

STUDY REGARDING THE UPPER LIMB RANGE OF MOTION AFTER BREAST CANCER SURGERY

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ABSTRACT. Introduction: Mastectomy surgery in association with local radiotherapy and chemotherapy generates side effects such as: lymphedema, decreased range of motion, chronic pain, cardiotoxicity, neuropathy, premature menopause, infertility, anxiety, depression, fatigue. Decreased range of motion is the most disabling side effect of the treatment. Aerobic and resistive exercises can prevent lymphedema and improve the range of motion of the upper limb on the side of mastectomy. **Objective:** The purpose of the present study is to verify the effectiveness of an individualized kinetic program, applied to improve the upper limb range of motion after breast cancer surgery. **Methods:** In this study, 5 subjects (females, aged between 49 and 67) with right radical mastectomy and axillary lympho-dissection were included. They performed a kinetic program twice a week for 6 months and we evaluated the range motion at the level of the upper limb. **Results:** All the movements performed in upper limb (flexion, extension, abduction, adduction, internal and external rotation) improved, suggesting that the kinetic program is efficient. The average of the flexion movement increased by 35°, from 126° to 161°. The values obtained for the extension movement show an increase of the average by 14.6°. The abduction movement improved from 120° to 170°. At the elbow level, the flexion increased by 24.4° and the extension decreased by 6°. At the wrist level, the flexion increased by 37.4° and the extension increased from 41.8° to 78°. **Conclusions:** After applying the therapeutic program, the final physical assessments highlights that the range of motion increased in the upper limb.

Key words: breast cancer, range of motion, mastectomy.

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REZUMAT. Studiu privind amplitudinea de mișcare a membrului superior după intervenția chirurgicală în cancerul de sân. Introducere: Intervenția de mastectomie asociată cu radioterapia locală și chimioterapia generează efecte secundare cum ar fi: limfedem, amplitudine de mișcare scăzută, durere cronică, cardiotoxicitate, neuropatie, menopauză prematură, infertilitate, anxietate, depresie, oboseală. Amplitudinea de mișcare diminuată este cel mai dăunător efect secundar al tratamentului. **Obiective:** Scopul prezentului studiu este de a verifica eficiența unui program kinetic individualizat, aplicat pentru a îmbunătăți amplitudinea mișcărilor membrului superior după intervenția chirurgicală în cancerul de sân. **Metode:** În acest studiu au fost incluși 5 subiecți (de gen feminin, cu vârsta cuprinsă între 49 și 67 de ani) cu mastectomie radicală dreaptă și limfodisecție axilară. **Rezultate:** Toate mișcările efectuate la nivelul membrului superior (flexie, extensie, abducție, adducție, rotație internă și externă) s-au îmbunătățit, sugerând că programul kinetic este eficient. Media mișcării de flexie a crescut cu 35°, de la 126° la 161°. Valorile obținute pentru mișcarea de extensie arată o creștere a mediei cu 14.6°. Mișcarea de adducție s-a îmbunătățit de la 120° la 170°. La nivelul cotului, flexia a crescut cu 24.4° și extensia a scăzut cu 6°. La nivelul mâinii, flexia a crescut cu 24.4° și extensia s-a îmbunătățit de la 41.8° la 78°. **Concluzii:** După aplicarea programului terapeutic, evaluare finală evidențiază că amplitudinea mișcărilor membrului superior s-a îmbunătățit.

Cuvinte cheie: cancer de sân, amplitudine de mișcare, mastectomie.

Introduction

Mastectomy surgery in association with chemotherapy and radiation therapy have negative effects on the human body (Shapiro & Recht 2001). These side effects can be systematized as follows:

- diseases secondary to the application of local radiotherapy: cardiotoxicity, pneumonia, rib fractures, pain, lymphedema;
- systemic conditions following the administration of chemotherapy: myelosuppression, peripheral neuropathy, premature menopause, infertility, weight gain, cardiovascular disease, nausea and vomiting, anxiety, depression, insomnia, fatigue, fear of recurrence;
- side effects of the surgical intervention: decreased range of motion, keloid scars, chronic pain.

According to Jung et al., (2003) the pain felt after surgery is transitory and occurs as a consequence of muscle and ligament injuries. Chemotherapy and radiotherapy may increase the intensity of the pain. Chronic pain can be a disabling factor and there are two types: neuropathic pain and phantom pain felt in the removed breast.

