The effect of radiotherapy following modified radical mastectomy on hand grip strength and pinch grip strength in breast cancer females

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Background: Breast cancer is most common malignancy among women, accounting for nearly 1 in 3 cancers diagnosed among women in USA & is among most common cancers in women in India. Decreased muscle strength and long term weakness following surgical management of breast cancer may lead to reduced hand function including range of motion. The present study was conducted to compare hand grip strength and pinch strength pre and post radiotherapy in patients following modified radical mastectomy.

Methods: Twelve subjects who had recent modified radical mastectomy were recruited for the study. Readings of hand grip strength and pinch strength (tip to tip, key pinch and palmar pinch) were recorded and compared by a hydraulic jamar hand dynamometer and pinch gauge meter respectively pre and post radiotherapy.

Results: The result of the present study showed that there was significant difference in grip strength (p=0.0064) and pinch strength (tip to pinch, p=0.0018, Key pinch p=<0.0001) and palmar pinch p= <0.0001) pre and post radiotherapy following modified radical mastectomy in breast cancer subjects.

Conclusion: The present study shows decrease in hand grip and pinch grip strength post-radiotherapy following modified radical mastectomy in breast cancer subjects. The study emphasizes the role of long term physiotherapy and rehabilitation of the patients.

Keywords: Radiotherapy, Radical Mastectomy, Pinch Gauge Meter, Grip and Pinch Strength.
were almost perfect (ICC values 0.85 – 0.98). In addition to its predictive value grip strength and pinch strength are considered to be the objective outcome parameters and are used to quantify outcome after orthopedic intervention. Although changes in upper limb has been noticed but there is not much literature showing post radiotherapy effects on the hand grip and pinch grip strength. Therefore, we conducted current pilot study to note the effects of radiotherapy following modified radical mastectomy on hand grip and pinch grip strength.

Materials and Methods
The current pilot study was conducted in Himalayan Institute of Medical Sciences after taking approval from the ethical committee. It was a non-interventional, observational study conducted in first 6 months 2013. Patients between the age of 28 to 50 years, who had undergone radiotherapy following unilateral mastectomy, with no history of shoulder disorder were included in the study. Patients who had undergone bilateral mastectomy or had history of repeated surgery of breast or radiotherapy or had any neurological condition affecting spine and shoulder joint were excluded from the study.

The patients were evaluated 3 weeks after radical mastectomy but before radiotherapy and 1 day after completion of total radiotherapy sessions. Twelve subjects were found eligible for the study and were included in this pilot project. Pre and post readings of grip strength and pinch strength following radiotherapy were recorded by a hand held jamar dynamometer and pinch gauge meter respectively by a single observer.

Procedure
To record the grip strength the subject was seated in a chair with forearm supported and the upper limb positioned according to the recommendations of the American Hand Society of Hand Therapists i.e. shoulder adducted and neutrally rotated, elbow 90° flexed, forearm in neutral position, and wrist slightly extended (0-30°). The dynamometer was reset to zero prior to each reading of grip strength. The subject was told to squeeze the handles of the dynamometer together with as much force as possible and make a total of three attempts in the above-mentioned position, thereafter the mean of these readings was recorded in kg. To control for fatigue, the subject was asked to take a rest period of 30 sec between each attempt. To record pinch strength, the hand was kept parallel to the floor and measures were taken. The three pinch tests were performed. The pinch gauge meter was rested on the therapist hand. The thumb tip to tip of the index finger (tip to tip pinch), thumb to the side of middle portion of the index finger (key pinch) and thumb tip to the tip of both the index and middle finger (palmar pinch) were measured. For hand grip and pinch strength measurements were recorded in kilograms and were rounded up to the nearest kilogram.

Data Analysis
Statistical analysis was performed using Graph Pad. Pre and post radiotherapy groups were compared using paired “t” test for analysis and following values with significance levels P= 0.0002, P< 0.0001, P< 0.0001 and P=0.0015 were taken.

Results
Four variables were included i.e. hand grip strength, key pinch strength, tip to tip pinch strength and palmar pinch. The pre and post mean for hand grip strength was (5.592± 0.9681) and (5.258± 0.9060) with p value of 0.0002, whereas the mean for tip to tip pinch strength was (2.583±0.3589) and (2.275± 0.4137) with p value of (p< 0.0001), key pinch strength mean (2.417±0.2887) and (2.417± 0.2887) with p value of (p<0.0001) and palmar pinch strength mean (2.708±0.2575) and (2.508± 0.3204) with p value of 0.0015 respectively.

Discussion
The current study measured the four variables i.e. hand grip, tip to tip pinch, key pinch and palmar pinch before and after the radiotherapy following modified radical mastectomy. We found a significant reduction in all 4 parameters. Jurdana studied “Radiation effects on skeletal muscle” and suggested that higher doses of radiation may induce apoptotic cell death and muscle necrosis, caused by o damage of blood capillaries and connective tissue. Resulting in myo-fiber degeneration resulting in irrev. Schneider stated radiotherapy has influenced the bone marrow response possibly due to changes (or alteration) in bone marrow which affects the vascularization of the bone and muscle as well as other tissues and also disturbs the generation of the muscle forces due to failure in the excitation – contraction coupling process thus limiting muscle contraction.

Sandra stated upper body morbidity is common following treatment for breast cancer despite advances treatment methods such as radiation or (radiotherapy) this support current pilot study with four variables showing significant reduction in hand grip and pinch strength.
Conclusion
Optimal hand grip strength is important for a normal functional independence and manipulative ability of the human hand requires muscle strength, sensibility and dexterity. This gets compromised after radiotherapy following modified radical mastectomy as noted in this study. A further study with larger sample size needs to be done to confirm these findings.

Limitation of Study
The present study was done on a small sample size and pain, range of motion criteria was not taken into account. Also implication of reduced grip and pinch strength on individual Activities of daily living not measured

References