Effect of myofascial techniques for treatment of upper limb dysfunctions in breast cancer survivors: randomized controlled trial

An De Groef¹, Marijke Van Kampen¹, Nele Verlvoesem¹, Evi Dieltjens¹, Lore Vos¹, Tessa De Vrieze¹, Marie-Rose Christiaens^{2,3}, Patrick Neven^{2,4}, Inge Geraerts¹, Nele Devoogdt¹

¹KU Leuven – University of Leuven, Department of Rehabilitation Sciences; University Hospitals Leuven, Department of Physical Medicine and Rehabilitation, Leuven, Belgium

²University Hospitals Leuven, Multidisciplinary Breast Center, Leuven, Belgium

³KU Leuven – University of Leuven, Department of Surgical Oncology, Leuven, Belgium

⁴University Hospitals Leuven, Department of Obstetrics and Gynecology, Leuven, Belgium

For correspondence contact:

An De Groef, Physical Therapist, PhD Student

University Hospitals Leuven

Department of Physical Medicine and Rehabilitation

Herestraat 49

3000 Leuven

Tel.: +32 16 342171

Email: an.degroef@faber.kuleuven.be

Abbreviated title: Effectiveness of myofascial therapy in breast cancer survivors.

Abstract

Purpose: Besides pain, myofascial dysfunctions may contribute to the presence of upper limb impairments such as impaired range of motion, decreased strength, lymphedema and altered postures and kinematics. Therefore, the aim of this study was to investigate the effect of myofascial therapy in addition to a standard physical therapy program for treatment of upper limb dysfunctions in breast cancer survivors.

Methods: Fifty women treated for a unilateral breast cancer with pain and myofascial dysfunctions at the upper limb region. The intervention group received 12 sessions of myofascial therapy consisting of release techniques on myofascial trigger points and adhesions in addition to a standard physical therapy program during 3 months. The control group received 12 session of a placebo intervention in addition to the same standard physical therapy program during 3 months. Outcome parameters are active shoulder range of motion (inclinometer), arm lymphedema (perimeter), upper limb strength (handheld dynamometer), scapular statics and dynamics (acromion-table and pectoralis minor-index; inclinometer), shoulder function (Disability of Shoulder, Arm and Hand questionnaire) and quality of life (Short-Form 36). Measures were taken before and after the intervention, at 6 and 12 months follow-up.

Results: No differences between groups were found for all outcome parameters over the course of one year. However, overall beneficial effects of the standard physical therapy program for active shoulder range of motion and shoulder function were found in both groups up to 1 year follow-up.

Conclusion: Myofascial therapy has no additional beneficial effect for improvement of upper limb function in breast cancer survivors.

Key Words: Breast Neoplasms, physical therapy modalities, shoulder function, myofascial pain syndromes

Introduction

Breast cancer is the most common cancer in women with 464.000 new cases diagnosed in Europe in 2012, representing 29% of the overall cancer burden.¹ Besides pain, women can suffer from a wide range of upper limb impairments after breast cancer treatment.^{2,3} Prevalence rates of impaired range of motion (ROM) are reported between 2-73% up to one year after surgery and between 0-52% later on.^{2,4-6} Limitations in activities of daily life are reported in 9-57% of breast cancer survivors more than one year after surgery.⁴

In physical therapy practice the aim is to treat the underlying cause of these upper limb impairments. Recently, awareness of the contribution of myofascial dysfunctions to upper limb pain and impairments has increased.^{2,3,5} A previous study has already indicated the beneficial effects of myofascial therapy for treatment of persistent upper limb pain after breast cancer treatment.⁶ Besides pain, myofascial dysfunctions may as well contribute to the presence of other upper limb impairments such as impaired ROM, decreased strength, lymphedema and altered postures and kinematics.^{2,7,8} A vicious circle of myofascial adhesions, tissue tenderness or myofascial trigger points and lack of mobility in fascia and muscles is created, contributing to the development of these upper limb impairments.^{2,9} In other populations, myofascial release techniques lead to significant improvements in shoulder range of motion¹⁰⁻¹² in patients with chronic shoulder pain^{10,12} and with ankle joint movement restrictions.¹¹ However, the effectiveness of myofascial therapy for these upper limb impairments in breast cancer survivors has not yet been investigated.

Therefore, the purpose of this study was to determine the effectiveness of myofascial therapy, in addition to a standard physical therapy program for treatment of upper limb dysfunctions in breast cancer survivors.

