ORIGINAL ARTICLE

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Examination of the Relationship Between Upper Limb Function, Posture and Quality of Life in Patients with and Without Lymphedema After Breast Cancer Surgery

ABSTRACT

Objective: The aim of this study was to compare the upper limb function, posture and quality of life between women with and without lymphedema after breast cancer-related surgery and to investigate whether there is a relationship between them.

Methods: The study included 27 women with upper limb lymphedema and 29 women without lymphedema, aged between 18 and 70 years and undergone unilateral breast cancer-related surgery. Minnesota Manual Dexterity Test was used to evaluate upper limb function, New York Posture Rating Chart for posture and European Organization for Research and Treatment of Cancer Core QoL Questionnaire for quality of life.

Results: Women with lymphedema had lower posture, upper limb function and quality of life scores than those without lymphedema ($p < 0.05$). In addition, a moderate positive correlation was found between posture and quality of life general health status in both groups ($r=0.516$, $p=0.007$, with lymphedema; $r=0.486$, $p=0.008$, without lymphedema). However, there was no correlation between upper limb function to posture and quality of life ($p > 0.05$).

Conclusions: This study demonstrated that women with lymphedema after breast cancer surgery had worse posture, upper limb function and quality of life than those without lymphedema. In addition, it was found that posture disorder was associated with poorer quality of life, but upper limb function was not associated with quality of life and posture.

Keywords: Posture, Breast Cancer, Quality of Life, Upper Limb Function

Meme Kanseri Sonrası Lenfödem Gelişen ve Gelişmeyen Kadınlarda Üst Ekstremite Fonksiyonu, Postür ve Yaşam Kalitesi Arasındaki İlişkinin İncelenmesi

ÖZET

Amaç: Bu çalışma, meme kanseri ilişkili cerrahi sonrası lenfödem gelişen ve gelişmeyen kadınlar arasında üst ekstremite fonksiyonu, postür ve yaşam kalitesini karşılaştırmak ve aralarında ilişki olup olmadığını incelemek amacıyla gerçekleştirildi.

Gereç ve Yöntem: Çalışmaya 18-70 yaş arasında unilateral meme kanseri ilişkili cerrahi geçiren, 27 üst ekstremite lenfödemli ve 29 lenfödemi olmayan kadın dahil edildi. Üst ekstremite fonksiyonu için Minnesota Manuel Beceriklilik Testi, postür için New York Postür Analiz Yöntemi ve yaşam kalitesi için Avrupa Kanser Araştırma ve Tedavi Organizasyonu Yasam Kalitesi Anketi kullanıldı.

Bulgular: Lenfödemli kadınların postür, üst ekstremite fonksiyonu ve yaşam kalitesi skorları lenfödem gelişmeyenlere göre daha düşük olacak şekilde bulundu ($p<0.05$). Ayrıca, postür ile yaşam kalitesi genel sağlık durumu arasında her iki grupta da pozitif yönde orta düzeyde ilişki bulundu ($r=0.516$, $p=0.007$, lenfödemli; $r=0.486$, $p=0.008$, lenfödemi olmayan). Ancak, üst ekstremite fonksiyonu ile postür ve yaşam kalitesi arasında bir ilişki saptanmadı ($p>0.05$).

Sonuç: Bu çalışma meme kanseri cerrahisi sonrası lenfödemi gelişen kadınların postür, üst ekstremite fonksiyonu ve yaşam kalitelerinin lenfödem olmayanlara göre daha kötü olduğunu gösterdi. Ayrıca, postür bozukluğunun daha kötü yaşam kalitesi ile ilişkili olduğu, ancak üst ekstremite fonksiyonu ile yaşam kalitesi ve postürün ilişkili olmadığı görüldü.

