Biophotometric Analysis of Shoulder and Elbow Movements Related to Functional Gains and Surgical Types in Women Undergoing Breast Cancer Surgery

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Análise Biofotométrica de Movimentos de Ombro e Cotovelo Relacionados com o Ganho Funcional e Tipos Cirúrgicos em Mulheres submetidas à Cirurgia Oncológica Mamária

Análisis Bio-Fotométrico de los Movimientos del Hombro y Codo Relacionados con la Ganancia Funcional y los Tipos Quirúrgicos en Mujeres Sometidas a Cirugía Oncológica de Mama

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Abstract

Introduction: Breast cancer surgeries cause a reduction in shoulder range of motion (SRM) impacting its functionality. Biophotometry is a resource that can assess SRM, showing precision and reproducibility. **Objective**: To measure the shoulder and elbow range of motion and relate them to the functional gains after physiotherapeutic intervention and surgical type in women undergoing breast cancer surgery. **Method**: An analytical observational research, with 30 mastectomized women being monitored at the Uberlândia Cancer Hospital, Brazil, submitted to biophotometric evaluation with graduation marks at standardized points in the upper limbs (ULs) in order to analyze the SRM in frontal and profile view, apply the Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire and questions about the daily activities by filling in an anamnesis form before and after four months of intervention. **Results**: There was a reduction in SRM in all shoulder movements, the means of abduction and flexion scores of the homolateral shoulder, before and after four months of physiotherapeutic intervention, were 130.3 and 149.4 degrees (p=0.002) and 128.1 and 140 (p=0.008), respectively. The DASH score decreased from 38.1 to 32.15 (p=0.047) and, in issues involving shoulder abduction and flexion, there was greater increase in the percentage of responses answering "no difficulties", with mean from 23.08% to 42.86%. **Conclusion**: Shoulder abduction and flexion are the most altered movements in the homolateral limb to the surgery, however, after four months of physiotherapy, there was an improvement in the SRM, leading to functional gain, regardless of the surgery type.

Key words: Mastectomy; Physical Therapy Modalities; Breast Neoplasm; Range of Motion, Articular.

Resumo

Introdução: As cirurgias no câncer de mama ocasionam a redução da amplitude de movimento (ADM) de ombro, impactando na sua funcionalidade. A biofotometria é um recurso capaz de avaliar a ADM, mostrando precisão e reprodutibilidade. **Objetivo:** Mensurar a ADM de ombro e cotovelo e relacioná-las com o ganho funcional após intervenção fisioterapêutica e o tipo cirúrgico em mulheres submetidas à cirurgia oncológica mamária. **Método:** Pesquisa observacional analítica, com 30 mulheres mastectomizadas em acompanhamento no Hospital do Câncer de Uberlândia, submetidas à avaliação biofotométrica, com marcações em pontos padronizados nos membros superiores (MMSS) para análise de ADM em vista frontal e perfil, aplicação do questionário de disfunção de braço, ombro e mão (DASH) e questões de atividades diárias propostas em uma ficha de anamnese antes e após quatro meses de intervenção. **Resultados:** Observou-se redução da ADM em todos os movimentos de ombro, as médias de abdução e flexão do ombro homolateral, antes e após quatro meses de intervenção fisioterapêutica, foram de 130,3 e 149,4 graus (p=0,002); e 128,1 e 140 (p=0,008), respectivamente. O escore do DASH diminuiu de 38,1 para 32,15 (p=0,047) e, nas questões que envolvem abdução e flexão de ombro, houve maior aumento da porcentagem de respostas para "nenhuma dificuldade", com média de 23,08% para 42,86%. **Conclusão:** A abdução e a flexão de ombro são os movimentos mais alterados no membro homolateral à cirurgia, entretanto, após quatro meses de fisioterapia, houve melhora da ADM acarretando ganho funcional, independentemente do tipo cirúrgico.

Palavras-chave: Mastectomia; Modalidades de Fisioterapia; Neoplasias da Mama; Amplitude de Movimento Articular.

