

VASTUS MEDIALIS OBLIQUE AND VASTUS LATERALIS ACTIVITIES RATIO ON SELECTED DEGREES OF RANGE OF MOTION IN OPEN AND CLOSED KINETIC CHAIN DURING ISOMETRIC CONTRACTION

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ABSTRACT

Background: The purpose of this study was to investigate the ratio of Electromyography (EMG) activities of the vastus medialis obliquus (VMO) and vastus lateralis (VL) within seven angles of knee joint range of motion using isometric contraction in open kinetic chain (OKC) and closed kinetic chain (CKC).

Methods: The dominant knees of 44 healthy female subjects (mean age: 24.84 with range: 20-30 years old) were analyzed. Surface electrode pairs were attached over the VMO and VL by using Basmajian methods. The EMG biofeedback data was collected while the subject performed isometric contraction on isometric and squat exercise within 7 degrees (0° to 90°) with 15° intervals of knee flexion angle.

Results: Paired T-test and ANOVA were performed between variables. Results demonstrated that in this study there are significant differences: I) between OKC and CKC exercise in 0°, 15°, and 30° of knee flexion, II) between all angles in CKC except: 0-15°, 0-30°, 0-45°, 15-30°, 60-75°, and 75-90°, and III) between 15-60°, 30-60°, 45-60°, and 60-90° in OKC ($p < 0.001$).

As a result in OKC and CKC respectively, 60° and 15° angles of knee flexion were most sufficient positions (i.e. increased VMO/VL activities ratios), -15° and 90° of knee flexion were the most insufficient positions and arc of movement between 45-75° and 0-30° was considered as the most sufficient arc of movement.

Conclusion: As the result of this research and biomechanical and neuro-physiological viewpoints, emphasized in the literature, our recommendations are: in early phase or in early sessions of treatment of patellofemoral joint dysfunction, treatment exercise done in CKC & sufficient position and after progression of the patient's condition, OKC exercises could also be considered.

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Keywords: Patellofemoral Joint, Closed Kinetic Chain, Open Kinetic Chain, Electromyography.

Comparison of different degree of knee angles in a different kinetic chain exercise

In OKC exercise:

1) The muscle activities ratio of VMO/VL at 90° angle compared with other used angles was not statistically significant,

2) Ratio of VMO/VL muscle activities at 15° knee flexion with exception of 0° and 90° angle of knee flexion was statistically significant,

3) In all remaining conditions one can say that the important point is that 60° knee flexions with compared used angles are far better, and the VMO ratio of muscle activities can be benefited (Fig. 1),

4) The degree of angle in kinetic chain exercise, 45-75° angles are the most effective knee flexion in the exercise, which might benefit the VMO muscle compared with VMO/VL muscle activities.

In CKC exercise:

1) The important point in CKC investigation is that in comparing all positions with respect to VMO/VL muscle activities there are significant differences and in most measured angles lower angles (toward extensions) had a higher ratio, which would benefit the VMO.

2) In all remaining conditions the ratio of VMO/VL had benefited VMO muscle activities. As the knee moves from flexion into extension, this ratio also increases.

3) 0-30° knee range of motion would be the most suitable angle to be defined in CKC exercise (Fig. 1).

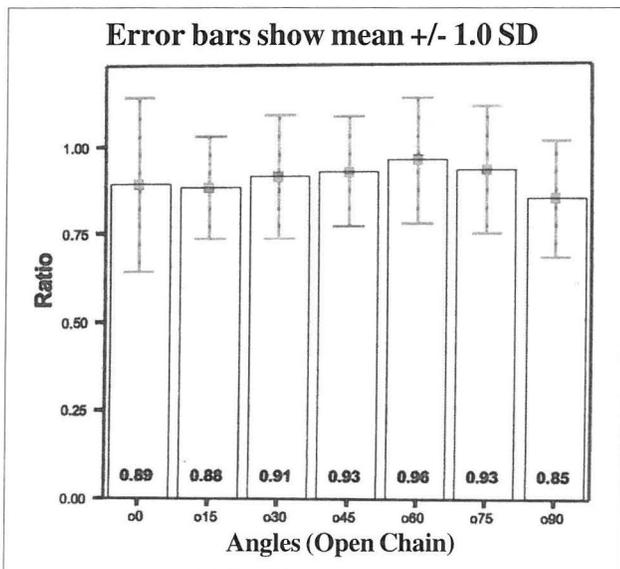


Fig. 1. Mean of VMO/VL ratio comparison for OKC.

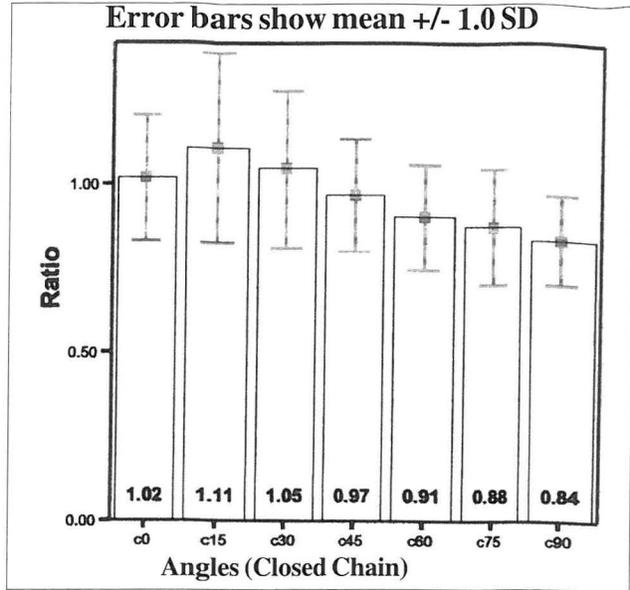


Fig. 2. Mean of VMO/VL ratio comparison for CKC.

In conclusion, in CKC exercise:

1) All over, the ratio of muscle activities in VMO/VL were statistically significant even at lower degree of angles.

2) VMO/VL muscle activities ratios were found to follow the sequences in favor of VMO, as ROM moves.

3) Results demonstrate that the 0-30° of angles could be most suitable and effective curve in CKC exercise (Fig. 2).

DISCUSSION

VMO activity was significantly higher in the closed chain compared to the open chain regardless of angle, however insignificant differences were seen in VL activity between the open and closed chains. MVICs for knee extension performed in the closed kinetic chain at 15° of knee flexion appear to generate the highest EMG activity of the VMO compared to the other positions examined in this study, however differences between differing knee flexion angles within and between the OKC and CKC exercises suggest that knee flexion angle should be considered when prescribing OKC and CKC rehabilitation exercises for quadriceps strength development.

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