Anahtar Kelimeler: Postür, Meme Kanseri, Yaşam Kalitesi, Üst Ekstremite Fonksiyonu

INTRODUCTION

Breast cancer, in terms of incidence, is placed in the top among all cancer types around the world (1) as well as in Turkey (2). Breast conserving surgeries involving the axillary region, and partial or total mastectomy surgeries are of great importance in the treatment of the breast cancer (3,4). However, as a result of these methods some complications such as pain, upper limb dysfunction, decreased range of motion, lymphedema and loss of muscle strength in upper limb can arise following treatment (5,6,7).

Lymphedema and upper limb dysfunction are the most common complications after breast cancer related surgeries (8,9). Due to the type of surgical intervention involving the axillary region, it was stated in the reports that 45% to 85% of the patients demonstrated decreasing of range of motion in shoulder joint (9), as well as between 5% to 45% patients had upper limb lymphedema following surgery (10,11). In addition, it has been shown that there is a greater decrease in the range of motion of the shoulder joint due to lymphedema and the increase in the severity of lymphedema deteriorates upper limb function (12,13).

Postoperative complications and tissue tension are main causes of impairment in the upper limb functionality of the patients (14). It was demonstrated that there were some alterations after surgery in the mobility and biomechanics of the thoracic region, especially around the shoulder (15). In addition, the increase in limb volume and weight due to lymphedema deteriorates these alterations (16). Especially after mastectomy surgeries, women tend to have kyphotic posture and demonstrates anterior inclination of the trunk (17). In addition, muscle contraction of the cervical and scapular regions may be observed after surgery in affected side (18). The trunk and the center of gravity are displaced towards the anterior, the shoulder is protracted, and some rotation occurs in the trunk (19). As a result, some postural disorders occur, and women have difficulty in performing some activities of daily life with the affected upper limb (18).

Complications arising from surgery also affect the work, home and social life of individuals negatively (20). When both physical and psychological effects that occur after surgery are considered, it is seen that individuals' functionality decreases, their concerns may tend to increase and body image of the women deteriorate, therefore there is decrease in the quality of life of women after breast cancer (21,22).

There are studies indicating that the adverse effects of surgical interventions and subsequent treatments adversely affect posture, upper limb functions and quality of life; however, there is a limited number of studies investigating whether these parameters affect each other or not. Therefore, the aim of this study was to investigate the relationship between upper limb functions, posture and quality of life in women with and without lymphedema after breast cancer surgery.

MATERIAL AND METHODS

This study was conducted between 2016-2018 after the ethical permissions obtained from Bolu Abant Izzet Baysal University Clinical Research and Ethics Committee with the 2016/76 reference number.

Women who had undergone breast cancer-related surgery were included in the study. They were divided into two groups as with lymphedema and without lymphedema after breast cancer surgery. Women who were volunteer, aged between 18-70 years and had a history of unilateral breast cancer surgery were included in the study. Individuals with active metastasis, shortness of between the lower extremities, neurological or orthopedic disorder, a history of spine surgery and no independent ambulation were excluded from the study. Participants were informed about the study and then written consent was obtained from the patients.

Thirty women with lymphedema in the upper limb and 31 women without lymphedema were included in the study at the Department of Physical Therapy and Rehabilitation. However, 3 individuals with and 1 without lymphedema were excluded from the study because they stated that did not want to continue due to shortage of time. In addition, because of one of the patients with lymphedema was also lower limb swelling, and 1 patient without lymphedema was also diagnosed with asthma. It was thought these conditions may affect the quality of life, therefore they were excluded from the study, as well. After all, the study was completed with 27 women with lymphedema and 29 without lymphedema.

Patient Characteristics and Medical Conditions: Type (mastectomy, breast conserving surgery) and duration of surgery, radiotherapy and chemotherapy histories, duration and severity of lymphedema, age, height, weight and body mass index (BMI) was recorded to the patient evaluation form.

