Mapeamento dinâmico da dor aos três, seis e nove meses após a cirurgia do câncer de mama

Dynamic pain mapping at three, six and nine months after breast cancer surgery

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RESUMO

Objetivo: Mapear a frequência e intensidade da dor de acordo com as atividades no domínio físico do *The Disabilities of the Arm, Shoulder and Hand Questionnaire* (DASH), aos três, seis e nove meses após a cirurgia do câncer de mama. Além disso, verificar a correlação entre a função dos membros superiores e a intensidade da dor. **Métodos:** Este é um estudo de coorte prospectiva, com acompanhamento em três tempos. 22 mulheres brasileiras diagnosticadas com câncer de mama foram incluídas aos três meses após a cirurgia de mama. Elas responderam ao questionário DASH, o Diagrama de Dor Corporal e a Escala Visual Analógica. Medidas de frequência foram utilizadas para analisar a frequência e intensidade da dor nos itens do domínio físico do DASH. O coeficiente de correlação de Pearson entre a intensidade da dor e a pontuação total do DASH, foi calculado nos três momentos de análise, um intervalo de confiança de 95% foi estabelecido. **Resultados:** Para vinte e duas mulheres aos três, seis e nove meses após a cirurgia, a área do corpo com maior frequência de dor foi o membro superior (MS) homolateral à cirurgia, embora, o MS contralateral também tenha sido citado como uma das áreas com maior frequência de dor no sexto e nono meses. A intensidade da dor aos três e seis meses permaneceu leve e moderada no nono mês. As atividades do DASH com a maior frequência de dor foram: "colocar algo em uma prateleira acima da cabeça", "fazer tarefas domésticas pesadas" e "carregar um objeto pesado". A correlação entre a intensidade da dor e a função do MS contralateral à cirurgia aos nove meses foi forte (r=0,718; p<0,01). **Conclusão:** A área do corpo com maior frequência de dor em todos os tempos de análise foi o MS homolateral à cirurgia, embora o MS contralateral também estivesse presente no sexto e nono mes. Houve um aumento na intensidade da dor ao longo do tempo. As atividades mais dolorosas foram aquelas que exigiam grandes amplitudes em diferentes planos de movimento. No nono mês, a dor no MS contralateral mostrou uma forte correlação com a disfunção dos membros.

Palavras-chave: Neoplasia de mama, Medição da dor, Funcionalidade, Atividades de vida diária, Pós-operatório.

ABSTRACT

Purpose: To map pain frequency and pain intensity according to activities in the physical domain of the Disabilities of the Arm, Shoulder and Hand Questionnaire (DASH), at three, six and nine months after breast cancer surgery. In addition, to verify the correlation between upper limb function and pain intensity. ***Methods:*** This is a prospective cohort study, with follow-up at three time points. 22 Brazilian women diagnosed with breast cancer were included at three months after breast surgery. They performed the DASH questionnaire, the Body Pain Diagram and the Visual Analogue Scale. Frequency measures were used to analyze the frequency and intensity of pain in the items of the physical domain of the DASH. Pearson's correlation coefficient between pain intensity and the DASH total score at the three different times was calculated, a 95% confidence interval was set. ***Results:*** For twenty-two women at three, six and nine months after surgery, the body area with the highest pain frequency was the upper limb (UL) homolateral to the surgery, although, the contralateral UL was also cited as one of the areas with the highest pain frequency at sixth and ninth month. Pain intensity at three and six months remained mild and moderate in ninth month. The DASH activities with the highest pain frequency were: “putting something on a shelf above your head”, “doing heavy household chores” and “carrying a heavy object”. The correlation between pain intensity and function of the UL contralateral to surgery at nine months was strong (r=0,718; p<0.01). ***Conclusion:*** The body area with the highest pain frequency at all three

times points of analysis was the UL homolateral to the surgery, although the contralateral UL was also present in sixth and ninth month. There was an increase in pain intensity over time. The most painful activities were those that required large amplitudes in different planes of motion. At the ninth month, pain in the contralateral UL showed a strong correlation with limb dysfunction.

Keywords: Breast neoplasm, Pain measurement, Functionality, Daily Living Activities, Postoperative.

