

Meeting Abstract

Difference between the activation level of the vastus medialis oblique and longitudinal muscle during an open kinetic chain exercise

Diferencia entre el nivel de activación del músculo vasto medial oblicuo y longitudinal durante un ejercicio de cadena cinética abierta

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Introduction

The role of the vastus medialis (VM) of the quadriceps, as a medial patellar stabilizer, has been linked to pathomechanics of patellofemoral dysfunction, which is a high-prevalence pathology, especially in women. From the anatomical point of view, it has been described that this muscle has two large groups of fibers that are differently aligned, which could indicate a subdivision of the VM in an oblique (VMO) and a longitudinal portions (VML) (1,2). However, there are few bibliographic records that support this assumption from the functional point of view (3). The aim of this study was to compare the activation level of the oblique and longitudinal portions of the vastus medialis during an open kinetic chain exercise of the knee. The purpose was to contrast the following hypothesis: During a knee extension exercise, "The activation level of the VMO is higher than the VML's". The acceptance or rejection of this hypothesis may provide new information about the functionality of the compartmentalization of this muscle.

Methodology

The sample consisted of 12 healthy young women volunteers (age: 21.4 ± 2.0 ; weight: 58.1 ± 7.5 ; height: 1.6 ± 0.1) who gave their informed written consent; the EMG activity of VMO and VML was recorded (4) using two two-dimensional 32 surface electrodes arrays, arranged in four columns of eight. Records were performed during an open kinetic chain exercise of the knee, on a quadriceps bench, from 90° of flexion to full extension position and subsequent return to the starting position. The speed of the concentric and eccentric phases of exercise was controlled by visual feedback to volunteers from an electrogoniometer located on their knee. Volunteers performed the exercise with loads of 5, 10 and 15% of their body weight (BW). Amplitude values of the EMG signal were determined using the root mean square (RMS). The comparison of the amplitude values between the muscles was performed using the Student's t-test for

independent samples, using one tail and a statistical confidence level of 95%. Those differences associated with a p-value less than 0.05 were considered as statistically significant differences.

Results

In the isometric phase of exercise at 5% of BW, an increased activation of VML ($p = 0.007$) was observed, while at 10%, the VMO showed a greater activation ($p = 0.003$) in the same phase. In the exercise at 15% of BW, the VMO, in all phases, a greater activation than the VML (concentric: $p = 0.03$; isometric: $p = 0.03$, eccentric: $p = 0.04$) was shown.

Discussion

The knee extension exercise on a quadriceps chair is a regular exercise in the rehabilitation of patients with patellofemoral dysfunction. An important role has been given to the VM in the medial stabilization of the patella during this pathology. Based on the anatomical background, this muscle would have two portions, which have been identified by the arrangement of their fibers. Therefore, the VMO would have a greater medialization function of the patella than the VML, which may be the cause of the greater activation level of the VMO recorded in this study. Another important element is that this increased activation is apparently dependent on the resistance level in which the exercise is applied, since at low levels (5 and 10%), these differences were not so evident. The findings of this study indicate that there is a functional substrate which corroborates the anatomical compartmentalization of the VM in the VMO and VML portions.

Conclusion

For the sample assessed, the VMO has a greater activation than the VML in open kinetic- chain knee-extension exercises with a resistance of 15% of body weight.

References

1. Vieira EPL. Anatomic Study Of The Portions Long And Oblique Of The Vastus Lateralis And Vastus Medialis Muscles: Review Article. *J Morphol Sci.* 2011; 28(4):228-34.
2. Carlson K, Smith M. A Cadaveric Analysis Of The Vastus Medialis Longus And Obliquus And Their Relationship To Patellofemoral Joint Function. *I Res J Biological Sci.* 2012; 1(5):70.
3. Hubbard JK & Opersteyn S. EMG Analysis of two Portions of the vastus medialis muscle during selected knee rehabilitation exercises. *J Musculoskelet Res.* 2002; 6(2):107-18.

4. Rainoldi A, Falla D, Mellor R, Bennell K, Hodges P. Myoelectric Manifestations Of Fatigue In Vastus Lateralis, Medialis Obliquus And Medialis Longus Muscles. J. Electromyogr Kinesiol. 2008; 18:1032-7.
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