Posture: New York Posture Rating Chart (NYPR) was used to evaluate posture. With this method, 13 different body regions are scored according to 3 different degrees of postural disorder. Five “5” points are given if the person's posture is good, three “3” points are moderately impaired, and one “1” point is severely impaired, and the total score is ranging from between “65” and “13”. Higher scores indicate better postural condition (23).

Upper Limb Function: Functional status of the upper limb was assessed by Minnesota Manual Dexterity Test (MMDT). This test contains 2 different method: placement and turning tests. For the placement test, the affected limb and unaffected side were evaluated separately. Patients were asked to insert the disks into the holes in the board from the left to right in order. The placement times were recorded for both limbs, separately. Fort he turning test, it was asked from the patients pick up the disks with one hand, turn them with the other hand, and replace the disks back into the holes on the board as fast as they can, and total turning time of all disks as second was recorded (24).

Quality of Life: To measure the cancer-related quality of life of the individuals, the European Organization for Research and Treatment of Cancer Core Quality of Life Questionnaire (EORTC QLQ C-30) was used. The questionnaire contains 30 questions in seven sub-headings: general well-being, physical function, role function, emotional function, cognitive function, social function and symptom score. High scores for all dimensions except symptom score indicate high quality of life, whereas high scores for symptom score reflect low quality of life (25).

Statistical Analysis: Descriptive values of the measurements were calculated as mean, standard deviation, number and % frequencies and given in tables. The Kolmogorov-Smirnov test was used to determine whether the numerical properties were normal in each group. Correlation coefficients and statistical significance were calculated with Spearman correlation coefficient for the relationships between at least one of the variables which were not normally distributed. Statistical significance level was taken as $p \leq 0.05$.

RESULTS

There were not any significant differences between the groups in terms of age, body weight, BMI, body length ($p>0.05$). Data on anthropometric characteristics of individuals are shown in Table 1. 19 (62.96%) of the patients in lymphedema group and 12 (41.37%) of the patients in without lymphedema group had undergone mastectomy surgery. 19 patients (70.37%) with lymphedema and 18 patients (62.07%) without lymphedema had a history of breast cancer surgery for more than 12 months. In addition, 17 (62.96%) of the patients with lymphedema had mild and 8 (29.62%) had moderate lymphedema; only 2 patients (7.40%) had severe lymphedema. Information including the medical history of the individuals is shown in Table 2. The posture score of the patients with lymphedema was lower than those without lymphedema ($p=0.004$). In terms of quality of life, general health status ($p<0.001$), physical ($p<0.001$), role ($p=0.011$), emotional ($p=0.002$), cognitive ($p<0.001$) and social function scores ($p<0.001$) were higher in without lymphedema group; symptom score ($p=0.004$) was higher in patients with lymphedema.

Table 1. Anthropometric characteristic of patients

	With lymphedema n=27	**Without lymphedema n=29**		
	X ± SS	**X ± SS**	**test value**	**p**
Age (year)	52,78 ± 7,65	50,62 ± 7,25	z=0,48	0,587
Body lenght (m)	1,55 ± 0,04	1,58 ± 0,06	z=0,798	0,671
Body weight (kg)	73,96 ± 9,18	69,97 ± 8,42	t=2,212	0,116
BMI (kg/m^2)	29,51 ± 3,60	28,01 ± 3,23	t=2,255	0,111

*p<0,05; BMI: Body Mass Index, m: meter, kg: kilogram; z: Mann Whitney U test value, t: independent samples t test

Table 2. Medical history of patients

		With lymphedema n=27	**Without lymphedema n=29**	**test value**	**p**
Dominant side	Right	24 (88,89%)	27 (93,1%)	t=2,534	0,282
	Left	3 (11,11%)	2 (6,9%)	-	-
Affected side	Right	11 (40,74%)	18 (62,07%)	t=2,547	0,110
	Left	16 (59,26%)	11 (37,93%)	t=2,039	0,632
Type of surgery	Mastectomy	19 (62,96%)	12(41,37%)	t=2,149	0,874
	Lumpectomy	8 (29,63%)	17 (58,62%)	-	-
Severity of lymphedema	Mild	17 (62,96%)	-	-	-
	Moderate	8 (29,62%)	-	-	-
	Severe	2 (7,40%)	-	-	-

*p<0,05; t: independent samples t test

When the upper limb functions were examined, MMBT healthy and affected side placement times, total placement time and turning time were higher in lymphedema patients (p<0.001). Posture, quality of life and upper limb function values and comparisons of the groups are shown in Table 3.