1 INTRODUCTION

According to the World Health Organization (WHO), breast cancer is the most common cancer in the world among women (FERLAY et al., 2021). Breast cancer is also the most incident cancer in Brazilian female population, with an increase of 2.9% cases per year among women between 55 and 64 years old (INCA, 2020; WILD CP, WEIDERPASS E, 2020). In Brazil, it is estimated 66 thousand new cases of breast cancer for the next years(INCA, 2020; WILD CP, WEIDERPASS E, 2020).

With increased survival after diagnosis, there is persistence of adverse effects, often associated with surgical and adjuvant therapies (COONEY; CULLETON-QUINN; STOKES, 2013; FERREIRA; FRANCO, 2019; WANG et al., 2018). Limitations in the shoulder range of motion, changes in musculoskeletal structures and pain intensity are factors that together or in isolation, contribute to the upper limbs (UL) dysfunction in this population (DE GROEF et al., 2017; DE OLIVEIRA et al., 2017; RANGON et al., 2018; TATHAM et al., 2013).

Pain after cancer is reported in 25% to 60% of cases (WANG et al., 2016). The condition of severe pain in the postoperative period, lasting up to three months, is a risk factor for the development of chronic musculoskeletal pain (BELFER et al., 2013; BEYAZ et al., 2016; DIVELLA et al., 2020), becoming more evident during daily living tasks.

The continuous assessment by clinicians and researchers is required after breast cancer treatments, since can lead to a decrease in functionality (HARRINGTON et al., 2011; IBRAHIM et al., 2017). Hence, an affordable tool to assess pain behaviour and its development is pain mapping that allows a quick identification of segments with pain via observation of a body scheme in different standing positions (BACK et al., 2021; JUD et al., 2010).

Due to continuous adaptations and changes faced by breast cancer survivors after treatments(IBRAHIM et al., 2017; YANG et al., 2015), the pain analysis during functional activities over time can prevent the worsening of physical dysfunctions, allow the monitoring and management of symptoms that impact the daily living tasks and contribute to a safer the return to work (BACK et al., 2021)

Given this context, the aim was to map pain frequency and pain intensity during the activities listed in the physical domain of the Disabilities of the Arm, Shoulder and Hand Questionnaire (DASH), at three, six and nine months after breast cancer surgery. Secondarily, to verify the correlation between upper limb function and pain intensity.

2 METHODS

2.1 PARTICIPANTS

This is a prospective observational cohort study involving Brazilian women diagnosed with breast cancer assessed at three, six and nine-months post-surgery. The assessments were performed between August 2018 and May 2019, in the same shift of the day, by the same researcher and a properly trained assistant.

The study included women diagnosed with breast cancer who were and submitted to unilateral surgical treatment, after three months of surgery, who were receiving or not the adjuvant therapies, who were under medical follow-up in Florianopolis (SC). The following exclusion criteria were adopted: open lesions due to radiotherapy or dysfunctions prior to cancer that resulted in limitation of the UL range of motion, no healing of the surgical incision or acquired infection, metastases, and women with cognitive impairment and/or difficulty in answering the questionnaires or carrying out the proposed activities. All women in the study were evaluated at three, six and nine months after surgery.

This research is part of a major project (BACK et al., 2020, 2021), approved by the Research Ethics Committee with Human Beings (CEPSH) of the Santa Catarina State University (UDESC), under registration 2.835.766. Co-participating institutions also gave their approval under the registration numbers: 2.650.148 and 2.814.975.

2.2 INSTRUMENTS

2.2.1 Sociodemographic and clinical evaluation form

For the data collection of sociodemographic and clinical aspects, an assessment form was elaborated to address individual aspects such as: age, marital status (with

partner or without partner), schooling (up to eight years of study or more than eight years of study), ethnicity (white or black/asian/indigenous) and family-income (up to one minimum wage or more than one minimum wage). Questions about the clinical aspects included: the type of surgery (mastectomy or breast-conserving), axillary surgery (axillary lymph node dissection or sentinel lymph node biopsy), side of the surgery (left or right), and breast reconstruction surgery (yes or no).

At three, six and nine months, questions related to the type of curative therapy used (radiotherapy, chemotherapy and/or hormone therapy), return to work (yes or no), and physical therapy (yes or no) were assessed.

