Effectiveness of proprioceptive neuromuscular facilitation for improving for shoulder biomechanical parameters, function, and pain after axillary lymph node dissection: a randomized controlled study

Study Protocol and Statistical Analysis

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Breast cancer is the most common type of cancer affecting women of all ages worldwide. An increase in the incidence of breast cancer is observed with the effect of widespread screening programs today. Improved and comprehensive treatment options (surgery, radiotherapy, systemic adjuvant and neoadjuvant therapy, hormonal therapy) have increased the survival rate and life expectancy. This has necessitated a focus on the short, medium and long term complications of breast cancer treatment and their management. Axillary lymph node dissection and radiotherapy are associated with pain, physical symptoms, and decreased functional abilities in the upper extremity. This study aimed to compare the potential effects of proprioceptive neuromuscular facilitation (PNF) technique on muscle strength, pain and functionality in this patient group with progressive resistance exercise (PRT).

Inclusion Criteria:

- Individuals diagnosed with stage II-III breast cancer
- 30-65 years old
- ALND was performed by the same surgeon regardless of breast resection level.
- Receiving radiotherapy
- Individuals who spent the first six months after surgery were included in the study.

Exclusion Criteria:

- Diagnosed with stage IV or metastatic breast cancer
- Developing bilateral breast cancer
- Developing lymphedema in the postoperative period
- Any contraindication to exercise
- Participating in any physiotherapy program for the upper extremity in the last 6 months
- Have significant cardiac, pulmonary or metabolic comorbid disease
- Individuals with communication problems were excluded from the study.

The study was designed as a randomized, controlled, single-blind, prospective study to compare the effectiveness of PNF technique and progressive resistance exercise. Patients who applied to Istanbul Medipol University General Surgery Department for routine control after breast cancer treatment were determined. Individuals who were willing to participate and met the inclusion criteria were divided into 3 groups (PNF, progressive resistant ex., control) using the website www.randomizer.org.

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Proprioceptive Neuromuscular Rehabilitation group

The PNF technique was performed in the supine position with the hip joints of the patients in 30° flexion and the lower extremities in semi-flexion. The application was performed in 2 different diagonal and 4 different patterns (flexion-abduction-external rotation/extension-abduction-internal rotation, and flexion-adduction-external rotation/extension-abduction-internal rotation) of the upper extremity. When starting the exercise, the muscles were first brought to their longest position and the patient was asked to move in the direction of the pattern with resistance (concentric contraction) and to maintain this position for 6 seconds at the end of the pattern (isometric contraction). Then, while the therapist was taking the patient's arm to the starting position, the patient was asked to prevent movement (eccentric contraction). All of these moves counted as one repetition. 3 sets of 8-12 repetitions were performed for each pattern.

Progressive Resistance Exercise Group

Strengthening exercises targeting the upper extremity main muscles were applied to the PRE group with progressive resistance. Dumbbells and sandbags were used as resistance equipment. resistance intensity; 50-80% of a repetition maximum (RM) was determined according to the patient's tolerance. The exercises were applied as 8-12 repetitions and 3 sets. A rest period of 60-90 seconds was allowed between each set. After the 4th week of the training, 1 RM was measured again and the resistance density was updated. The 8 strengthening exercises to be applied were created by taking examples from the literature and in accordance with the "Guidelines for implementing exercise programs exercise programs for cancer patients". These exercises are: "dumbbell fly", "triceps extension", "biceps curl up", "one-arm bent over row", "dumbbell sides rise", "lifting the arm forward", "wrist curl" and side lying shoulder internal - external rotation".

Control Group

The patients in the control group were instructed to continue their usual daily lives (not changing their physical activity levels, diet, drug use, etc.) until the date of re-evaluation after the initial evaluation. Information was given about the upper extremity normal range of motion exercises that they could apply at home, and a brochure was given.

Primary Outcome Measure:

1.Isokinetic dynamometer

Humac Norm, model 770, Computer Sports Medicine Inc., Stoughton, USA was used to biomechanically evaluate shoulder flexors/extensors, abductor/adductors, internal/external rotators. Muscle strength was measured at 60°/s, muscle strength at 120°/s, endurance at 180°/s angular velocity and in concentric/concentric mode. 5 repetitions at 60°/s and 120°/s angular velocity, and 15 repetitions at 180°/s angular velocity were performed at the measured active range of motion. The measurement was performed only on the operated side upper extremity. A rest period of 2 minutes was provided between series of each muscle group and 5 rest periods between different movement patterns. For each angular velocity, the first trial was subtracted, and the average peak torque value of the remaining repetitions (the force produced by the individuals at the maximum during the angular velocity) was recorded in Newton-meters (Nm). It was applied before and after the 8-week treatment protocol.

2.Disabilities of the Arm, Shoulder, and Hand (DASH)

The scale includes 30 questions about symptoms (5 items) and functionality (25 items). In this study, business/sport-specific additional modules of the scale were not used. Each item offers 5 answer options and is scored on a likert scale from 1 to 5. 1: reflects 'no difficulty' and 5: reflects 'serious difficulties'. The resulting scores for all items are then used to calculate the total score from 0 (no disability) to 100 (most severe disability) (16). It is accepted as the most consistent test in terms of construct validity and responsiveness in examining upper extremity problems in individuals undergoing breast cancer treatment. It was applied before and after the 8-week treatment protocol.

3.Visual Analogue Scale (VAS)

The patients were asked to mark their pain levels in the breast, shoulder and axilla regions on the affected side during rest and activities of daily living on a 10 cm scale (0=no pain, 10=worst pain ever experienced). The distance (cm) between the zero point and the point marked by the patient indicates the level of pain. It was applied before and after the 8-week treatment protocol.

4.Global Rating Of Change Scale (GRC)

The Global Rating of Change Scale (GRC) contains a single question in which the patient can rate how much he has improved retrospectively from his own perspective. The validity and reliability of the GRC scale has been verified and is widely used in the assessment of change for musculoskeletal problems. 7 different answers (-3: much worse, 2: worse, -1: slightly worse, 0: the same, 1: a little better, 2: quite good, 3 They were asked to answer by choosing one of the :much better) options. In scoring, scoring can be done according to a 7-point Likert evaluation, as well as calculations can be made using negative scores. This scale was applied only to the study groups in the post-treatment measurement. It was applied only at the end of the 8-week treatment protocol.

Statistical analysis

In the descriptive statistics of the data, mean, standard deviation, median minimum, maximum, frequency and ratio values were used. The distribution of variables was measured with the Kolmogorov-Smirnov test. Kruskal-wallis, mann-whitney u test was used in the analysis of quantitative independent data. Wilcoxon test was used in the analysis of dependent quantitative data. Chi-square test was used in the analysis of qualitative independent data, and fischer test was used when the chi-square test conditions were not met. SPSS 27.0 program was used in the analysis.

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