Courneya K. et al. (2007) analyzed the effects of aerobic exercise and resistive exercise on patients receiving chemotherapy. The authors observed that if patients practice aerobic and resistive exercises, they can complete chemotherapy without developing lymphedema, improving their self-esteem and physical state.

Fong et al. (2012), emphasizes the effects of physical activity on oncologic patients. The types of physical exercises that can be used in the treatment of patients consist of aerobic exercises, low-intensity exercises and resistive exercises. Physical activity has beneficial effects on the quality of life, promotes weight loss of overweight patients, improves cardiovascular fitness and the functional level of the upper limb on the side of the surgery.

Decreased mobility in the upper limb and, therefore a decrease in the functional level, is the most annoying complication of the treatment applied to the breast cancer and has a major impact on the quality of life of patients (Kaya et al., 2010).

According to Ewertz M. and Jensen A. B. (2011), the decreased range of motion of the joints of the upper limb on the side of the mastectomy is part of the long-term side effects of the surgical and oncological treatment. The authors point out that the recovery has the role of enabling patients to reach and maintain the optimal level of functionality from a physical, intellectual, psychosocial and spiritual point of view.

The decrease in the shoulder joint mobility is considered by the authors Lauridsen et al. (2007), as a consequence of axillary lymphodissection in association with local radiotherapy. These authors applied *the Constant Shoulder Score (CSS)* questionnaire, performed a joint balance at the shoulder level and perimetry on both upper limbs and found that the abduction movement is the most affected movement, the amplitude being reduced by 30° to 60°. Patients who received local postoperative radiotherapy also experienced a more pronounced decrease in joint mobility compared to those who underwent only a mastectomy.

We consider it important to assess the quality of life through the questionnaire proposed by the World Health Organization as well as to establish the coefficient of disability of the upper limb on the side of the surgery by applying the questionnaire Disabilities of the Arm, Hand and Shoulder (Guzin et al., 2022).

Including hirokinetotherapy in the therapeutic protocol through partial or total immersions, has beneficial effects on lymphedema and muscle strength due to the mechanical factors of water (Tidhar D. and Katz-Leurer M., 2009). The biomechanics of movement are facilitated by the ascending force and exercises and mobilizations can be performed even with patients who cannot exercise on land or have a contraindication in this regard.

Objective

The aim of this research is to verify the effectiveness of the application of an individualized kinetic program to improve the upper limb range of motion after breast cancer surgery.

Materials and methods

5 subjects, aged between 49 and 67 years, with right radical mastectomy and axillary lymphodissection were included in this study.

The hypotheses that formed the basis of this research is: the application of an individualized kinetic program increases the range of motion of the upper on the side of the surgery.

We evaluated the possible movements at the level of the upper limb. The test was performed with the goniometer, on both upper limbs, in order to make a comparison between the affected upper limb and the unaffected one.

The kinetic means used are classified in:

- ✓ specific means: physical exercises and massage;
- ✓ non-specific means: multilayer compressive bandage and kinesiio taping.

Each subject benefited from a recovery program focused on the objectives of the therapeutic approach. In order to respect the principle of progressivity, the number of repetitions varied between 6 and 10 for each exercise.

The exercise program was performed with a frequency of 2 sessions per week and consists of exercises aimed at increasing the range of motion of the upper limb.

Results

Flexion in the scapulohumeral joint

Measurements made for flexion show an increase in the average value by 35°, from 126° at the initial assessment to 161° at the final assessment. The minimum value increased from 90° to 155° while the maximum value increased from 145° to 165°. The results of the measurements performed are relatively homogeneously dispersed at the initial evaluation and homogeneous at the final evaluation (table 1.).

Table 1. Results regarding the amplitude of the flexion movement

EVALUA- TION	Average	Average difference	Median	Standard Deviation	Min.	Max.	Amplitude	Variation Coef.
Initial	126.0	35.0	135.0	22.2	90	145	55	17.6%
Final	161.0		160.0	4.2	155	165	10	2.6%

Extension in the scapulohumeral joint

In the case of the extension, the measurements performed show an increase of the average by 14.6°, from 28.4° at the initial assessment to 43° at the final assessment. The minimum value increased from 20° to 35° and the maximum value increased from 35° to 50°. The measured values are dispersed relatively homogeneously at the initial evaluation and homogeneously at the final evaluation (table 2.).