Resumen

Introducción: Las cirugías de cáncer de mama causan una reducción de la amplitud de movimiento del hombro (AMH), que afecta su funcionalidad. La bio-fotometría es un recurso capaz de evaluar AMH, mostrando precisión y reproducibilidad. **Objetivo**: Averiguar la amplitud de los movimientos del hombro y codo y relacionarlos con la ganancia funcional después de la fisioterapia y la intervención quirúrgica en mujeres sometidas a cirugía de cáncer de mama. **Método**: Investigación analítica observacional con 30 mujeres mastectomizadas, en acompañamiento en el Hospital del Cáncer de la ciudad de Uberlândia, Brasil, sometidas a evaluación bio-fotométrica con marcaciones en puntos estandarizados en los miembros superiores (MMSS) para análisis de la AMH en vista frontal y perfil, aplicación del cuestionario de disfunción de brazo, hombro y mano (DASH) y preguntas sobre las actividades diarias propuestas en formato de anamnesis, antes y después de cuatro meses de intervención. **Resultados**: Hubo una reducción en la AMH en todos los movimientos de los MMSS, la abducción y flexión media del hombro homolateral, antes y después de cuatro meses de la intervención fisioterápica, fue 130,3 y 149,4 grados (p=0,002); y 128,1 y 140 (p=0,008), respectivamente. La puntuación mediana del DASH disminuyó de 38,1 a 32,15 (p=0,047), y en las preguntas relacionadas con la abducción y la flexión del hombro, hubo un mayor aumento en el porcentaje de respuestas para "sin dificultad", con un promedio de 23,08% a 42,86%. **Conclusión**: La abducción y flexión del hombro son los movimientos más alterados en el miembro homolateral a la cirugía, entretanto, después de cuatro meses de fisioterapia, hubo una mejora en la AMH, lo que llevó a una mejora en la capacidad funcional, independientemente del tipo de cirugía.

Palabras clave: Mastectomía; Modalidades de Fisioterapia; Neoplasias de la Mama; Rango del Movimiento Articular.

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INTRODUCTION

Breast cancer is one of the main non-communicable diseases, comprehending more than 100 types of abnormal cellular growth and multiplication invading tissues and organs the organism defense system is unable to stop[1]. In Brazil, according to the National Cancer Institute José Alencar Gomes da Silva (INCA), the estimate for each year of the triennium 2020-2022 is 625 thousand new cancer cases, being 66,280 of breast cancer, which corresponds to an anticipated risk of 61.6 new cases at each 100 thousand women[1]. The prognosis varies for each case and depends from factors as metastasis, compromise of lymph nodes and extension of the disease[2]. Breast cancer has high mortality in women and the strategies for its control are contingent upon health public policies and agility for fast and effective treatment since early identification and intervention reduce the disease's morbimortality[3].

The repercussions of the breast cancer treatment are negative in many aspects of the woman's life as psychological, social and physical, since after breast surgery, body image is modified[4]. In addition, the functional capacity of the upper limb (UL) is compromised because of different surgical procedures and post-surgery immobilization; furthermore, in radical surgeries, the major and minor pectoralis muscles are removed causing reduction of the strength and movement of the UL homolateral to the procedure[5].

Physical alterations resulting from surgical treatment are found in nearly 63.5% of operated women and the active articular range of movement (RM) of UL is more frequent among the alterations, mainly in the shoulder[6,7] movements of flexion and abduction. To reduce these complications, physiotherapy encompasses techniques as kinesiotherapy and electrotherapy. A review conducted in 2020[8] demonstrated that the interventions formed by global strengthening, stretching, articular mobilization and vibratory therapy bring great benefits to the functional recovery in women post breast cancer surgery.

There are several ways to measure RM[9]. Biophotometry is a resource that can be used for such, passively or actively[10]. This instrument has been used in several areas for elaboration of physical-functional diagnosis because is accessible in clinical practice with large trustworthiness, low cost, ease-to-manipulate, high accuracy and reproducibility, in addition to reducing the error by evaluators and intra-evaluators, different from other types of measurement[10-12].

Although the literature presents large quantity of studies about the functional impact of the breast cancer treatment, few studies show the impact different types of surgery cause in the RM and to what extent the gain of RM post physiotherapy intervention of the post-surgery outpatient routine modified the functioning of the upper limbs (ULS). The studies present data about of only one moment of the patient with individual variables, mostly, without considering the time passed between the surgery and the beginning of the physiotherapeutic treatment[13-16].

