KNEE EXTENSORS FUNCTION AND MORPHOLOGY IN ELDERLY WITH KNEE OSTEOARTHRITIS AFTER ELECTRICAL STIMULATION TREATMENT

[1]Marco A. Vaz, [1,2]Rafael R. Baptista, [1]Jeam M. Geremia, [1]Fernando A. de Lemos, [1]Fábio J. Lanferdini, [1]Alexandre Mayer, [3]Adamantios Arampatzis

[1]Federal University of Rio Grande do Sul – Brazil; [2]Pontifical Catholic University of Rio Grande do Sul - Brazil

[3]Institute of Biomechanics and Orthopaedics of the German Sport University of Cologne; email: marcovaz@esef.ufrgs.br

INTRODUCTION

Knee osteoarthritis (OA) seems to affect quadriceps muscle architecture [1] and strength [2]. A recent study with older adults submitted to a home-based electrical stimulation treatment for knee osteoarthritis, found an increase in quadriceps strength [3]. However, none of the studies reviewed evaluate the effects of electrical stimulation on muscle structure. Therefore, the purpose of this study was to evaluate vastus lateralis (VL) morphology (muscle architecture, volume and cross sectional area) and quadriceps torque-angle relationship of elderly with knee OA after eight weeks of electrical stimulation treatment.

METHODS

Fourteen women and two men (age 59.13±8.20 years) with clinical OA diagnosis were submitted to an eight weeks electrical stimulation treatment of the quadriceps muscle. The torque-angle relationship was determined with an isokinetic dynamometer (Biodex System 3 Pro) at knee joint angles of 30º, 45º, 60º, 75º and 90º. Additionally, subjects were submitted to ultra-sonography (ALOKA SSD 4000) at rest to evaluate in vivo muscle architecture (pennation angle and fascicle length) of VL seated in the dynamometer with the knee joint set at the same angles as those of the torque-angle relationship. Subjects had their VL anatomic cross sectional area (CSA) measured by magnetic resonance image (MRI; Siemens Magnetom Visio Plus) by axial scans of the thigh (slice thickness = 4 mm). The VL volume was calculated by adding the product of cross-sectional area and slice thickness of all images. A t-test for dependent samples was used to check for any differences in the above variables between the pre and post electrical stimulation periods. The level of significance was set at $p \leq 0.05$ for all statistical tests.

RESULTS AND DISCUSSION

The fascicular length increased (pre-treatment = 86.19 ± 19.71 cm; post-treatment = 102.77 ± 19.00 cm; p=0.02) and pennation angle decreased (pre-treatment = 10.12 ± 2.58º; post-treatment = 7.98 ± 2.55º; p=0.03) with treatment at the knee joint angle of 90º. There was a 10% increase in torque at 60º (p=0.03) and a 9.7% increase at 75º (p=0.04), respectively (figure 2). Also, a 10.2% increase was found (p=0.0002) for the cross-sectional area (figure 1) between pre- (11.77 ± 2.26 cm^2) and post-treatment (12.97 ± 2.03 cm^2), whereas the VL volume increased 10.5% (p=0.0017) from pre- (805.01 ± 147.74 cm^3) to post-treatment (889.80 ± 148.94 cm^3). Unfortunately, due to the higher cost of the radiology exams, we were unable to match our experimental group with healthy patients. Although this is a clear limitation in our study, which does not allow us to conclude on effects of electrical stimulation on muscle morphology and function, our results agree with Talbot et al. [3] that found an improvement in quadriceps strength. Furthermore, our patients improved their torque at the plateau of torque-angle relationship, accompanied by an increase in rest fascicular length.

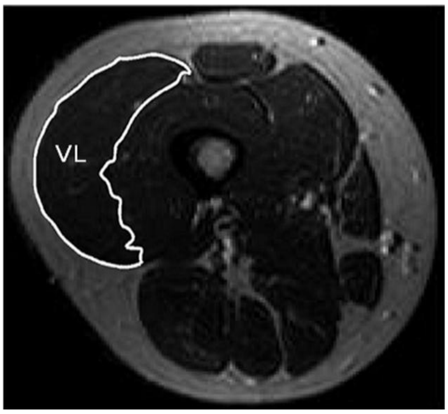

Figure 1: MRI images showing how the VL CSA was obtained for pre- and post-treatment comparison.

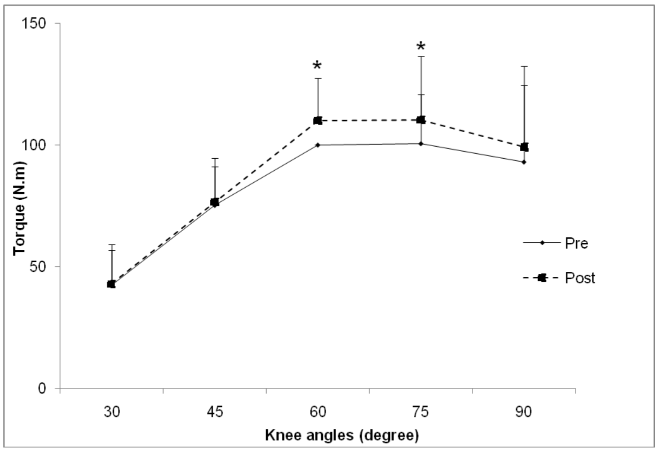

Figure 2: Quadriceps torque-angle relationship from pre- and post-treatment (*=p≤0.05).

CONCLUSIONS

After eight weeks of electrical stimulation we found an increased VL CSA, volume and fascicular length, and a reduced pennation angle in elderly with knee OA. We also observe an increased knee extensors torque at 60º and 75º, suggesting a positive effect in both muscle morphology and mechanical function.

REFERENCES

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ACKNOWLEDGEMENTS

We would like to thank Kirsten Albracht for technical help.

Financial support: FINEP - Brazil