Table 2. Results regarding the amplitude of the extension movement

EVALUA- TION	Average	Average difference	Median	Standard Deviation	Min.	Max.	Amplitude	Variation Coef.
Initial	28.4	14.6	30.0	5.5	20	35	15	19.4%
Final	43.0		45.0	5.7	35	50	15	13.3%

Abduction in the scapulo-humeral joint

The values obtained in the joint balance for the abduction movement show an increase of the average by 50°, from 118° at the initial assessment to 168° at the final assessment. The minimum value increased from 100° at the initial assessment to 165° at the final one, and the maximum value increased from 140° to 170°, data found in table 3.

Table 3. Results regarding the amplitude of the abduction movement

EVALUA- TION	Average	Average difference	Median	Standard Deviation	Min.	Max.	Amplitude	Variation Coef.
Initial	118.0	50.0	120.0	17.9	100	140	40	15.2%
Final	168.0		170.0	2.7	165	170	5	1.6%

Internal rotation in the scapulohumeral joint

In the case of the internal rotation, the recorded values showed an increase of the average by 45°, from 39° at the initial evaluation to 84° at the final evaluation. The minimum value increased from 30° to 80° and the maximum value from 50° to 90°. Regarding the homogeneity of the values obtained in the evaluations, they are dispersed relatively homogeneously at the initial evaluation and homogeneous at the final evaluation (table 4.).

Table 4. Results regarding the amplitude of the internal rotational movement

EVALUA-TION	Average	Average difference	Median	Standard Deviation	Min.	Max.	Amplitude	Variation Coef.
Initial	39.0	45.0	40.0	7.4	30	50	20	19.0%
Final	84.0		85.0	4.2	80	90	10	5.0%

External rotation at the scapulohumeral joint

In the case of the external rotation, the values obtained showed an increase of the average by 42.4°, from 33.6° at the initial evaluation to 76.0° at the final evaluation. The minimum value increased from 25° initially to 65° at the final assessment, while the maximum value increased from 40° to 90°. The dispersion of values is relatively homogeneous at the initial evaluation and homogeneous at the final evaluation (table 5.).

Table 5. Results regarding the amplitude of the external rotational movement

EVALUA-TION	Average	Average difference	Median	Standard Deviation	Min.	Max.	Amplitude	Variation Coef.
Initial	33.6	42.4	33.0	6.5	25	40	15	19.4%
Final	76.0		75.0	11.4	65	90	25	15.0%

Flexion in the elbow

In the case of the flexion at the level of the elbow, the measurements made show an increase of the average by 24.4°, from 113.6° at the initial evaluation to 138° at the final evaluation. At both evaluations the values obtained are dispersed homogeneously. The results are presented in table 6.

Table 6. Results regarding the amplitude of the flexion movement in the elbow

EVALUA-TION	Average	Average difference	Median	Standard Deviation	Min.	Max.	Amplitude	Variation Coef.
Initial	113.6	24.4	115.0	10.9	100	125	25	9.6%
Final	138.0		138.0	2.1	135	140	5	1.5%

Extension in the elbow

Measurements made for extension at the elbow emphasis a decrease of the average by 6°, from 7.6° at initial evaluation to 1.6° at final evaluation. The minimum value is 5° at the initial assessment and 0° at the final assessment, while the maximum value decreased from 10° to 3°. The recorded values are dispersed relatively homogeneously at the initial evaluation and homogeneously at the final evaluation. The datas are presented in table 7.

Table 7. Results regarding the extension movement in the elbow

EVALUA-TION	Average	Average difference	Median	Standard Deviation	Min.	Max.	Amplitude	Variation Coef.
Initial	7.6	-6.0	7.0	1.9	5	10	5	25.6%
Final	1.6		2.0	1.5	0	3	3	94.8%

Flexion at the wrist level

The evaluation at the wrist for the flexion movement point an increase of the average by 30.6°, from 37.4° at the initial evaluation to 68° at the final evaluation. The minimum value increased from 33° to 65°, while the maximum value increased from 42° to 70°. The values obtained during the evaluation are homogeneously dispersed (table 8).