Patients and Methods

Participants

Patients were recruited at the Multidisciplinary Breast Centre and the department of Physical Medicine and Rehabilitation of the University Hospitals in Leuven from March 2013 until February 2015. All patients (n=169) referred by the doctors were screened and 50 patients (30 %) agreed to participate. Inclusion criteria were (1) women treated for a primary breast cancer; (2) radiation therapy was terminated at least three months ago; (3) pain at the upper limb region reaching a score of at least 40 out of 100 on the Visual Analogue Scale (VAS) during the past week and (4) presence of myofascial dysfunctions at the upper limb region (yes/no). Patients were excluded if (1) they were not able to visit the hospital for the therapeutic sessions and measurements the entire duration of the study; (2) presence of shoulder pathologies for which surgical indications exist (defined by ultrasound investigation) or (3) presence of current episodes of cancer or metastasis. All included patients gave written informed consent.

Procedure

Patients were randomized into the **intervention group** (receiving a standard physical therapy program and myofascial therapy) or the **control group** (receiving a standard physical therapy program and placebo therapy). The random allocation sequence was computer-generated. Randomization was performed by using permuted blocks (size=4). The allocation to the groups was concealed. A different person from the one doing the recruitment and physical therapy treatments carried out the randomization. The sequence of randomization was determined by the patient's identification number, which she received after inclusion in the study.

Interventions

All participants attended an individual standard physical therapy program of 12 weeks (two sessions per week, fading out to one session per week) at the department of Physical Medicine and Rehabilitation of the University Hospitals of Leuven. The sessions were individual, lasted 30 minutes and consisted of different physical therapy modalities including: (1) passive mobilizations of the shoulder to improve passive and active shoulder ROM; (2) stretching of pectoral muscles to improve muscle flexibility and passive and active shoulder ROM; (3) scar tissue massage to improve flexibility of the scar(s) and (4) exercise schemes to improve muscle flexibility, endurance and strength, scapula-thoracic control and active shoulder ROM. Patients in the intervention group received myofascial therapy consisting of manual myofascial release techniques on (1) active myofascial trigger points at the upper limb region and (2) on myofascial adhesions in the pectoral, axillary and cervical region, diaphragm and scars. The pressure applied by the therapist's hands proceed from the superficial to the deep layers of the myofascial tissue. When a resistance is felt, the barrier is softly maintained until a release is felt. This approach is repeated until a soft end-feel is reached in every direction and layer. One session of myofascial therapy lasted 30 minutes with a frequency of once a week for 12 weeks. Patients in the control group received a placebo treatment consisting of static bilateral hand placements at the upper body and arm. This session took 30 minutes as well, with a frequency of once a week for 12 weeks. Patients were blinded for their treatment allocation.

Two manual therapists (ADG, NV) performed the physical therapy sessions of the patients of both groups. Both therapists were Master in Rehabilitations Sciences, one with 4 years of clinical experience and one just graduated. This last one underwent two months of training in

our center before the start of the study. Two other manual therapists (ED, SDG) performed the myofascial/placebo treatments. Both therapists were educated in myofascial therapy and had several years of clinical experience. At several times during the study, training sessions were organized for all therapists to ensure standardization and similarity of the treatment sessions.

Outcomes

Information about the breast surgery, axillary surgery and adjuvant treatments was collected from the medical file of the patient. All patients were measured before the start of the treatment program, at the end (after 12 weeks) and at 6 and 12 months follow-up at the department of Physical Medicine and Rehabilitation of the University Hospitals in Leuven. Three blinded assessors (ADG, RVH, EC) performed the measurements. Assessors were trained before the start of the study during one month. The outcome parameters and the measurement methods are given in Table 1.

Table 1: Overview of the outcome parameters and measurement method

Outcome parameter	Measurement methods
Shoulder range of motion	
Active forward flexion and abduction ROM (°)	ROM(°) measured with inclinometer in sitting position ¹³
Point prevalence of impaired shoulder ROM (%)	Interlimb difference of $\geq 15^\circ$ measured with inclinometer in the sitting position ¹⁴

Number of patients with clinical relevant improvement in shoulder ROM	Increase of $\geq 15^\circ$ of shoulder ROM at the operated side compared to baseline, measured with inclinometer ¹⁴
Arm Lymphedema	
Relative arm volume (%)	The perimeter was used to measure circumferences and the formula of the truncated cone was used to calculate volumes. ¹⁵ Relative arm volume was calculated by the formula: arm volume difference/arm volume non-operated side*100)
Point prevalence of arm lymphedema (%)	$\geq 5.0\%$ increase of relative arm volume difference compared to pre-surgical value. ¹⁵
Upper limb strength	
Upper limb strength (kg)	Handgrip strength (kg) measured with the Jamar Handheld dynamometer. ¹⁶
Point prevalence of impaired upper limb strength (%)	Decrease of ≥ 6.5 kg, measured with the Jamar Handheld dynamometer. ¹⁶
Scapular statics and dynamics	

