

THE EFFECTS OF TWO SINGLE LEG REHABILITATION EXERCISES ON MUSCLE ACTIVATION AND RECRUITMENT USING SURFACE ELECTROMYOGRAPHY

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Introduction

Knee injuries are the second most frequent musculoskeletal pathology found in primary care (Van Grinsven, 2010). It has been suggested that the efficacy of knee rehabilitation protocols require further development (Augustsson, 2012). The present study aims to assess the activation of biceps femoris (short and long head (BFS, BFL)) and vastus medialis obliquus (VMO) muscles using surface electromyography (sEMG).

Methods

After University ethical approval the first 7 of 15 participants volunteered, (height $179.3.0\pm 8.9$ cm, mass 79.6 ± 15.8 kg and age 21.3 ± 1.7 yrs). Participants performed an isometric single leg squat (SLBS) and a single leg supine bridge (SLB) at 100, 135 and 170 degrees of knee extension. For five minutes the participants performed 20 seconds of isometric activity followed by 40 seconds recovery and sEMG (Biometrics DataLOG Type MWX8) was collected simultaneously from VMO, BFS and BFL.

Root mean squared sEMG and median frequency of the power density spectrum were analyzed with respect to muscle, exercise and knee joint angle, using a 4 way ANOVA.

Results

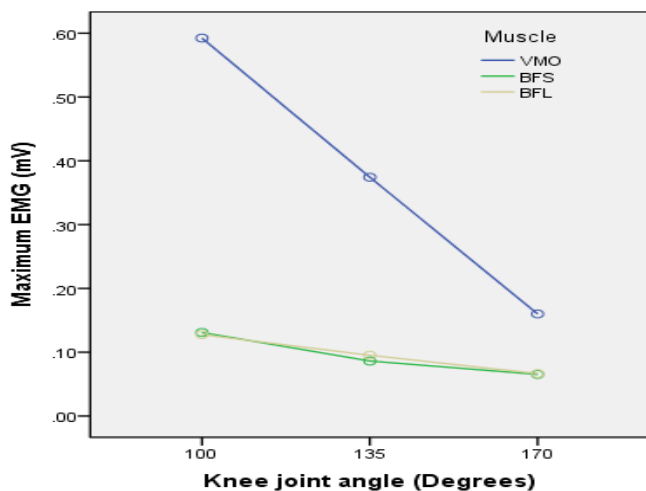


Figure 1: Pooled mean, maximum EMG (SLBS)

A significant interaction was observed between muscle type and position during SLBS and SLB ($p = 0.05$ and 0.02 respectively). Peak muscle activity was greatest in VMO at 100 deg. (0.59 ± 0.10) during SLBS and decreased with increasing joint angle. BFS activity was greatest at 170 deg. (0.29 ± 0.06) during SLB and decreased with decreasing joint angle. BFL activity was greatest at 170 deg. (0.26 ± 0.06) during SLB and decreased with decreasing joint angle. Greatest activation combinations were observed between VMO (100 deg. SLBS) and BFS (170 deg. SLB) and VMO (100 deg. SLBS) and BFL (170 deg. SLB).

Discussion

Greatest VMO activation at the deepest knee joint angle during SLBS suggests deeper angles during resisted flexion are preferred for VMO contrary to traditional rehabilitation methodology. This is substantiated with minimal change in MF across the remaining joint angles. BFL and BFS exhibited low activation patterns with respect to knee joint angle suggesting SLBS is an ineffective exercise for lateral hamstring activation.

The increase in both BFL and BFS activity with increasing joint angle, suggest large knee joint angles during SLB activate the lateral hamstrings during resisted knee extension. The MF remained constant across the angles suggesting this bi-articular muscle maybe activated across a broad spectrum of angles.

Conclusion

The relationships between intra and inter-muscular activity & motor unit behaviour vary dependent on joint angle specificity. This information may be useful in developing the optimal protocols for rehabilitation programs.

References

- Augustsson, J. Knee Surg Sports Traumatol Arthrosc. DOI 10.1007/s00167-012-2167-3 2012
- Van Grinsven S. *et al.*, Knee Surg Sports Traumatol. 18:1128-1144, 2010