Breast Cancer Survivors Alter Scapular Kinematics during a Progressive Lifting Task

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Summary

Breast cancer survivors experience altered scapular kinematics during a progressive lifting task both between consecutive repetitions and between sets with increasing loads. As workload increases, breast cancer survivors adapt scapular kinematics to meet the task demands.

Introduction

Breast cancer survivors (BCS) may experience shoulder issues after treatment [1]. Elucidating movement deficiencies post-surgery can inform intervention strategies to improve shoulder function and health longevity. Following breast cancer surgery, upper limb strength is affected and fatigue can ensue which can hinder quality of life [2]. Therefore, we examined shoulder motion among BCS during a progressive overhead lifting task with increasing loads.

Methods

Twenty-one female BCS (53±11 years; 17 right-handed) who underwent either mastectomy and/or reconstruction were assessed. Participants were fitted with reflective markers tracking thorax and upper limbs. A double calibration method was used for the scapulae.

Each participant performed a progressive overhead lifting task, involving lifting a crate from waist height to forehead height. Four sets of 5 repetitions were completed. Load was increased for each set according to participants' rating of perceived exertion with the goal of reaching a challenging (>8/10 rating) exertion.

Scapular internal rotation (IR) and upward rotation (UR) were calculated bilaterally [3]. Scapular angles were extracted per repetition cycle which represented the bottom of the lift (near wasit height) to the top of the lift (when the hand reached peak position) and normalized to 100 data points. Statistical parametric mapping (SPM) repeated measures analysis of variance tests were used to compare the entire cycle between repetitions and sets per scapular angle and side.

Results and Discussion

SPM analyses indicate there is a main effect for repetition and set. Right ($F_{4,80}$=4.19, p<0.001, range: 27-55% cycle) and left ($F_{4,80}$=4.06, p=0.004, range: 25-42% cycle) scapular IR increased over repetitions within a set (Figure 1). Left side IR ($F_{3,60}$=4.96, p=0.013, range: 20-29% cycle) decreased between sets, as did left side UR ($F_{3,60}$=4.79, p=0.002, range: 80-100% cycle) while right side UR increased ($F_{3,60}$=4.78, p<0.001, range: 70-100% cycle) (Figure 2).

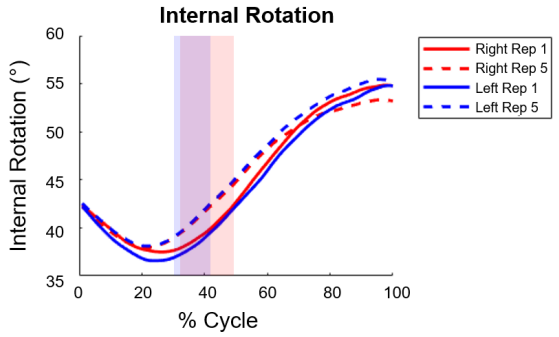

Figure 1. Average internal rotation of the first and last repetitions.

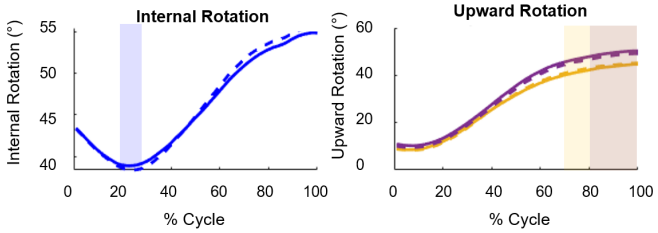

Figure 2. Average internal rotation and upward rotation (right: yellow; left: purple) of the first (solid) and last (dash) sets.

BCS are known to have pectoralis tightness and demonstrate greater IR [1] which could become more pronounced during demanding tasks, representing an adaptation for increased effort.

Final sets show the right side exhibits more UR while the left side exhibits less. While more participants were right-handed, this might explain varied adaptations with increasing workload. IR and UR movement alterations are connected to other musculoskeletal injuries, suggesting a connection between task demands, scapular motion, and musculoskeletal health [4].

Conclusions

BCS alter scapular motion between repetitions and sets with increasingly loaded lifts. These adaptations may impact abilities or injury risk in daily life.

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References

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