DIFFERENCES BETWEEN OPERATED AND NON-OPERATED SHOULDER MUSCLE ACTIVATION PATTERNS RECORDED DUIRNG THE DRAGON BOAT "LONG AND HARD" STROKE

[1]Linda McLean, Ellen Keeves, Jen Wolfe, Karen Filion, Anna Smith, Tierney Bowen, Degen Southmayd
[1]Queen's University School of Rehabilitation Therapy,
Email: mcleanl@post.queensu.ca

INTRODUCTION

Surgery for breast cancer often results in muscle weakness, loss of shoulder motion, and pain (Blomqvist et al., 2004). Many women begin to participate in dragon boat training and racing post-operatively as a form of fitness and as a source of social support. Changes in the force couples at the shoulder joint may predispose women who dragon boat to develop shoulder overuse and/or impingement syndromes.

We hypothesized that women who had undergone partial or complete mastectomy with lymph node dissection would demonstrate differences in muscle activation patterns during the performance of the dragon boat stroke on their operated as compared to their non-operated side.

METHODS

Nine experienced female dragon boaters and breast cancer survivors from the Kingston Region participated in this study. Participants were required to have undergone a unilateral partial or complete mastectomy with lymph node dissection.

Delsys™ DE2.1 electrodes were used to record electromyographic (EMG) activity from seven muscles bilaterally, including the anterior deltoid, serratus anterior, pectoralis major, posterior deltoid, teres major, infraspinatus, and supraspinatus based on positioning described by Decker et al.(1999) and Hintermeister et al. (1998). Bipolar fine wire electrodes were used to record the activity of the subscapularis muscle. Each subject performed a series of three repetitions of a maximal voluntary isometric contraction (MVIC) for each muscle. She then performed ten repetitions of the "long and hard" dragon boat paddle stroke on each side, using a water trough and regular dragon boat paddle to simulate the activity.

Maximum voluntary electrical activation (MVE) was determined by using the highest root mean square value (RMS) computed over 200ms moving windows across each data set. The MVE was compared between the operated and non-operated sides for each muscle using a one-way repeated measures ANOVA (alpha = 0.05). The maximum activation amplitudes achieved during paddling were tested using a three-way repeated-measures ANOVA including muscle, recording side (operated vs. non-operated) and paddling side (operated vs. non-operated) as factors, and all two-way interactions (alpha = 0.05).

RESULTS AND DISCUSSION

Four subjects had been operated on their dominant side, while five had been operated on their non-dominant side. Four subjects consented to having fine wires inserted bilaterally.

There were no significant differences between the operated and non-operated sides in terms of the MVE generated during the MVIC at any of the eight muscles studied.

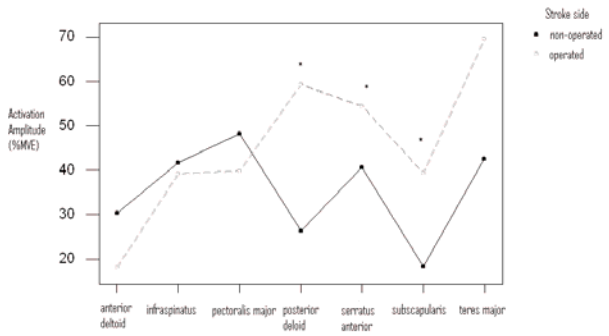

Figure 1: Mean peak muscle activation amplitude on the operated side when paddling on the operated vs. the non-operated side. (* denotes statistically significant differences)

During performance of the dragon boat stroke, there were significant muscle by side (operated and non-operated) and muscle by paddling side interactions ($p<0.0005$). As such the data for each muscle were analyzed separately. Post-hoc analyses revealed that the posterior deltoid, serratus anterior and subscapularis muscles on the operated side worked significantly harder than those same muscles on the non-operated side, particularly when paddling on the operated side.

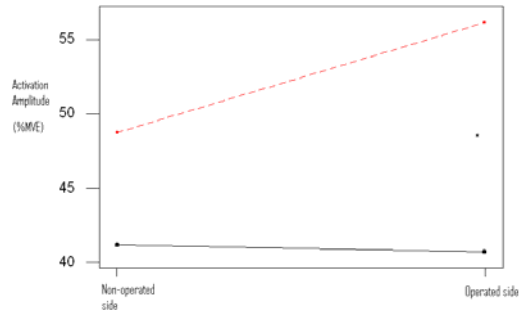

Figure 2: Activation amplitude of serratus anterior muscle on the operated and non-operated side during the "long and hard" stroke. (Solid line denotes paddling on the non-operated side; dotted line denotes paddling on the operated side, * denotes statistical significance at alpha = 0.05)

CONCLUSIONS

Due to differences in force couples at the shoulder induced by these muscle activation differences, these results may explain why women who participate in dragon boat training often develop shoulder pain on their operated side.

REFERENCES

Blomqvist L et al., *Acta Oncologica*. Vol. 43(3) pp 280-283, 2004.
Hintermeister RA. Et al. *Am J Sports Med. Vol. 26(2)pp 210-220, 1998.*
Decker MJ et al. *Am J Sports Med. Vol. 27(6)pp 784-791, 1999.*