Forward shoulder position (% of body length)	<p>1) Acromion-Table Index (ATI): the subject was in a supine position and was asked to adopt a natural relaxed position. The distance between the most posterior border of the acromion and the table was measured and</p> <p>2) Pectoralis Minor Index (PMI): The resting muscle length of the pectoralis minor was measured between the caudal edge of the 4th rib and the inferomedial aspect of the coracoid process with a sliding caliper. Both measurements were performed with a sliding caliper (Hogetex, 0 to 300 mm) and normalized to body length.¹⁷</p>
Scapular upward rotation (°)	<p>One gravity inclinometer was velcro taped perpendicular to the humeral shaft, just below the deltoid tuberosity. The second inclinometer was aligned manually along the scapular spine. The subject was asked to perform one arm abduction movement in the scapular plane, i.e. scaption (30° anterior to the coronal plane) with full elbow extension, neutral wrist flexion/extension and with the thumb leading. The movement</p>

	was guided by the raters' instructions. The subject was asked to stop at 45°, 90°, 135° and at their maximum achievable arm movement. The degree of scapular upward rotation was noted at each available scaption position. ¹⁷
Shoulder function	
Shoulder function (%)	DASH questionnaire ¹⁸
Point prevalence of impaired shoulder function (%)	DASH score of > 15% ¹⁸
Quality of life	
Quality of life – mental functioning (0-100)	SF-36 questionnaire ¹⁹
Quality of life – physical functioning (0-100)	SF-36 questionnaire ¹⁹

ROM =range of motion; ATI=Acromion-Table Index; PMI=Pectoralis Minor Index;

DASH=Disability of arm, shoulder and hand; SF-36=Short Form-36

Statistical analyses

Calculation of the sample size was done based on the primary outcome 'pain intensity'.

Results on the these primary outcome parameter have been published elsewhere.⁶

Data were analyzed according to the intention to treat principle. Patients characteristics between the intervention and control group were compared. The independent t-test for continuous data and X² tests for nominal data are used. The fisher exact test was used to compare point prevalence rates. Overall treatment effects were analyzed by a multivariate

linear model for repeated (longitudinal) measurements, using an unstructured covariance matrix. The effect size for continuous outcomes is given by the difference in mean change and its 95% Confidence Interval (CI). For binary outcomes relative risk reduction (%) and its 95% CI is given as measures of effect size. Statistical significance was taken as $p < 0.05$. All data were analyzed with SPSS 22.0.

Results

Figure 1 shows the flow of patients. Eighty-seven patients did not meet the inclusion criteria. Thirty-two patients refused participation. These 32 non-participants were 5.6 years older ($p=0.011$) compared to participants. All other characteristics related to disease and treatment, such as number and levels of lymph nodes dissected, type of breast surgery, tumor size, lymph node stage, radiotherapy, chemotherapy, target therapy and endocrine treatment and time after surgery, were comparable between groups (data not shown). From the fifty included patients 25 were randomized in the intervention group and 25 in the control group. All patients were measured before the start of the treatment program. Two patients from the intervention group dropped out during the study and were not measured at follow-up. One had to undergo urgent back surgery, the other refused further participation (see figure 1).

Figure 1: Flow of the patients

All baseline characteristics of the two groups were comparable, except for Body Mass Index (BMI) (Table 2). BMI in the intervention group was significantly higher (28.5 kg/m² versus 25.4 kg/m², p=0.018). All patients had both active myofascial trigger points and adhesions at baseline. Patients in the intervention group received 12 sessions of myofascial therapy and 17 sessions of physical therapy on average. In the control group, patients received 12 sessions of placebo therapy and 16 sessions of physical therapy on average (Table 2). All outcome parameters were comparable between both groups at baseline, except for forward flexion ROM (Table 3). The intervention group had a significantly greater forward flexion ROM at baseline (147° versus 134°, p=0.023).

Table 2: Characteristics of patients according to treatment allocation. Figures are numbers (percentage) of patients or Mean (SD).

