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# A Comparison of the Upper Limb Lift Test between Women with Breast Cancer and Healthy Control Subjects

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**Abstract title: A COMPARISON OF THE UPPER LIMB LIFT TEST BETWEEN WOMEN WITH BREAST CANCER AND HEALTHY CONTROL SUBJECTS.**

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Background: Objective measures of upper limb (UL) function specific to breast cancer survivors (BC) are limited. Motion, strength, and muscular endurance are measurable components of UL function. A clinical test that quantifies these components is needed.

Purpose: This study compares the Upper Limb Lift Test (ULLT) between women with BC and healthy control subjects (HC) at baseline, 1-3 months, and 12+ months post-operatively enrolled in a prospective surveillance trial with early intervention. A secondary purpose was to validate the ULLT by comparing findings to self-reported UL function, symptom distress, and shoulder motion in a group of women with BC and healthy control subjects.

Methods: One hundred sixty BC (53.1± 11.7 years with a body mass index of 26.7±6.1kg/m<sup>3</sup>) completed ULLT and self-reports of UL function, symptom distress, and shoulder motion pre-operatively and at 1-3 months and 2 months post-operatively. Fifty-nine HC subjects (51.4±13.6 years with a body mass index of 26.3±5.7 kg/m<sup>3</sup>) completed the same measures during a single visit. Each subject completed ULLT on each limb (right = RULLT and left = LULLT). The ULLT is a series of repeated shoulder elevations against resistance, moving a dumbbell anthropometrically scaled to the participant weight from a scaled height. Perceived exertion (RPE) using BORG20 was measured post ULLT. Descriptive statistics of all variables including repetitions and PE were calculated for group by time using SPSS ver21. A repeated measures analysis of variance was used to compare HC to BC over time. The ULLT and shoulder flexion, abduction, internal and external rotation motion were measured by a clinician. Subjects completed the following questionnaires: Disabilities of the Arm, Shoulder, and Hand-Quick (Quick DASH), SF-36 and Symptom Distress questionnaire. Women with BC completed the questionnaires at baseline, 1-3 months and 12 months post-operatively, and were compared to HC at one time point.

Results: At baseline the mean (SD) repetitions lifted were 17±5 and for RULLT and LULLT for BC and 15±6 for RULLT and LULLT for HC respectively. Differences between number of repetitions completed for both RULLT, LULLT were significant between HC and BC groups (p=0.003) at baseline. There were no significant differences at 1-3 months and 12+ months between RULLT and LULLT with the mean (SD) for BC was 16±7 and 16±6 for the RULLT respectively, and 15±7 and 16±6 for the LULLT respectively. RPE averaged 12.4± 2.9 for all BC. No significant differences in RPE were found between groups at 1-3 months, however, RPE at 12+ months was significantly lower at 12+ months in the BC (p=0.034).

Conclusion(s): The ULLT repetitions were significantly lower in HC compared to BC at baseline for both UL. This suggests that women with BC had adequate lifting capacity at time of cancer diagnosis. There was no significant difference at 1-3 months or 12+ months post-operatively indicating the prospective surveillance and early intervention was effective in improving upper limb lifting capacity.

Implications: The ULLT provides an objective measure of UL function (motion, strength, and muscular endurance) which can be used throughout BC treatment to identify if impairments exist and guide rehabilitation strategies.

Key-Words: breast cancer; muscle endurance; muscle strength

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Ethics approval: This study was an NIH and WRMMC IRB approved trial, and informed consent was obtained from all participants.

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