Table 3. Comparison of posture, quality of life and upper limb function between groups

	With lymphedema n=27	**Without lymphedema n=29**		
	X ± SS	**X ± SS**	**test value**	**p**
NYPR Total score	39,31 ± 1,16	45,07 ± 1,45	z= -2,893	**0,004***
QoL Global health status	47,74 ± 10,53	59,66 ± 11,50	z=-3,554	**<0,001***
QoL Physical functioning	50,99 ± 15,37	71,17 ± 15,45	z=-4,201	**<0,001***
QoL Role functioning	49,73 ± 17,16	63,64 ± 19,29	z=-2,559	**0,011***
QoL Emotional functioning	58,89 ± 25,42	77,93 ± 23,76	z=-3,118	**0,002***
QoL Cognitive functioning	69,84 ± 34,99	95,11 ± 14,69	z=-3,861	**<0,001***
QoL Social functioning	44,02 ± 12,23	71,82 ± 16,15	z=-5,292	**<0,001***
QoL Symptom score	48,41 ± 11,82	38,66 ± 11,97	t=3,035	**0,004***
MMDT US-Placing time	67,65 ± 8,4	55,52 ± 6,86	t=5,625	**<0,001***
MMDT AS-Placing time	74,83 ± 10,66	62,93 ± 7,89	z=-3,847	**<0,001***
MMDT Total placing time	142,48 ± 17,35	118,78 ± 13,43	t=3,642	**<0,001***
MMDT Turning time	77,09 ± 7,26	60,22 ± 7,81	t=2,397	**<0,001***

*p<0,05; QoL: Qualtiy of life, US: Unaffected side, AS Affected side; NYPR: New York Posture Rating; MMDT: Minnesota Manual Dexterity Test; z: Mann Whitney U test value, t: independent samples t test

When the relationship between posture and quality of life was examined separately for each group, there was a moderate positive correlation between posture and quality of life general health status scores in both with and without lymphedema groups (r=0.516, p=0.007; r=0.486, p=0.008; respectively). There was no correlation between quality of life subscales and posture of lymphedema group (p>0.05), while positive correlation was found between only emotional and cognitive function scores and posture among the quality of life sub scores in without lymphedema group (r=0.415, p=0.025; r=0.455, p=0.013; respectively). There was no correlation between posture and upper limb function in both groups (p>0.05). The correlations between posture and quality of life, and posture and upper limb functions of the groups are shown in Table 4.

Table 4. Correlation between posture with quality of life and upper limb function

		With lymphedema n=27	**Without lymphedema n=29**
		NYPR Score	**NYPR Score**
QUALITY OF LIFE – EORTC QLQ C-30			
Global health status	**r**	**0,516***	**0,486***
	p	**0,007**	**0,008**
Physical functioning	**r**	-0,093	0,133
	p	0,650	0,493
Role functioning	**r**	-0,003	0,213
	p	0,989	0,268
Emotional functioning	**r**	0,101	**0,415***
	p	0,622	**0,025**
Cognitive functioning	**r**	-0,185	**0,455***
	p	0,367	**0,013**
Social functioning	**r**	-0,154	0,340
	p	0,452	0,071
Symptom score	**r**	-0,298	-0,137
	p	0,139	0,478
UPPER LIMB FUNCTION			
MMDT US-Placing time	**r**	0,091	0,125
	p	0,679	0,534
MMDT AS-Placing time	**r**	0,114	0,096
	p	0,603	0,633
MMDT Turning time	**r**	-0,131	0,158
	p	0,551	0,432
MMDT Total Placing time	**r**	0,097	0,192
	p	0,660	0,338

p<0,05; US: Unaffected side, AS Affected side; NYPR: New York Posture Rating; MMDT: Minnesota Manual Dexterity Test