	Intervention group (N=25)	Control group (N=25)	P value
Age (years)	55.3 (7.5)	53.1 (7.5)	0.312
BMI (kg/m ²)	28.5 (4.7)	25.4 (4.1)	0.018
Time since surgery (years)	3.6 (3.4)	3.0 (3.4)	0.535
Number of standard physical therapy sessions	17 (4)	16 (3)	0.741
Number of myofascial/placebo therapy sessions	12 (1)	12 (1)	0.212

Number of lymph nodes removed	17 (12)	16 (9)	0.663
Type of breast surgery			
Mastectomy	17 (68)	18 (72)	0.758
Breast conserving	8 (32)	7 (28)	
Level of axillary surgery			
I	5 (20)	6 (24)	0.965
I-II	8 (32)	8 (32)	
II-III	12 (48)	11 (44)	
Tumor Size			0.138
pT0	0 (0)	2 (8)	
pT1	13 (52)	6 (24)	
pT2	10 (40)	12 (48)	
pT3	2 (8)	3 (12)	
pT4	0 (0)	2 (8)	
Lymph node stage			0.206
pN0	12 (48)	16 (64)	
pN1	8 (32)	8 (32)	
pN2	4 (16)	0 (0)	
pN3	1 (4)	1 (4)	
Radiotherapy	18 (72)	21 (84)	0.435
Radiotherapy, axilla	5 (20)	3 (12)	0.403
Chemotherapy	17 (68)	15 (60)	0.556

Neo-adjuvant chemotherapy	2 (8)	3 (12)	0.637
Target therapy	4 (16)	3 (12)	0.684
Endocrine treatment	22 (88)	23 (92)	0.637

BMI=Body Mass Index

The results for the different outcome parameters are given in Table 3. Compared to baseline, the changes in active shoulder ROM, relative arm volume, upper limb strength and shoulder function were comparable between the two groups over the course of one year. For scapular statics and dynamics some differences between groups were found. First, for the Acromion-Table Index in retraction position a significantly different change between groups was found in favor of the control group after 3 months (mean difference in change of -0.4 95%CI (-0.8 to -0.0), $p=0.039$). Second, for scapular upward rotation in the resting position and at 45° of scaption, significantly different changes between groups were found as well after 1 year. The intervention group showed an increase in scapular upward rotation while the control group showed a decrease (Table 3). For quality of life, conflicting results were found. For physical functioning a significantly different change between groups after 3 and 12 months was found, in favor of the intervention group. In contrast, for mental functioning, significantly different changes between groups were found after 6 and 12 months, in favor of the control group (Table 3). Additionally, within groups analysis revealed significant improvements up to 1 year follow-up for active shoulder ROM. For abduction ROM, both groups had a significant improvement that lasted 1 year. For forward flexion ROM, only the control group showed improvements lasting for 1 year. Shoulder function (measured with the DASH) improved significantly in both groups up to 1 year follow-up ($p<0.001$, data not shown).

Prevalence rates of impaired shoulder ROM, arm lymphedema, impaired upper limb strength and shoulder dysfunction were comparable between groups (Table 3). Number of patients who had a clinical relevant improvement of shoulder ROM was comparable between groups as well (Table 3).

Table 3: Comparison between the outcome parameters between the intervention and control group.

	Intervention group		Control group		P value	Effect size ¹ 95% CI
Active forward flexion ROM (°)		n		n		
Baseline	147 (12)	25	134 (25)	25	0.023	
At 3 months	156 (14)	23	146 (22)	23	0.451	4 (-6 to 14)
At 12 months	150 (13)	23	143 (20)	23	0.090	7 (-1 to 15)
Active abduction ROM (°)						
Baseline	126 (20)	25	116 (29)	25	0.143	
At 3 months	144 (16)	23	134 (27)	25	0.916	-0.68 (-13.71 to 12.34)
At 12 months	141 (17)	23	131 (26)	25	0.996	0.03 (-12.43 to 12.49)
Prevalence of impaired forward flexion ROM (%)						
Baseline	13 (52%)	25	13 (52%)	25	1.000	
At 3 months	6 (26%)	23	8 (32%)	25	0.756	19% (-99 to 66)

At 12 months	7 (30%)	23	11 (44%)	25	0.383	31% (-48 to 68)
Prevalence of impaired abduction ROM (%)						
Baseline	10 (40%)	25	15 (60%)	25	0.258	
At 3 months	5 (22%)	23	8 (32%)	25	0.523	32% (-78 to 74)
At 12 months	4 (17%)	23	9 (36%)	25	0.200	52% (-36 to 83)
N Patients with clinical relevant improvement in forward flexion ROM (%)						
At 3 months	6 (26%)	23	8 (32%)	25	0.756	
At 12 months	5 (22%)	23	5 (20%)	25	1.000	
N Patients with clinical relevant improvement in abduction ROM (%)						
At 3 months	11 (48%)	23	10 (40%)	25	0.771	