Based in the exposed, this article intended to analyze RM of shoulder and elbows of women submitted to breast cancer treatment and relate with the functional gain caused by the individualized physiotherapeutic treatment during four months, identifying the possible impact different surgical types, radical or conserving cause in RM of these articulations.

METHOD

Observational correlational analytical study approved by the Institutional Review Board of Federal University of Uberlândia number 2,731,732.

Non-probabilistic sample, by convenience because it is an exploratory study which aimed to identify the relation between articular amplitude measured by biophotometry and its impact in the disability of ULs measured by the questionnaire of Disabilities of the Arm, Shoulder and Hand – DASH, complete version, validated and translated into Portuguese in a study with 65 patients with rheumatoid arthritis, demonstrating high level of reproducibility and confidence interval of 90%[17,18].

Collection was conducted at the Physiotherapy Outpatient of Clinics Hospital/Cancer Hospital of Uberlândia from May 2018 to June 2019. The volunteers were invited to participate of the study and guided about the data to be collected. After this, those who agreed to join signed the Informed Consent Form and the study was initiated.

Women submitted to radical and conserving breast cancer surgery with or without axillary emptying and authorized by the practitioner to perform supervised physical activity; exclusion criteria were the presence of wound and/or bruises in the chest area, metastasis and pathological fractures of the UL.

Sociodemographic, health and treatment data were collected from the chart (age, time between the surgery and evaluation, surgery of the dominant size or not, conserving or radical surgery) and co-adjuvant treatment (chemotherapy, radiotherapy, hormone therapy and combination among these). Next, the questionnaire DASH, the questionnaire of functioning in specific activities proposed in the evaluation card were applied and anamneses as complementary analysis of the functional capacity and collection of biophotometry.

Collection of these information occurred in the day of the physiotherapeutic treatment and the dependent variables were collected in the evaluation performed four months after the individualized treatment for each patient, aiming the functional gain, without modifications along this study, formed by electrotherapy and kinesiotherapy performed twice a week for 50 minutes in outpatient by expert physiotherapists in oncology, the time between evaluations was considered the mean for recovery of the RM[19]. The resources utilized were excito-motor currents (FES and Russian current) for 20 to 30 minutes with intensity of until 120 milliamperes according to the sensitiveness of the patient, with electrodes positioned in the scapular region, extension of the ULs and pectorals, passive stretching of pectoral muscles and trapeze and global strengthening of ULs with elastic bands and dumbbells of up to 3 kg with moderate intensity determined by the subjective perception of the patient effort.

Evaluation of the shoulder range of movement by biophotometry

Biophotometry is a fast, easy-to-manage, high reproducibility instrument and can be used to measure angulation in UL and functional diagnosis. It has been used by several authors in different areas showing great utility and trustworthiness in its results, allowing the filing of records as well. In addition, is well disseminated and accepted by the professionals that evaluate the human movement because of its high level of objectivity and concurrence among evaluators in comparison with other measuring techniques of RM as goniometry, reason for which this method was utilized[11,20,21].

For biophotometry, it was utilized a Canon camera model EOS Rebel T6 EF-S 18-55 f/3.5-5.6 III with good resolution to record the images. The camera was placed in parallel to the floor in a leveled and fixed tripod. The distance and height of the tripod were standardized in 1.50 meter. The environment to conduct the analyzes was well lit with minimum interferences as much as possible[22].

The volunteers were analyzed seated to minimize compensatory movements of the body observed in the orthostatic position. The chair utilized was standardized for all the volunteers and did not hampered the execution of the movements analyzed and allowed adjustments for anthropometric adaptation (height of the seat), if necessary, for the feet of the women to lay fully on the floor. The women were verbally instructed for positioning and clothes for photos. The anatomic spots were marked with 150 mm diameter, high reflective white cylinders. The spots determined were acromion extremity of the right and left clavicle; head of the right and left radius, styloid process of the right and left radius and center of the right and left wrists. The photos were taken in frontal plan, anterior view and sagittal plan and lateral views[23]. In the frontal plan, it was analyzed the abduction movement of the shoulder. In the sagittal plan, the movement of flexion and extension of the shoulders and extension and flexion of the elbows. Both limbs, homolateral and contralateral to surgery were evaluated to determine the extent of compromise of the homolateral limb to the surgery, being the contralateral taken as normal reference for the volunteers.