2.2.2 Disabilities of the Arm, Shoulder and Hand Questionnaires (DASH)

The DASH was developed to evaluate physical disability and UL symptoms during activities of daily living (ADLs), and has been translated and validated to Brazilian population since 2005 (ORFALE et al., 2005). The questionnaire is composed of 30 items, divided in domains of physical function, symptoms, and social function. The first 20 items are related to physical function and the ability to perform specific daily tasks, such items were chosen so that pain intensity during these tasks could be assessed together. Each item is scored using a Likert-type scale (0 to 5) and the total score ranges from 0 to 100, whereas a score closer to 100 indicates higher physical disability and symptoms in the upper limbs, with scores ≥20 representing significant loss of function (HARRINGTON et al., 2011; HUDAK et al., 1996; LAURIDSEN; CHRISTIANSEN; HESSOV, 2005; ORFALE et al., 2005; RIBEIRO et al., 2019).

2.2.3 Body Pain Diagram (BPD)

The BPD is a tool developed by the authors based on a previous published study by the same research group (BACK et al., 2021; JUD et al., 2010). The tool consists of a graphic representation of a woman's body, in three views: anterior, posterior and lateral (BACK et al., 2021). The BPD was designed to identify the pain location and its frequency.

2.2.4 Visual Analog Scale (VAS)

This instrument consists of a numerical scale composed of a line with numbers from 0 to 10cm to quantify pain intensity. The number 0 indicates “no pain” and the

number 10 the “worst pain imaginable”. The classification is made as follows: 1 to 3 mild intensity, 4 to 6 moderate intensity, and 7 to 10 severe intensity (BREIVIK et al., 2008).

2.3 DATA COLLECTION

After signing the informed consent form, data collection was performed using the clinical and sociodemographic form. Then, participants answered the DASH questionnaire, for each item of the physical domain, they were instructed to look at the DCD, record if they feel pain during the task execution, and paint with a red pencil the regions where they present. These items would make the mental representation of these tasks in their daily life. In cases of absence of pain, they were instructed to leave the diagram in blank.

Subsequently, the women classified the pain intensity of the colored regions on the BPD according to the VAS. This strategy was used in the three-time analysis. To distinguish the UL homolateral and contralateral to surgery, the mapping was divided between women who underwent surgery on the right and left breast.

2.3.1 Processing of the Body Pain Diagram

The body pain diagrams were scanned individually using an HP DeskJet Ink Advantage 4536® multifunction printer. To overlap the images, the free image editor GNU Image Manipulation Program® (GIMP), version 2.10.12 was used. The images were opened and overlapped individually, creating layers that were combined and unified. The image editing parameters were as following: 35% opacity, noise reduction (strength 32).

Initially the intra-subject images were overlapped, and each participant generated a pain map in the tree periods of analysis. At three months postoperatively, 111 images were produced, at six months 91 images and at nine months 129 images were analyzed.

The inter-subject analysis occurred through the combination of the maps in each postoperative period. As a result of the mapping, the areas considered most painful were those where the red color was brighter. Hence, it was possible to analyze the most frequent pain areas, in the different periods, in a distinct and isolated way.

2.4 STATISTICAL ANALYSIS

The data was organized in the Excel program (version 2010) and then analyzed in SPSS software - Statistical Package for Social Sciences (version 20.0). To characterize

the sample, the measures of frequency, mean and standard deviation were used. In the analysis of areas, frequency, and pain intensity on DASH questions, at three, six and nine months after breast cancer surgery, frequency measures were used. The Pearson's correlation coefficient between the pain intensity in the most incident sites and the total score of the DASH at the three different times was calculated. A 95% interval of confidence was set.

The classification of the adopted correlation coefficient was: values between 0 and 0.3 were considered insignificant; between 0.31 and 0.5 weak; 0.51 to 0.7 moderate; 0.71 to 0.9 strong; and> 0.9 very strong correlations (MIOT, 2017; MUKAKA, 2012).

2.5 SAMPLE SIZE CALCULATION

The sample size calculation was performed using the G* Power program. The correlation test was adopted for the sample calculation necessary to achieve the objective of correlating the data obtained between the DASH questionnaire score and pain intensity. Sample size was calculated based on an effect size of 0.53, with an alpha level of 0.05 and a power of 0.8 (AARTS et al., 2015; PORTNEY;, 2015). This calculation resulted in a sample size of 20 participants. Allowing for a 10% loss to follow-up, 22 women were recruited to participate.

3 RESULTS

The sample consisted of 22 women up to the sixth month, with a sample loss of two participants at nine months (one death, one scar dehiscence, which by medical recommendation it was not possible to perform the assessment). Table 1 presents the sample characterization in terms of sociodemographic and clinical aspects. The mean age of the participants was 56 years (±11.70), with 68.2% (n=15) of women having undergone to breast-conserving surgery and 77.3% (n=17) not having undergone breast reconstruction.