The relationship between upper limb function and quality of life was examined, and it was found that there was a negative moderate correlation only between the duration of placement of the affected side and the social function score of the quality of life subscale in lymphedema group (r=-0.468, p=0.024). In the group of without lymphedema, MMDT scores was correlate negatively moderate (r=-0.599, p=0.001) and mild (r=-0.392, p=0.043) with the physical function score and emotional function score of the quality of life sub-dimensions for the placement time with the healthy side, respectively. In addition, there was moderate positive correlation between MMDT healthy side placement score and symptom score (r=0.451, p=0.018). Further, there was a moderate negative correlation between total placement time and physical function score of quality of life sub-dimensions in the group of without lymphedema (r=-0.482, p=0.011). Correlations between upper limb function and quality of life of the groups are shown in Table 5.

Table 5. Correlation between quality of life and upper limb function

		With lymphedema n=27			
		MMDT US - Placing time	**MMDT AS - Placing time**	**MMDT Turning time**	**MMDT Placing Total time**
QoL Global health status	**r**	0,188	0,059	0,038	0,167
	p	0,389	0,787	0,862	0,447
QoL Physical functioning	**r**	-0,098	-0,048	0,257	-0,001
	p	0,658	0,826	0,236	0,996
QoL Role functioning	**r**	-0,085	-0,105	0,041	-0,079
	p	0,701	0,633	0,852	0,719
QoL Emotional functioning	**r**	0,139	0,367	0,049	0,285
	p	0,526	0,085	0,825	0,188
QoL Cognitive functioning	**r**	0,064	0,260	-0,086	0,239
	p	0,771	0,230	0,696	0,272
QoL Social functioning	**r**	-0,297	**-0,468***	-0,100	-0,344
	p	0,169	**0,024**	0,648	0,108
QoL Symptom score	**r**	-0,027	-0,005	0,007	-0,077
	p	0,903	0,982	0,974	0,725
		Without lymphedema n=29			
QoL Global health status	**r**	-0,298	-0,077	0,068	-0,228
	p	0,131	0,701	0,735	0,252
QoL Physical functioning	**r**	**-0,599***	-0,345	0,000	**-0,482***
	p	**0,001**	0,078	0,998	**0,011**
QoL Role functioning	**r**	-0,177	-0,288	0,120	-0,300
	p	0,377	0,146	0,550	0,128
QoL Emotional functioning	**r**	**-0,392***	-0,024	-0,030	-0,255
	p	**0,043**	0,904	0,883	0,200
QoL Cognitive functioning	**r**	0,124	0,073	0,167	0,170
	p	0,536	0,716	0,406	0,396
QoL Social functioning	**r**	-0,212	0,004	-0,155	-0,113
	p	0,288	0,985	0,439	0,574
QoL Symptom score	**r**	**0,451***	0,206	0,134	0,370
	p	**0,018**	0,303	0,506	0,057

p<0,05; US: Unaffected side, AS Affected side; QoL: Quality of life; MMDT: Minnesota Manual Dexterity Test

DISCUSSION

This study demonstrated that upper limb lymphedema adversely affects posture and upper limb functions and decreases quality of life in patients with upper limb lymphedema following breast cancer related surgery. In addition, according to the results of the study, it was concluded that there was relationship between postural alterations and health-related quality of life; however, there was no relationship between postural changes and upper limb functions, and between upper limb functions and quality of life in patients with lymphedema.