For the quantitative analysis of biophotometry, it was utilized the easy-to-handle software Kinovea where the pre-marked spots were used as reference to measure the angle.

To analyze the movements of abduction, flexion and extension of the shoulder, the axis of the angle was fixated in the acromium, one of the lines perpendicular to the floor and the other line at the extremity of the radius (Figures 1-a, 1-b and 1-c). And to analyze the flexion of the elbow, the axis was marked in the head of radius, one of the lines through the projection of the acromion and the other, up to the styloid of the radius (Figure 1-d).

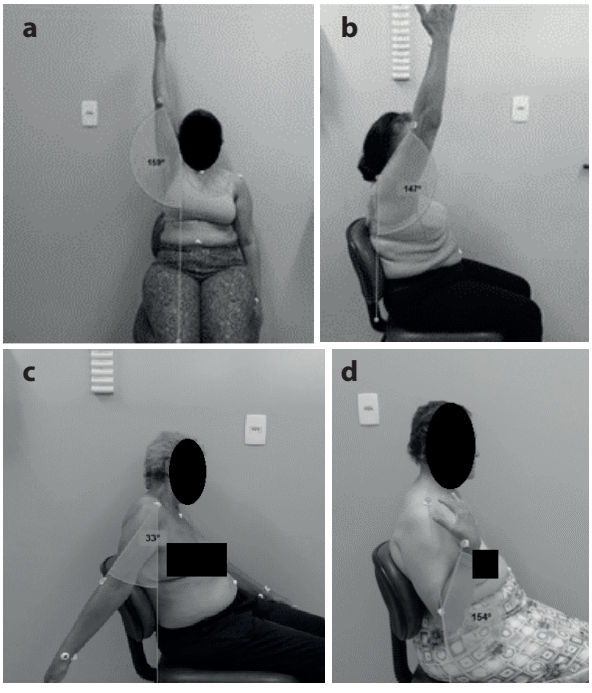

Figure 1. Kinovea biophotometry analysis of abduction (1-a), flexion (1-b) and shoulder extension (1-c) and flexion of the elbow (1-d) by the

Evaluation of the functional capacity of upper limbs

It was used the questionnaire DASH to evaluate the functional capacity of ULs.

DASH has 30 self-explanatory questions informing the level of difficulty in performing the activities, the

intensity of the symptoms of pain, weakness, stiffness and paresthesia, compromise of the social activities, difficulty to sleep and psychological compromise, having as reference the week before the application of the instrument.

The questions of the instrument address the health status of the woman in the last week, being 21 questions about the level of difficulty to perform physical activities because of the compromise of the arm, shoulder or hand; five questions addressing the severity of the symptoms as pains, paresthesia, weakness and stiffness and four questions about the impact of the pathological condition in social activities, work, sleep and self-image. Each question of DASH has five options of response, ranging from one, no difficulty or symptoms up to five, for disability to perform the task or extreme severity of the symptom. These values were transformed in a score of 100, subtracting 1 and multiplying for 25. This transformation was done to compare the scores with other scales from 0 to 100. The high score indicates high dysfunction from the equation: [(Sum of the responses/30) -1] X 25[24].

In the DASH questionnaire, as high the score, higher is the disability, that is, worse will be the functional capacity. This is because DASH was created within the perspective of disability, higher raw scores indicate higher compromise of the functional capacity[24].

Further to DASH, functioning was also analyzed based in the evaluation protocol elaborated in the physiotherapy outpatient itself as a supplementary material to evaluate the functional capacity consisting of eight activities where the patient should classify from 1 to 4, being 1 – Unable to perform it alone; 2 – Performs with great difficulty; 3 – Performs with little difficulty; 4 – No difficulty to perform. In the end of the study, the percentage of the responses will be calculated. The higher the percentage of the participants who responded 1 or 2, worse the functioning.

Statistical analysis

The variables analyzed were stored in a Microsoft Excel database for further analysis in the software "RStudio" to obtain the descriptive and comparative analyzes with all the copyrights secured to the original company. For the descriptive analysis, the central tendency measures (mean) were calculated for the continuous variables. The measures of relative and absolute frequency were calculated for the categorized variables for better understanding of the data.