Table 1. Sample characterization regarding sociodemographic and clinical data (n=22).

Variables	N (%)	Mean (±SD)
Age[1]		56 (±11.70)
Marital Status		
With a partner	8 (40.9)	
Without a partner	14 (59.1)	
Schooling		
Up to 8 years of study	7 (31.8)	
More than 8 years of study	14 (63.6)	
Did not answer	1 (4.5)	
Ethnicity		
White	20 (90.9)	
Black/Asian/Indigenous	2 (9.1)	
Family income		
Up to 1 minimum wage	9 (40.9)	
More than 1 minimum wage	12 (54.5)	
Did not answer	1 (4.5)	
Type of breast surgery		
Mastectomy	6 (27.3)	
Breast-conserving	15 (68.2)	
Did not answer	1 (4.5)	
Axillary Surgery		
Axillary lymph node dissection	10 (45.5)	
Sentinel lymph node biopsy	9 (40.9)	
Did not answer	3 (13.6)	
Surgery side		
Right	8 (36.4)	
Left	14 (63.6)	
Breast reconstruction		
Yes	5 (22.7)	
No	17 (77.3)	

[1] Data presented as mean ± standard deviation.

The aspects related to the treatments used, return to work and physical therapy treatment at the different times are shown in Table 2. At three months, 36.4% (n=8) of women had undergone to chemotherapy, 27.3% (n=6) to radiotherapy and 27.3% (n=6) hormone therapy. At six months, there was an increase of women who underwent to chemotherapy 54.5% (n=12). At nine months of post-operatory 60% (n=12) of women were undergoing radiotherapy and hormone therapy. At three months, 63.6% (n = 14) of the women had not returned to work and at six months this number increased to 81.8% (n=18).

Table 2. General characteristics of the sample at 3, 6 and 9 months postoperatively in breast cancer survivors.

Variables	3 Months (n=22)	6 Months (n=22)	9 Months (n=20)
	N (%)	N (%)	N (%) †
Chemotherapy			
Yes	8 (36.4)	12 (54.5)	12 (60.0)
No	14 (63.6)	10 (45.5)	8 (40.0)
Radiotherapy			
Yes	6 (27.3)	8 (36.4)	12 (60.0)
No	16 (72.7)	14 (63.6)	8 (40.0)
Hormone therapy			
Yes	6 (27.3)	7 (31.8)	12 (60.0)
No	16 (72.7)	15 (68.2)	8 (40.0)
Return to work			
Yes	4 (18.2)	4 (18.2)	5 (25.0)
No	14 (63.6)	18 (81.8)	15 (75.0)
Missing	4 (18.2)	0	0
Physical therapy			
Yes	7 (31.8)	4 (18.2)	1 (5.0)
No	15 (68.2)	18 (81.8)	19 (95.0)

†n=20 due to sample loss

After processing the BPD, unique maps of all participants were generated at three, six and nine months. The areas with higher pain frequencies are shown in Figures 1 and 2. At three months postoperatively, the area with higher pain frequency was the UL homolateral to the surgery with 63.6% (n=14), followed by the lateral trunk 45.5% (n=10) and anterior trunk 36.4% (n=8).

Figure 1. a) represents the body pain diagram at three months postoperatively in breast cancer survivors, anterior, posterior, and lateral views; b) represents the body pain diagram at six months postoperatively in breast cancer survivors, anterior, posterior, and lateral views; c) represents the body pain diagram at nine months postoperatively in breast cancer survivors, anterior, posterior and lateral views.