Surgical options are one of the most essential treatment modalities in the treatment of breast cancer and come to the fore as an important interventional

method for tumor removal (3). Surgery includes different options ranging from extensive radical to minor interventional methods (26). Therefore, different sizes of tissue may affect in the body according to the type of surgery and this also constitutes the size of physical changes (27,28). Upper limb functions deteriorate due to physiological and physical complications such as pain, large incision, muscle strength loss and lymphedema after surgery (28,29) and some postural changes occur after surgery (18, 19).

In this study, it was seen that the postures of individuals with upper limb lymphedema were more affected than individuals with a history of breast cancer surgery but who did not develop lymphedema. Considering that the severity of lymphedema caused changes in the volume and weight of the limbs and affected the body center of gravity, the results of our study revealed the effects of upper limb lymphedema on posture. Most of the women with lymphedema in the current study had mild in terms of severity. However, our results showed that even the severity of lymphedema was mild, it may pave the way for posture disorder. Haddad et al. (19) found that there was anterior inclination in the trunk and body center of gravity after mastectomy and concluded that these values were higher in those who developed lymphedema than those who did not. In addition, they showed that the anterior protrusion of the head, especially in patients with lymphedema, and that the side developing lymphedema had head rotation in the opposite direction. It was set out that shoulder protraction and scapular rotation affects postural alterations and some adaptive kinematic changes can develop (15). Therefore, it can stated that postural changes result in some functional disorders.

In this study, upper limb function was evaluated by MMDT, which reflects more functionally objective values on upper limb. The placement and turning tests results obtained from this test battery showed that the upper limb functions of the patients with lymphedema were worse than without lymphedema. When we consider the increase in the weight and volume of the limb due to lymphedema, we should say that this result is consistent with our expectations. When we look at similar studies in the literature, these studies support our findings. Smoot et al. (13), in a similar study, demonstrated that upper limb functions of both groups were affected; however, women with lymphedema had poorer functions than without lymphedema, with a significant reduction in elbow flexion muscle strength of the especially the affected limb, and the loss of sensation in the arm with lymphedema throughout the arm. Dawes et al. (30) In another study by the support of our findings, it was concluded that lymphedema adversely affects upper limb functions. In addition, as the severity of lymphedema increased dysfunction of the arm get worse, as well as concluded that the grip muscle strength decreased.

It was demonstrated that some postural disorders or changes can alter limbs kinematics (15,31) and some disorders of the arm may arise after breast cancer related surgery (13,30). Therefore, we predicted that postural disorders aggravated by lymphedema after breast cancer related surgery exacerbate the function of the arm. However, results of the study demonstrated that even if posture of the patients with lymphedema has worse upper limb function, there are no relationship between posture and functionality of the upper limb. These results may have been obtained because of the comparison of general posture scores in terms of posture and having the mild swelling on limb most of the patients with lymphedema.

The quality of life of the patients investigated and it was concluded that the presence of lymphedema decreases the quality of life more after surgery. Therefore, the presence of lymphedema can be considered to increase the negative effects on quality of life. According to results of the study, lymphedema affects quality of life such as emotional, functional, health, social aspects of life and symptomatic properties related to surgery and swelling of the limbs. There are studies that shows the impact of lymphedema on quality of life with different aspects of life such as physical, social, work related domains. It was obvious that performing important activities in daily life such as dressing, personal care and participation in social activities is an important factor to enhance life satisfaction. Therefore, failure to meet needs of daily care and limitation of participation of daily life and social activities has negative effects on quality of life (32,33). By contrast with, in the current study it was not found any relationship between quality of life and upper limb dysfunction. However, it was presented that there was a relationship between quality of life and posture which demonstrates that patients with lymphedema has worse posture and as posture deteriorates quality of life decreases. On the other hand, we found that posture and upper limb functions of patients with lymphedema affected more than without lymphedema; however, it seems that in terms of physical, emotional and symptom domains of quality of life in patients without lymphedema more related to upper limb functions than patients without lymphedema.