Table 8. Results regarding the flexion in the wrist

EVALUA-TION	Average	Average difference	Median	Standard Deviation	Min.	Max.	Amplitude	Variation Coef.
Initial	37.4	30.6	37.0	3.6	33	42	9	9.8%
Final	68.0		68.0	2.1	65	70	5	3.1%

Extension at the wrist level

In the case of extension at the wrist level, the initial and final evaluation emphasize an increase of the average by 36.2°. The minimum value is 38° and the initial evaluation an 75° at the final evaluation. The maximum value increased from 45° to 80°. At both evaluations the values are homogeneously dispersed (table 9).

Table 9. Average values regarding the extension in the wrist

EVALUA-TION	Average	Average difference	Median	Standard Deviation	Min.	Max.	Amplitude	Variation Coef.
Initial	41.8	36.2	42.0	2.9	38	45	7	6.9%
Final	78.0		79.0	2.0	75	80	5	2.6%

Abduction at the wrist level

The measurements made for the abduction movement in the wrist, highlight an increase of the average of 4.6°, from 8.4° to 13°. The standard deviation increased from 1.1 to 2.2 and the amplitude changed from 3 to 6. The values are dispersed homogeneously at both assessments (table 10).

Table 10. Average values regarding abduction movement in the wrist

EVALUA-TION	Average	Average difference	Median	Standard Deviation	Min.	Max.	Amplitude	Variation Coef.
Initial	8.4	4.6	8.0	1.1	7	10	3	13.6%
Final	13.0		13.0	2.2	10	16	6	17.2%

Adduction in the wrist

In the case of wrist adduction, the assessments performed shows an increase of the average of, 6.4°, from 34.2° at the initial evaluation to 40.6° at the final evaluation. Standard deviation has modified from 2.8 to 1.1, and the amplitude decreased from 7 to 3. The values are dispersed homogeneously at both assessments (table 11).

Table 11. Average values regarding adduction movement in the wrist

EVALUATION	Average	Average difference	Median	Standard Deviation	Min.	Max.	Amplitude	Variation Coef.
Initial	34.2	6.4	35.0	2.8	30	37	7	8.1%
Final	40.6		41.0	1.1	39	42	3	2.8%

Discussions

The disability that occurs in the upper limb following the application of the treatment for breast cancer is defined by Harrington et al. (2013) as a result of the decrease in strength, endurance and range of motion in the joints that make up the upper limb. Early physical activity stops the side effects of the treatment and contributes to regaining the functionality of the upper limb (Falcetta et al., 2018).

Early application of an individualized therapeutic program improves the amplitude of upper limb movements and contributes to the decrease of lymphedema secondary to the treatment applied to the breast neoplasm.

Moderate intensity aerobic exercise, performed with a frequency of 2 sessions per week during chemotherapy, has much more beneficial effects on muscle strength, fatigue and cardiovascular system activity compared to low intensity exercise performed daily (Hamma van Waart et al., 2015).

Conclusions

Surgical treatment used in the neoplasm contributes to decreased range of motion of the upper limb on the side of mastectomy, which negatively influences the quality of life of patients.

Following the statistical processing of the results obtained in the initial and final assessment, we found the aspects presented below.

The initial and final evaluation of the flexion movement shows an increase in amplitude, in terms of the average value, by 35°, from 126° to 161°. The median changed from 135 to 160. The standard deviation decreased from 22.2 to 4.2, which shows that the final values are more strongly grouped around the average value.

The values obtained for the extension movement show an increase of the average by 14.6°, from 28.4° to 43°. The minimum value increased from 20° to 35°, and the maximum value changed from 35° to 50°.

For the median abduction movement, the value increased from 120 to 170. The standard deviation changed from 17.9 to 2.7, and the amplitude decreased from 40 to 5, which indicates a relatively homogeneous dispersion of the values obtained.

In the case of the internal rotational movement, the average increased by 45°. The homogeneity of the values, they are relatively homogeneously dispersed at both the initial and the final evaluation.

The initial and final assessment of the external rotation show an increase of the average by 42.5° and the amplitude also increased from 15 to 25.

At the elbow level, the flexion increased by 24.4° and the extension decreased by 6°.

At the wrist level, the flexion increased by 37.4° and the extension increased from 41.8° at the initial assessment to 78° at the final assessment. The standard deviation, in the case of abduction, increased from 1.1 to 2.2 and the average increased by 4.6°. The amplitude of the adduction movement increased by 6.4° and the standard deviation decreased from 2.8 to 1.1.

After applying the therapeutic program, the final physical assessments highlights that the range of motion increased in the upper limb.

Authors contribution

All authors have equally contributed to this study

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