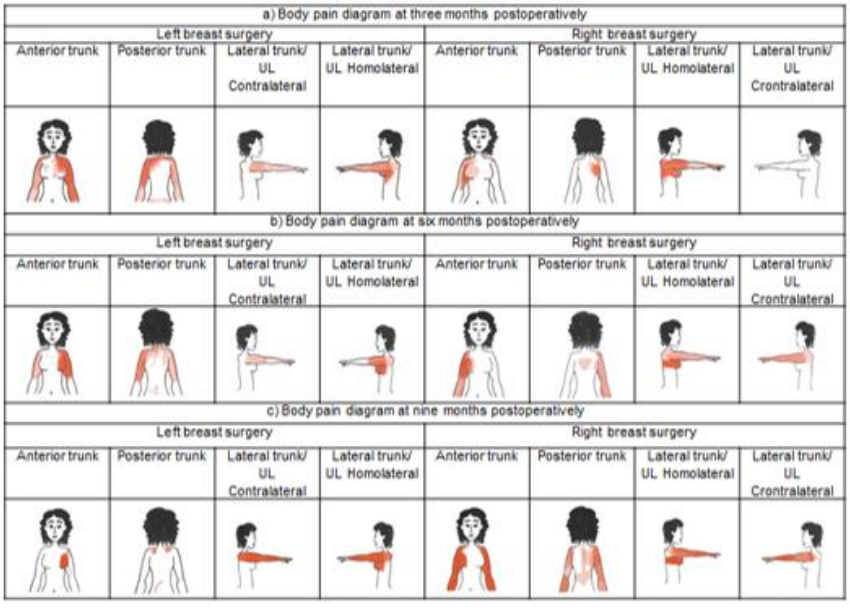
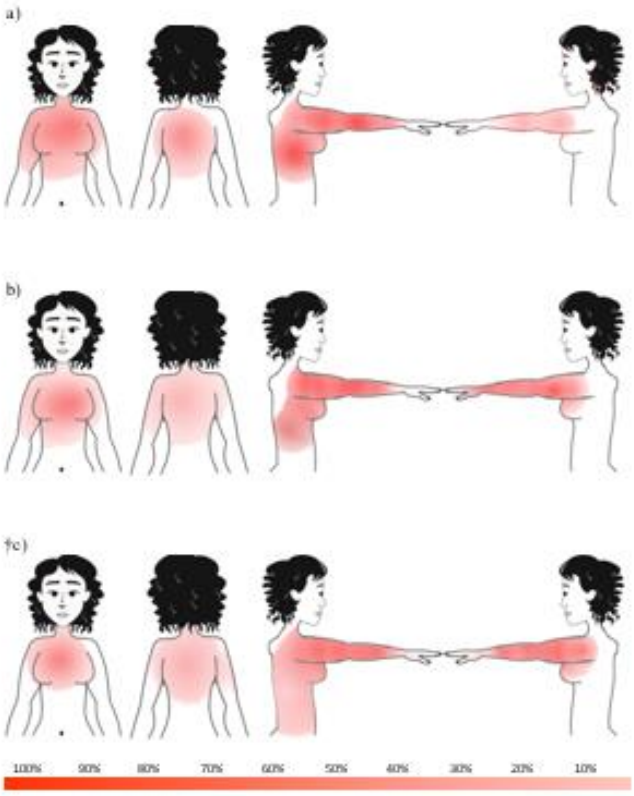


Figure 2. Pain frequency area (%) at three, six and nine months postoperatively, in breast cancer survivors (n=22) †n=20 due to sample loss; a) represents the analysis of the third postoperative month; b) represents the analysis of the sixth postoperative month; c) represents the analysis of the ninth postoperative month.