In our study, we could not obtain the predicted results in terms of the relationships between some parameters examined. This may be because the fact that the most of patients with lymphedema are mild in severity of lymphedema. If we had a homogeneously distributed sample within the group in terms of the severity of lymphedema, we could examine better whether the parameters of posture, limb function and quality of life would change according to the severity. This was the main limitation of the study. In addition,

there was other questionnaires to assess quality of life for breast cancer, however, we could not use them. Using disease specific instruments can give more accurate results, may reflecting better relationship with other parameters. Another limitation of the study was distribution of the surgery types within and between the groups. This heterogeneous distribution may be the main reason for the differences in terms of results between the groups. Studies involving both groups of the same type of surgery and distributed at equal numbers of different severities of lymphedema patients in the lymphedema group will reflects more reliable results.

In conclusion, posture, upper limb function and quality of life of patients with upper limb lymphedema were affected more adversely than whose did not develop lymphedema after breast cancer surgery, even if severity of lymphedema was mild. In addition, severity of postural disorders is associated with the worse quality of life. However, there is no relationship between upper limb function with posture and quality of life.

REFERENCES

1. Ferlay J, Héry C, Autier P, et al. Global burden of breast cancer. Breast cancer epidemiology: Springer; 2010: 1-19.
2. Şencan İ, Keskinkılıç B. Türkiye Kanser İstatistikleri. TC Sağlık Bakanlığı, Türkiye Halk Sağlığı Kurumu. 2015.
3. Verkooijen HM, Fioretta GM, Rapiti E, et al. Patients' refusal of surgery strongly impairs breast cancer survival. Ann Surg 2005;242(2):276.
4. Kuehn T, Klauss W, Darsow M, et al. Long-term morbidity following axillary dissection in breast cancer patients–clinical assessment, significance for life quality and the impact of demographic, oncologic and therapeutic factors. Breast Cancer Res Tr 2000;64(3):275-86.
5. Ebaugh D, Spinelli B, Schmitz KH. Shoulder impairments and their association with symptomatic rotator cuff disease in breast cancer survivors. Med Hypotheses 2011;77(4):481-7.
6. Büyükakıncak Ö, Akyol Y, Özen N, et al. Quality of Life in Patients with Breast Cancer at Early Postoperative Period: Relationship to Shoulder Pain, Handgrip Strength, Disability, and Emotional Status. Turk J Phys Med Rehab's 2014;60(1).
7. Koehler LA, Hunter DW, Blaes AH,et al. Function, Shoulder Motion, Pain, and Lymphedema in Breast Cancer with and Without Axillary Web Syndrome: An 18-Month Follow-Up. Phys Ther 2018; 98(6):518-527.
8. DiSipio T, Rye S, Newman B, et al. Incidence of unilateral arm lymphoedema after breast cancer: a systematic review and meta-analysis. Lancet Oncol 2013;14:500–515
9. Leidenius M, Leppänen E, Krogerus L, et al. Motion restriction and axillary web syndrome after sentinel node biopsy and axillary clearance in breast cancer Am J Surg. 2003;185(2):127-30
10. Norman SA, Localio AR, Potashnik SL, et al. Lymphedema in breast cancer survivors: incidence, degree, time course, treatment, and symptoms. J Clin Oncol 2009;27(3):390.
11. McLaughlin SA, Wright MJ, Morris KT, et al. Prevalence of lymphedema in women with breast cancer 5 years after sentinel lymph node biopsy or axillary dissection: objective measurements. J Clin Oncol 2008;26(32):5213.
12. Karadibak D, Yavuzsen T. Evaluation of kinesthetic sense and hand function in women with breast cancer-related lymphedema. J Phys Ther Sci 2015;27(6):1671-5.
13. Smoot B, Wong J, Cooper B, et al. Upper limb impairments in women with or without lymphedema following breast cancer treatment. J Cancer Surviv 2010;4(2):167-78.
14. Hopwood P, Haviland JS, Sumo G, et al. Comparison of patient-reported breast, arm, and shoulder symptoms and body image after radiotherapy for early breast cancer: 5-year follow-up in the randomised Standardisation of Breast Radiotherapy (START) trials. Lancet Oncol 2010;11(3):231-40.
15. Crosbie J, Kilbreath SL, Dylke E, et al. Effects of mastectomy on shoulder and spinal kinematics during bilateral upper-limb movement. Phys Ther 2010;90(5):679-92.
16. Kisner C, Colby LA. Exercícios terapêuticos: fundamentos e técnicas. Exercícios Terapêuticos: fundamentos e técnicas.2009:1000.
17. Bąk M, Cieśla S. Assessment of postural disorders in women after radical mastectomy followed by immediate breast reconstruction. Physiotherapy 2009;17(1):30-7.
18. Collins LG, Nash R, Round T, et al. Perceptions of upper-body problems during recovery from breast cancer treatment. Support Care Cancer 2004;12(2):106-13.
19. Haddad CAS, Saad M, Perez MdCJ, et al. Assessment of posture and joint movements of the upper limbs of patients after mastectomy and lymphadenectomy. Einstein (Sao Paulo) 2013;11(4):426-34.
20. Ahmed RL, Prizment A, Lazovich D, et al. Lymphedema and quality of life in breast cancer survivors: the Iowa Women's Health Study. J Clin Oncol 2008;26(35):5689.
21. Klassen AF, Pusic AL, Scott A, et al. Satisfaction and quality of life in women who undergo breast surgery: a qualitative study. BMC Women's Health 2009;9(1):11.
22. Nesvold IL, Reinertsen KV, Fosså SD, et al. The relation between arm/shoulder problems and HRQL in breast cancer survivors: a cross-sectional and longitudinal study. J Cancer Surviv 2011;5: 62–72.

