CO-CONTRACTION IN ACL DEFICIENT SUBJECTS

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INTRODUCTION

Co-contraction of the Hamstrings muscles is proposed in the literature as one of the strategies that anterior cruciate ligament deficient (ACLD) subjects can use to compensate the loss of ACL function. This study examined the response of ACLD and control subjects to shear forces in isometric knee extensions.

METHODS

Twelve chronic ACLD and 10 control subjects performed submaximal isometric knee extensions. The task was a positioning task with knee flexion target angles ranging from 5º to 45º with two external flexion moments both applied at two distances on the lower leg in a custom made chair (Figure 1). The shear force was controlled by changing the moment arm without changing the moment. A more proximal placement of a resistance pad will decrease the tibiofemoral displacement [1] and will thus lead to less force on the ACL [2]. Subjects received real-time position feedback about their knee joint angle (Optotrak). The subject was asked to extend the knee to one of the six target angle and hold it there for 5 seconds. Electromyographic data were collected from three Quadriceps and three Hamstring muscles. All EMG signals were normalized to the average EMG during a reference positioning task (30 Nm extension moment for extensors and 25 Nm flexion moment for flexors).

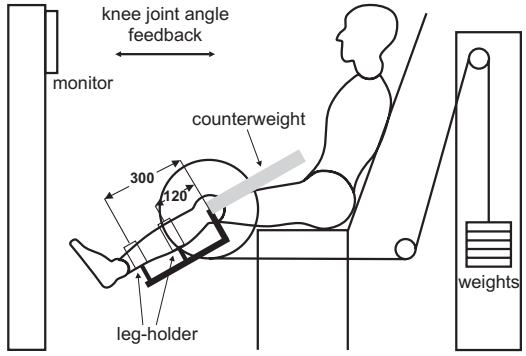

Figure 1: Experimental set-up

RESULTS AND DISCUSSION

The EMG of four muscles during positioning tasks is shown in Figure 2. In the analysis of variance, no significant effect of subject group was found in positioning across all muscles (p-values>0.2). There was a significant interaction between knee angle and subject group for the Biceps Femoris, but this effect was very small and will not have a great impact on the resulting shear forces.

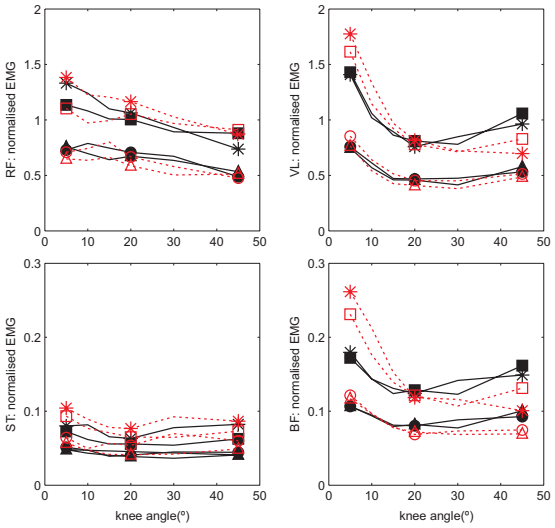

Figure 2: Normalized EMG of four muscles during positioning tasks for control (dashed red line) and ACLD group (solid black line). ✳ = 30 Nm at 120 mm, □/■ = 30 Nm at 300 mm, ○/● = 15 Nm at 120 mm, ▲/Δ = 15 Nm at 300 mm, RF = Rectus Femoris, VL = Vastus Lateralis, ST = Semitendinosus, BF = Biceps Femoris.

Interestingly, neither moment arm nor moment arm x knee angle interacted with subject group, indicating a comparable strategy between the control group and the ACLD group in response to shear force challenges to the knee joint.

CONCLUSIONS

The hypothesis that ACLD subjects increase co-contraction in situations with an increased shear load in sub-maximal isometric knee extensions was rejected.

REFERENCES

1. Jurist KA, et al. *Am J Sports Med* **13** 254-258 1985
2. Zavatsky AB, et al. *Am J Sports Med* **22** 418-423 1994