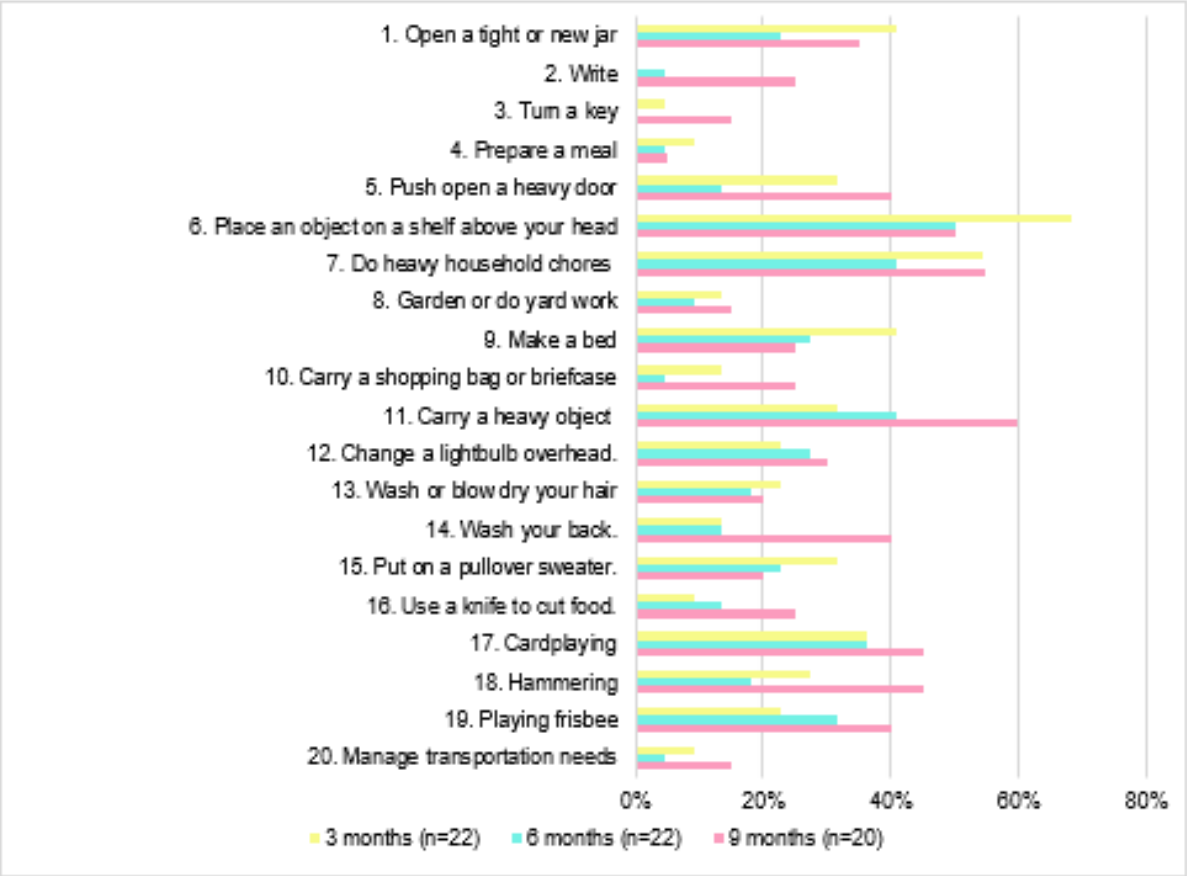


At both six and nine months, the area with higher pain frequency was the UL homolateral to the surgery, with 59.1% (n=13) and 65.0% (n=13) respectively, followed by the UL contralateral to the surgery, at six months 40.9% (n=9) and at nine months, 60.0% (n=12).

The pain intensity reported by most women during DASH activities at three and six months, was mild (VAS 1 to 3), but at nine months it was moderate (VAS 4 to 7).

