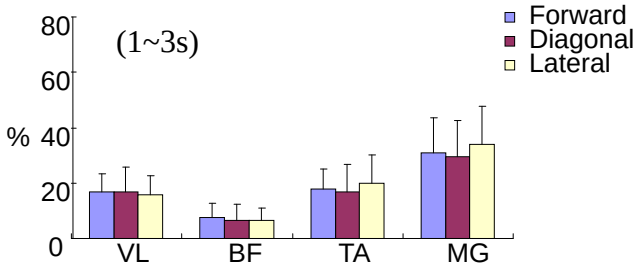

Figure 2

DISCUSSION: Muscles are often considered as dynamic stabilizers of a joint. During landing, greater muscle activations could enhance the function of dynamic stabilizer and lead to better joint stability. Compared to forward jump-landing, lateral and diagonal protocol demonstrated less muscle activations. Less muscle activation might cause less dynamic joint stability support and increase risk of injuries. Therefore, higher muscle activations could reinforce joint stability to prevent injuries.

CONCLUSION: In the current study, diagonal and lateral jump-landing protocol excited less lower extremity muscle activations which could lead to joint instability and result in injuries.

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