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Timing of Muscle Activation is Altered During Single-Leg Landing Tasks Following ACL Recontruction at the Time of Return to Sport

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Summary:
The aim of this study was to compare the timing and magnitude of activation of knee extensor and flexor muscles between anterior cruciate ligament reconstructed (ACL-R) and healthy subjects performing single-leg landing tasks. At the time of return to sport ACL-R individuals showed longer quadriceps and hamstrings pre-impact EMG duration, a wider IC and Maximum Post-Impact knee angle

Abstract:
Introduction

Existing literature is controversial in reporting successful or unsuccessful recovery of the motor control of landings after surgery (Bryant et al., 2009; Gokeler et al., 2010). The aim of this study was to compare the timing and magnitude of activation of knee extensor and flexor muscles between anterior cruciate ligament reconstructed (ACL-R) and healthy subjects performing single-leg landing tasks at the time of return to sport.

Methods

Fifteen male (?ST-GR group) and 15 female (?ST-GR group) subjects at an average of 6 months following ACL reconstruction using semitendinosus and gracilis autograft, as well as 15 males using patellar tendon (?PT group) autograft, were recruited. Fifteen male (?Control group) and 15 female (?Control group) healthy subjects served as the control group. Participants performed a Stop Landing (SL) in which they were asked to land holding a bent knee position of 30°, a Smooth Landing (SML) in which they were asked to land smoothly absorbing the impact and a Rebound Landing (RBL) in which they were asked to land and to perform a second jump immediately after the first landing. In all the tasks they landed on a force plate from a 20 cm height platform. Normalized vertical ground reaction force (vGRF/BW), knee angular displacement on the sagittal plane and Electromyographic (EMG) activity of Vastus Lateralis (VL), Vastus Medialis (VM), Rectus Femoris (RF), Biceps Femoris (BF) muscles in the examined limb were recorded during the whole landing phase. Multivariate ANOVA was used to analyze the differences between groups ($p<0.05$).

Results

ACL-R patients showed longer pre-impact EMG duration of quadriceps and hamstrings muscles in the SL task (SL task: ?ST-GR group= VM: 98 ± 19 ms, RF: 96 ± 16 ms, VL: 99 ± 18 ms, BF:182 ± 18 ms, ST: 190 ± 20 ms; ?PT group= VM: 106 ± 21 ms, RF: 104 ± 21 ms, VL: 108 ± 23 ms, BF:184 ± 29 ms, ST: 187 ± 27 ms) and in the other two tasks compared to healthy participants (SL task: ?Control group= VM: 76 ± 18 ms, RF: 68 ± 20 ms, VL: 67 ± 19 ms, BF:146 ± 26 ms, ST: 142 ± 20 ms; ?Control group= VM: 71 ± 10 ms, RF: 72 ± 11 ms, VL: 72 ± 10 ms, BF:159 ± 22 ms, ST: 156 ± 21 ms), as well as a wider Initial Contact (IC) and Maximum Post-Impact knee angle and a greater vGRF compared to healthy

participants in all the tasks.

Discussion

At the time of return to sport ACL-R individuals showed longer quadriceps and hamstrings pre-impact EMG duration, a wider IC and Maximum Post-Impact knee angle and a greater vGRF/BW peak showing an altered neuromuscular control of single-leg landing tasks when compared to healthy subjects, which likely increases the risk of re-injury.

References

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