TEMPORAL COMPARISON OF HAMSTRING CO-CONTRACTION LATENCY IN ANTERIOR CRUCIATE DEFICIENT KNEES -A PILOT STUDY

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INTRODUCTION

Recently, anterior cruciate ligament (ACL) research has been focusing on strengthening the hamstring muscles, as previous studies have found there to be a significant stabilizing effect by the hamstrings in those subjects with anterior cruciate deficiencies. Research has primarily focuses on whether differences existed between the strength (Moore & Wade, 1989; Seto, Orofino, Morrissey, Medeiors & Mason, 1988), the electromyographical (EMG) output (Tibone & Antich, 1988), or the muscle activation patterns between the quadriceps and hamstrings. (Beard, Kyber, Fergusson & Dodd, 1993; Jennings & Seedhom, 1994). A key factor in hamstring co-contraction during gait is that of timing. Should hamstring co-contraction occur immediately before heelstrike, when the greatest anterior shear force occurs during normal gait or, after heelstrike when muscular strength is ineffective. Joint stabilization therefore, cannot occur if the joint has already been displaced, or the counteracting force has already been exhausted.

This pilot study examined if latency exists between injured and uninjured knees, measuring muscular contractile timing of the hamstrings relative to heelstrike. Similar studies involving static positions with an applied shear force have been performed and have had contradicting results (Beard, Kyber, Fergusson & Dodd, 1993; Jenning & Seedhom, 1994). To date, no temporal measures incorporating a gait analysis have been examined.

METHODOLOGY

Data collection procedures involved using an 8 channel EMG monitor to indicate heelstrike, and the contractile timing of hamstring and quadriceps contraction during a 5-second period while walking/jogging on a treadmill at 5 km/h and 7 km/h both on incline, decline and flat surfaces. Data was collected a three randomly selected 5-second trial periods for both the anterior cruciate deficient and non-injured knee. Analysis involved normalizing the data and expressing hamstring latency as a percentage of the total gait cycle. A gait cycle was defined as the onset of one heelstrike to the onset of the following heelstrike. Hamstring latency was expressed as the percentage of total gait time relative to the hamstrings contraction point prior

to heelstrike during the gait cycle.

RESULTS

Results in this pilot study indicate a significant difference between injured and non-injured legs. Injured leg hamstring latency was greater than non-injured hamstring latency. This indicates that hamstrings begin contraction earlier in the ACL deficient knee than in uninjured knees. Differences found between injured and uninjured legs represent an area of concern for those in the field of rehabilitation. Research into variations in treatment methods to correct for latency in the hamstrings could provide method to develop stability in surgical or non-surgical patients.

DISCUSSION

The next step to further this research will involve the use of an eight-channel EMG recording to measure latency in both legs. A thorough patient history including results on the Cincinnati and Lysholm scales will be utilized to measure knee functional levels. A statistical analysis (ANOVA) will be used to measure differences between injured and non-injured legs during walking speeds of 5 and 7 km/h plus walking down a 10 degree decline. Should a significant difference exists, a correlation between hamstring latency values and scores on the Lysholm and Cincinnati Functional Activity Scales will be performed to reinforce the knee stability and timing differences. The study results will provide the first stage for recommendations to develop muscular retraining protocols utilizing a pre-programmed muscle stimulator.

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