23. McRoberts LB, Cloud RM, Black CM. Evaluation of the New York Posture Rating Chart for assessing changes in postural alignment in a garment study. Cloth Text Res J 2013;31(2):81-96.
24. Instrument L. The Minnesota Dexterity Test Examiner's Manual. USA, Lafeyette Company. 1998.
25. Fayers PM, Aaronson NK, Bjordal K, et al. EORTC QLQ-C30 scoring manual. 1999.
26. Hunt KK, Meric-Bernstam F. Surgical options for breast cancer. Breast Cancer 2nd edition: Springer; 2008:197-234.
27. Thompson A, Air M, Jack W, et al. Arm morbidity after breast conservation and axillary therapy. The Breast 1995;4(4):273-6.
28. Belmonte R, Messaggi-Sartor M, Ferrer M, et al. Prospective study of shoulder strength, shoulder range of motion, and lymphedema in breast cancer patients from pre-surgery to 5 years after ALND or SLNB. Support Care Cancer 2018; 26 (9): 3277–3287.
29. Johansson K, Holmström H, Nilsson I, et al. Breast cancer patients' experiences of lymphoedema. Scand J Caring Sci 2003;17(1):35-42.
30. Dawes DJ, Meterissian S, Goldberg M, et al. Impact of lymphoedema on arm function and health-related quality of life in women following breast cancer surgery. J Rehabil Med 2008; 40(8): 651-8
31. Cheville AL, Tchou J. Barriers to rehabilitation following surgery for primary breast cancer. J Surg Oncol 2007;95: 409–418.
32. Klernas P, Johnsson A, Horstmann V, et al. Health-related quality of life in patients with lymphoedema – a cross-sectional study. Scand J Caring Sci 2018;32(2):634-644
33. Ridner SH, Dietrich MS, Kidd N. Breast cancer tr eatment-related lymphedema self-care: education, practices, symptoms, and quality of life. Support Care Cancer 2011;19 (5):631–637.