ANALYSES OF ISOKINETIC AND CLOSED CHAIN MOVEMENTS FOR HAMSTRING RECIPROCAL CO-ACTIVATION

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**Introduction:** Researchers have postulated that co-activation of the hamstrings during active knee extension assists the anterior cruciate ligament in maintaining knee joint stability by exerting an opposing force to anterior tibial translation. A lack of knee-joint stability can result in unwanted stresses on the internal structures of the knee, episodes of the knee “giving out” and atrophy of the surrounding musculature. Rehabilitation for anterior cruciate ligament injuries often includes both open and closed chain exercises to strengthen the hamstrings. **Objective:** To analyze the reciprocal co-activation of the hamstrings while performing low and high velocity isokinetic open chain movements and two closed chain exercises, a one and two-legged squat. Hamstring co-activation is defined as the hamstring activity during knee extension. **Subjects:** The subjects were 12 healthy adult females (age = 22.7 ± 2.0 years, mean height = 161.1 ± 6.6 cm, mean weight = 63.5 ± 5.8 kg.) with no known knee pathologies and familiarity with isokinetic testing and the prescribed closed chain exercises. **Design and Setting:** Subjects performed six continuous isokinetic movements at 100° s⁻¹ and 400° s⁻¹ in a reciprocal pattern, (maximal knee extension followed by maximal knee flexion) on a Cybex Norm. They also performed one-legged and two-legged squat exercises, both for six repetitions. **Measurements:** The Root mean Square (RMS) of the Electromyogram (EMG) was used as a measure of overall muscle activity and is reported as a percentage of the maximal voluntary contraction (MVC) of the hamstrings. The RMS of the EMG was calculated for the hamstrings during the repetition of peak muscular activity for both the open and closed chain movements. **Results:** The RMS for hamstring co-activation during knee extension showed significant differences between the open chain isokinetic movements and the closed chain exercises (F= 37.414, P<0.0001) with greater co-activation when performing the isokinetic movements (27% vs. 16% MVC). In addition differences were seen between 100° s⁻¹ and 400° s⁻¹ (F= 5.142, P<0.05) with the greater activity seen at the higher velocity (30% vs. 23% MVC) and between the one and two legged squats (F= 5.06, P<0.05) with greater co-activation during the one legged squat (20% vs. 12% MVC). **Conclusions:** Within the limitations of the study design these results suggest isokinetic movements, particularly at high speed can more effectively strengthen the co-contraction activity of the hamstrings when compared to two commonly used closed chain activities.

Key words: Hamstrings, Isokinetic, Closed-Chain, Electromyogram