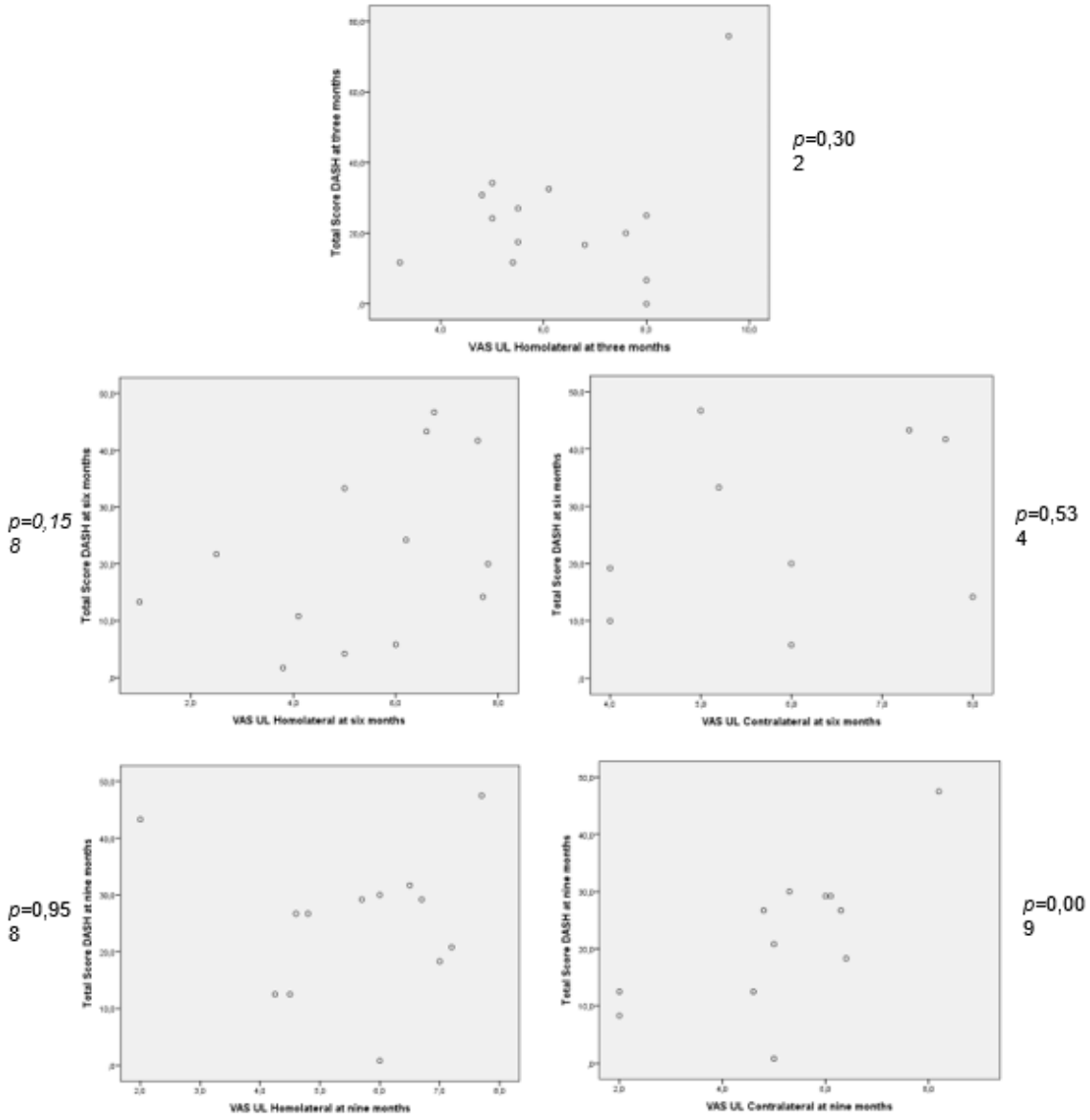
When applying the DASH questionnaire, the first 20 items, representing the physical domain, at three months, it was observed that the activities that presented the highest pain frequency were the following: Question six “Place an object on a shelf above your head” (68.2%), followed by question seven "Do heavy household chores (e.g., wash walls, wash floor)" (54.5%), question one "Open a tight or new jar" and question nine "Make a bed" (40.9%). At six months, the activities that presented the highest pain frequency were questions six (50%), seven (40.9%) and eleven “Carry a heavy object (over 10 lbs)” (40.9%). At nine months, question eleven was the one with the highest pain frequency, followed by questions six (50.0%) and seven (55.0%) (Figure 3).

Figure 3. Pain frequency in each of the 20 questions of the DASH instrument, at three, six and nine months after surgery in breast cancer survivors.



When we correlated the pain intensity in the most frequent areas at the three different times with the total score of the DASH questionnaire for each participant, no statistical significance was observed, as shown in the dispersion graph in Figure 4. However, at nine months the variable pain intensity in the UL contralateral to the surgery obtained a significant result, with a strong correlation.

Figure 4. Correlation of the DASH total score and pain intensity at three, six and nine months after surgery in breast cancer survivors. Pearson's correlation test; *p<0.01.



4 DISCUSSION

In this study, we aimed to map pain frequency and pain intensity during the activities listed in the physical domain of the Disabilities of the Arm, Shoulder and Hand Questionnaire (DASH), at three, six and nine months after breast cancer surgery. We observed that the UL homolateral to the surgery was the area of highest pain frequency. However, at both six and nine months after the surgery, the pain in the contralateral UL was also frequent. The pain intensity pointed to a growth pattern over time. The activities with higher pain frequencies were those were involving a combination of upper limbs movements. There was no correlation between the pain intensity and the DASH score at

three and six months, however, at nine months a strong correlation was observed between pain and function of the UL contralateral to the surgery.

Considering the pain frequencies, there is evidence that the most common affected areas one year after surgery are the lateral region of the trunk and the UL homolateral to the surgery (ANDERSEN et al., 2017; COONEY; CULLETON-QUINN; STOKES, 2013; HAMOOD et al., 2018). In our study, we observed this behavior in the initial stages and during the curative treatment of breast cancer, however, pain in the contralateral UL started to appear from six months after the breast cancer surgery, an event that has been little explored and discussed in previously published studies (LAURIDSEN; CHRISTIANSEN; HESSOV, 2005). This might occur due to multiple compensations, limiting pain complaints and tissue changes, such as radiodermatitis and fascial restrictions that affect the UL homolateral to the surgery, leading to disuse and overloading the contralateral UL (BACK et al., 2021; DE GROEF et al., 2018; LAURIDSEN; CHRISTIANSEN; HESSOV, 2005).

