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ORIGINAL RESEARCH

EFFICACY OF PERTURBATION-ENHANCED NEUROMUSCULAR TRAINING ON HAMSTRING AND QUADRICEPS ONSET TIME, ACTIVATION AND KNEE FLEXION DURING A TUCK-JUMP TASK

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ABSTRACT

Background: Deficits in dynamic neuromuscular control of the knee may contribute to the higher incidence of the anterior cruciate ligament (ACL), specifically in female athletes. Little is known about the effects of preventive training programs on muscle onset time and activation during functional tasks.

Purpose: The purpose of this study was to evaluate the efficacy of perturbation-enhanced neuromuscular training on hamstring and quadriceps onset time and activation, and knee flexion angle in female athletes with quadriceps dominance (QD) deficit during a tuck-jump (TJ) task.

Study Design: Quasi-experimental study

Methods: Thirty-one collegiate female athletes with neuromuscular quadriceps dominance deficit randomly divided into experimental (n = 16) and control (n = 15) group. The experimental group performed a six-week perturbation training (18 sessions). Electromyograhic (EMG) assessment of quadriceps and hamstring activation and knee flexion angles during a TJ task were completed at baseline and after six weeks.

Results: A significant decrease in the preparatory($p = 0.003$) and reactive ($p = 0.013$) quadriceps-hamstring (Q/H) co-activation ratio was found in the experimental group. Perturbation training markedly decreased latency in medial hamstring (MH) ($p = 0.001$), vastus medialis (VM) ($p = 0.004$) and lateral hamstring (LH) ($p = 0.031$), while latency increased for rectus femoris (RF) ($p = 0.001$) and vastus lateralis (VL) ($p = 0.023$) during a TJ task. The experimental group had average increases of 41.1%, 40.8%, and 39.5% in initial knee flexion, peak knee flexion and knee flexion displacement angle during the TJ task, respectively.

Conclusion: Increased preparatory VM and MH activities and decreased Q/H co-activation ratio, decreased VM and MH latency represent preprogrammed motor strategies learned during the perturbation training. This observed neuromuscular adaptation during TJ task could potentially reduce the risk for non-contact ACL injury.

Level of evidence: 2

Key Words: Anterior cruciate ligament, Electromyography, Female, Knee flexion angle, Movement System, Muscle activation.

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CONFILICT OF INTEREST: The researchers independently collected, analyzed and interpreted the results and have no conflicts of interest or financial interests in the results of this study

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