In the inferential analysis, it was utilized the normality test of Shapiro-Wilk for the dependent variables and after confirmation of the normal distribution, it was utilized the test t pairwise between the evaluation and reevaluation and biserial correlation when it was one of the nominal variables and the test of hypothesis with confidence interval of 95%; therefore, the values for $p<0.05$ were accepted for statistically significant data.

The values obtained by the correlations (r) were interpreted according to the limits established by Weber and Lamb[25]: 0.00-0,19= none or slight; 0.20-0.39=mild; 0.40-0.69=moderate; 0.70-0.89= high and 0.90-1.00 = very high[25].

RESULTS

Thirty volunteers were analyzed in the first evaluation and 19, in the reevaluation. The causes of the sample reduction were death (1), evolution to palliative care (2) and withdrawal for reevaluation (8). For the descriptive analysis, data of the volunteers were evaluated before beginning the physiotherapeutic treatment and for the comparative analysis, only the volunteers who were reevaluated after four months.

The mean age of the volunteers were 54.7±9.2 years and the surgical types included radical (23) and conserving (7) surgeries, 17 women underwent surgeries at the upper dominant side and 13, in the contralateral. The mean time between the surgery and the evaluation was 10.43±15.61 months. 28 volunteers submitted to co-adjuvant treatment: chemotherapy (2), radiotherapy (4), hormone therapy (2), associating chemotherapy and radiotherapy (11) and associating the three types (9).

In Table 1, the mean and standard deviation values of the angulation of the shoulder and elbow movements measured by biophotometry are represented. It can be observed that the movements of abduction and flexion of the shoulders of the contralateral limbs to the surgery are bigger in relation to the movements of the homolateral limb, as well as the increase of the angulation in the second evaluation.

While separating the data according to the surgical types (radical and conserving) it is observed there is difference in gains of angulation, mainly of the movements of abduction of the shoulder that, in the conserving surgery were 136.3±24.2 for 151.5±19.1 ($p=0.011$) in the homolateral side and 140.3±33.14 for 162.1±8.3 ($p=0.224$) in the counterlateral side; and flexion of the shoulder, which was 138.6±28.5 for 142.7±21.2 ($p=0.036$) in the homolateral side and 146.3±29 for 156.7±8.6 ($p=0.561$) in the contralateral side. In the radical surgery, the movement of abduction of the shoulder was in average of 108.2±40.72 for 138±14.1 ($p=0.016$) in the homolateral side and 136.6±40.2 for 146±4.25 ($p=0.351$) in the contralateral side; and the flexion of the shoulder was 95.6±45.10 for 145±8.48 ($p=0.017$) in the homolateral side and of 134.6±36.5 for 154.5±43.1 ($p=0.234$) in the counterlateral side.

Table 1. Values of the angulation of the movements of shoulders and elbows according to biophotometry

Movement\Phase of the study	Evaluation	Reevaluation	p=value
Abduction of the homolateral shoulder	130.4+29.7	149+18.7	0.0021
Abduction of the contralateral shoulder	139.5+33.8	159.8+9.7	0.0671
P=value	0.0008	0.032	
Flexion of the homolateral shoulder	129.7+36.1	143+19.6	0.008
Flexion of the contralateral shoulder	143.9+30.2	156.4+14.4	0.086
P=value	0.006	0.067	
Extension of the homolateral shoulder	43.9+18.2	48+17.2	0.044
Extension of the contralateral shoulder	42.2+14.2	49.6+16.3	0.013
P=value	0.225	0.098	
Flexion of the homolateral elbow	154.6+8.4	153.3+6	0.865
Flexion of the contralateral elbow	157.6+6.5	157+6.2	0.734
P=value	0.159	0.969	

Note: Rows: comparison between the evaluation and reevaluation; columns: comparison between homolateral and counterlateral sides; p<0.05

In relation to the questions of the proposed activities by functional evaluation, it is observed that the percentage of the responses that show better functionalities of UL increased; that is, the percentage of volunteers who responded "4" increased after four months of intervention, being 1 – Unable to perform alone; 2 – Performs with great difficulty; 3 – Perform with little difficulty; 4 – Without difficulty to perform (Figure 2).