The pain intensity was mild at three and six months postoperatively, becoming moderate at nine months. This fact may be related to the increase in the number of adjuvant therapy sessions, since at nine months, about 60% of women had undergone chemotherapy and radiotherapy sessions and were undergoing hormone therapy, which may partly justify this pain context (WANG et al., 2018). It is known that chemotherapy might lead to a neurotoxicity and chemical alterations in peripheral nerves, inducing to a peripheral neuropathy, which may cause a change in the pain processing pathways in the central and peripheral nervous system, triggering chronic painful conditions (LEYSEN et al., 2017; SILVEIRA et al., 2021). In addition, radiotherapy can generate fibrosis among the tissues of the breast region, adding up to the systemic pain effects in body structures, such as muscles, bones and joints (HELLERSTEDT-BÖRJESSON et al., 2015; LAURIDSEN; CHRISTIANSEN; HESSOV, 2005; RECCHIA; PRIM; LUZ, 2017). This is in line with the findings of our study, where women who started radiotherapy at nine months reported higher pain intensity.

During the application of the DASH, the questions that presented the highest pain frequencies, at the three different times of analysis, were questions one, six, seven and eleven. These activities require a high range of movement, resistance and strength, such as “Place an object on a shelf above your head”, “Do heavy household chores (e.g., wash walls, wash floor)”, “Open a tight or new jar”, or “Carry a heavy object”. These tasks require a biomechanical synergism of the upper limb as a whole, which easily exposes

possible functional instabilities (DE OLIVEIRA et al., 2017; RECCHIA; PRIM; LUZ, 2017; ZOMKOWSKI et al., 2019). Therefore, it is understood, that the reduction in the range of motion of the homolateral UL to surgery, restrictive and less varied movement strategies, together with kinesiophobia and adaptations to avoid pain, negatively interfere in the performance of ADLs in breast cancer survivors (BROOKHAM; CUDLIP; DICKERSON, 2018; RIBEIRO et al., 2019; VAN DER GUCHT et al., 2020).

When correlating the pain intensity in the most frequency areas with the DASH total score, we did not observe any correlation in the third and sixth months of analysis. This fact can be attributed to the low pain intensity presented in these periods. The pain in the contralateral UL in the ninth month, demonstrated a strong correlation with the function of the upper limbs. In addition to the effects of radiotherapy and chemotherapy sessions, the fact that women avoid performing activities with the UL homolateral to the surgery, can play an important role in maintaining and possibly worsening the pain, together with psychological factors (LEYSEN et al., 2017). It appears that the demands of women's daily tasks which are increasingly complex, could partly represent compensatory kinematics alterations, due to the overuse of the contralateral UL (BROOKHAM; CUDLIP; DICKERSON, 2018).

In general, this study has some limitations, such as the low sample size, due to the difficulty in recruiting volunteers, since they do not have financial incentive to participate. Another limitation was the memory bias, since the women should record the movement performed on daily living tasks and rater their pain. The heterogeneity of surgical treatment is something explained by the regional medical decision characteristic, in its majority are breast conservative surgeries. Another limitation found was the subjectivity of the VAS instrument and the difficulty some participants had to understanding the questions of the DASH questionnaire. Some items generated doubts during the application, such as: “Prepare a meal” (texture, quantity, and time), “Manage transportation needs (getting from one place to another)” (bus, car, bicycle or on foot), and “Garden or do yard work”. Furthermore, it is suggested that future research could increase the sample size, as well as better stratify the population according to the types of therapies adopted, increase the follow-up time, for example, up to two years, since the results presented demonstrated that the pain tends to increase over time.

5 CONCLUSION

The area with the highest pain frequency at the three different times of analysis was the UL homolateral to the surgery, however, pain in the contralateral UL also became frequency in the sixth and ninth months after breast cancer surgery. It is suggested that pain intensity follows a growth pattern over time. Pain at nine months in the contralateral UL showed a strong correlation with the upper limbs function. The activities with higher pain frequencies on upper limbs involved larger range of motion in different planes of motion after breast cancer surgery, according to the DASH items.

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