The score of this questionnaires was calculated, adding the values attributed to each activity, therefore, as high the score, better is the functional capacity of the volunteers. The mean of the first evaluation was 22.9±7.4 and in the reevaluation was 26.7±6.1, with p=0.047.

The DASH score presented value of 38.61±26.9 in the evaluation and 32.15±25.27 after four months (p=0.048).

When considering the type of surgery, the higher scores for both evaluations are remarkable for the women submitted to radical surgeries, the score of the first evaluation was 52.14±27.2 and after four months, of 45.28±34.3 (p=0.016), while for those who underwent conserving surgery, the scores were 34.5±26.1 in the first evaluation and of 29.7±23.09 (p=0.176), reminding that high score means bigger disability.

In addition, the means of the questions answered were calculated, the lowest the mean, better is the functional capacity. The calculation of the means was done by adding

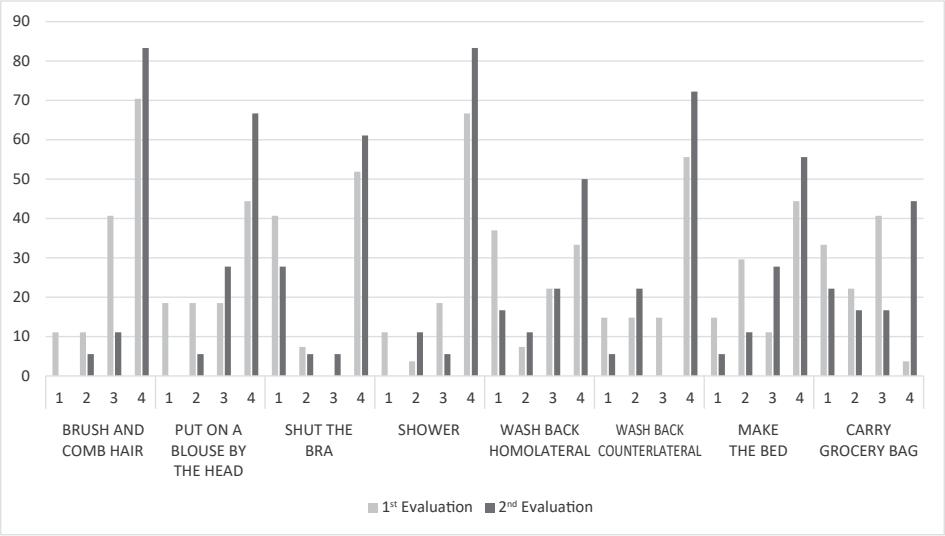

Figure 2. Frequency of the percentage of responses of the volunteers in the functional evaluation proposed in the anamneses file

the multiplications of the values for each level of the question by the number of volunteers who responded to that level divided by the total number of volunteers (weighted mean). With this, the activities proposed that reduced the mean more among the evaluations were "prepare a meal", going from 2.40 in the evaluation to 1.58 in the reevaluation; "put an object in a shelf above the head" from 2.90 to 1.53; "wash the back" from 2.73 to 2.32; and using a knife to chop food" from 2.43 to 2.05.

In the reevaluation, the mean of the values of the responses was reduced in most of the DASH questionnaire. Only five questions reached higher means in the reevaluation, being them: "open a new jar with the lid well tight" (from 3.07 to 3.37), "open or push a heavy door" (from 2.33 to 2.42), "perform heavy household tasks" (from 3.20 to 3.63), "gardening or work at the yard" (from 2.60 to 2.84) and "numbness in the arm or hand" (from 2.47 to 2.79).

The correlations between the DASH questionnaire and the functional evaluation were r=-0.82 (p=0.02). with age r=-0.574 (p=0.783) and time between surgery and evaluation r=0.558 (p=0.37). The correlations between the DASH with the movements of flexion and extension of the homolateral shoulders to the surgery were r=-0.52 (p=0.48) and r=-0.706 (p=0.782), respectively and between the functional evaluation of the protocol and flexion and extension of the homolateral shoulder were r=0.659 (p=0.581) and r=0.641 (p=0.842), respectively.

DISCUSSION

This study had the participation of women diagnosed with breast cancer, operated and in follow up in a regional reference public institution, where the physiotherapeutic treatment occurred at outpatient and whose objective was to analyze the characteristics of the movements of the shoulder and elbow of women submitted to breast oncologic surgery and relate them with the functional gain conquered after four months of individualized physiotherapeutic intervention with electrotherapy and kinesiotherapy performed from two to three times a week, considering the type of surgery and independent variables found in the study context.

In the first evaluation, the analysis of the RM by biophotometry demonstrated that women had reduction of the movements in the homolateral limb, regardless of the type of surgery. Similar result was described when 148 mastectomized women were analyzed, presenting significant loss of RM evaluated by biophotometry with difference between limbs of up to 20º in the shoulder flexion, being the most prevalent movement compromised[26], affirming that biophotometry is a useful instrument to measure RM in this type of patient.

The results showed that the movements of abduction and flexion of the shoulders of the limbs counterlateral to surgery were significantly bigger in relation to the movements of the homolateral limb, corroborating the fact that the surgical intervention in breast cancer changes the RM of these movements. These results were similar to articles whose objective also included the measurement of RM of ULs of mastectomized[27,06]. The restriction of the movements is likely to occur because of the presence of fibrosis resulting from radiotherapy and cicatricial adherences, emphasized in radical mastectomies[28], that generate more compromise.

In the sample studied, there was prevalence of conserving surgery (76.6%) and radical (23.3%), similar to the summary of data of INCA in 2019 and with the results presented by Souza et al.[29], who affirmed this surgical type has increased along the years.

The functional reduction in mastectomized patients is described in several studies[19,31] using questionnaires. In a study with 105 women, the authors described that the functional capacity is reduced with more compromise of the activities needing abduction and/or flexion of the shoulder, however, with physiotherapeutic treatment, the RM has returned to normal in most of the cases and functioning has increased[30]. Another study described that emotional experiences can reduce the functioning of these women[19]. In this study, all the participants were in psychological follow up concomitant to the physiotherapeutic treatment, minimizing this interfence.

The questionnaire DASH allows the correct evaluation of the ULs functional capacity in mastectomized patients[28,31-33]. The difference of evolution of the responses to the questionnaire was proportional in relation to the type of surgery even when there was more reduction in the score of those women submitted to radical surgery. However, there was low relation between the reduction of the movements of abduction and flexion of the shoulder regardless of the surgery type among the variables found in the study. With this, is possible to say that the functional capacity of ULs, though quite impacted by RM depends on more factors of the psychosocial context of the volunteer as environmental and personal factors[19].

Pereira et al.[34], Petito et al.[35], Kneis[36] and Oliveira et al.[3] present several physiotherapeutic resources with evidence for the post-surgery period. The literature quoted addresses protocols of consultations whose objective is the improvement of the quality of life (23%), improvement of the functioning and independence (13.5%) and preventive actions of complications (9.5%), which does not prove a

clear boundary of the objectives of the intervention; the primordial for these patients should be to regain their functioning and consequently, the improvement of the quality of life, regardless of the intervention[38]. The content presented shows that there was significant functional gain, which certainly will impact the quality of life with the intervention performed, but another study should analyze which interventions are more effective to reach this goal.

The study has limitations in relation to the sample size for the correlational analyzes, justified by the routine of the institution's physiotherapy department to meet all the demands; because of this, these damages may not represent the actual scenario of the women with breast cancer. However, due to the justification and favorable comparison with the literature presented in the text, this study stimulates new researches involving the analysis of the RM in different surgical types and their impact in the functional capacity, further to promoting information about the reality of the health public services about breast cancer.

CONCLUSION

It was observed in this study that the volunteers had limitations of the movements of abduction and flexion of the homolateral shoulder when compared to the counterlateral and after the individualized intervention with electrotherapy and kinesiotherapy, these movements increased proportionally for both surgical types, in higher degree for those submitted to radical surgery that impacted these movements more. In addition, there was improvement of the functional gain evaluated by the questionnaires.

Therefore, it was verified that the gain of the RM of abduction and flexion of the shoulder in these patients leads to functional gain for both surgical types.

CONTRIBUTIONS

All the authors contributed substantially for the conception and/or planning of the study, gathering, analysis and/or interpretation of the data, wording and/or review and approval of the final version for publication.

DECLARATION OF CONFLICT OF INTEREST

There is no conflict of interests to declare.

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