At 12 months	10 (44%)	23	13 (52%)	25	0.578	
Relative arm volume (%)						
Baseline	8.0 (13.7)	25	7.7 (11.0)	25	0.930	
At 3 months	8.0 (16.5)	23	8.8 (12.7)	25	0.264	-1.8 (-5.1 to 1.4)
At 12 months	8.3 (16.2)	23	9.5 (10.67)	25	0.388	-1.2 (-4.1 to 1.6)
Prevalence of arm lymphedema (%)						
Baseline	13 (52%)	25	13 (52%)	25	1.000	
At 3 months	10 (44%)	23	13 (52%)	25	0.578	-226% (-1357 to 27)
At 12 months	11 (48%)	23	12 (48%)	25	1.000	-81% (-575 to 51)
Handgrip strength (kg)						
Baseline	22.6 (7.2)	25	23.2 (6.2)	25	0.753	
At 3 months	24.8 (7.7)	23	24.8 (6.4)	25	0.717	-0.5 (-3.4 to 2.3)
At 12 months	24.8 (6.4)	23	24.4 (4.8)	25	0.507	-0.9 (-3.6 to 1.8)

Prevalence of impaired handgrip strength (%)						
Baseline	3 (12%)	25	5 (20%)	25	0.702	
At 3 months	2 (9%)	23	3 (12%)	25	1.000	28% (-296 to 87)
At 12 months	1 (4%)	23	3 (12%)	25	0.610	64% (-224 to 96)
Acromion-Table Index (% of body length)						
Baseline	3.9 (0.9)	25	4.0 (0.7)	25	0.566	
At 3 months	4.0 (0.9)	23	3.9 (0.7)	25	0.266	-0.3 (-0.7 to 0.2)
At 12 months	3.9 (1.3)	23	3.8 (0.7)	25	0.409	-0.2 (-0.8 to 0.3)
Acromion-Table Index Retraction (% of body length)						
Baseline	2.7 (0.9)	25	2.8 (0.8)	25	0.621	
At 3 months	2.9 (0.9)	23	2.5 (0.7)	25	0.039	-0.4 (-0.8 to -0.0)
At 12 months	2.8 (1.0)	23	2.5 (0.7)	25	0.133	-0.4 (-0.9 to 0.1)

Pectoralis Minor Index (% of body length)						
Baseline	9.1 (1.2)	25	8.7 (0.8)	25	0.112	
At 3 months	8.8 (1.0)	23	8.8 (0.7)	25	0.080	0.4 (-0.1 to 1.0)
At 12 months	8.9 (0.9)	23	8.7 (0.9)	25	0.284	0.3 (-0.3 to 0.9)
Scapular upward rotation in rest (°)						
Baseline	-2 (4)	25	-2 (3)	25	0.636	
At 3 months	0 (4)	23	0 (4)	25	0.574	-0.9 (-4.3 to 2.4)
At 12 months	0 (3)	22	-3 (4)	25	0.027	-3.7 (-7.0 to -0.5)
Scapular upward rotation at 45° scaption (°)						
Baseline	1 (6)	25	2 (5)	25	0.437	
At 3 months	4 (4)	23	4 (5)	25	0.634	-1.0 (-5.1 to 3.2)
At 12 months	6 (5)	22	2 (6)	25	0.030	-4.4 (-8.3 to -0.4)

Scapular upward rotation at 90°						
(°)						
Baseline	15 (7)	25	16 (9)	25	0.836	
At 3 months	17 (8)	23	17 (9)	23	0.691	1.1 (-4.4 to 6.5)
At 12 months	19 (6)	22	17 (9)	25	0.416	-2.2 (-7.6 to 3.2)
Scapular upward rotation at 135°						
(°)						
Baseline	33 (13)	22	29 (7)	21	0.179	
At 3 months	36 (10)	22	36 (8)	20	0.194	4.84 (-2.5 to 12.2)
At 12 months	41 (8)	22	37 (12)	19	0.693	1.5 (-6.0 to 9.0)
Scapular upward rotation at maximal scaption (°)						
Baseline	37 (16)	7	31 (9)	2	0.666	
At 3 months	41 (11)	13	42 (8)	10	0.903	1.5 (-23.8 to 26.9)
At 12 months	47 (7)	11	39 (10)	8	0.700	-4.7 (-29.4 to 20.0)

Shoulder function (DASH 0-100)						
Baseline	36 (16)	22	40 (19)	24	0.445	
At 3 months	30 (17)	21	33 (21)	24	0.894	-0.55 (-8.83 – 7.73)
At 12 months	30 (19)	21	31 (19)	22	0.867	0.50 (-5.49 – 6.49)
Impaired shoulder function (%)						
Baseline	20 (87%)	22	23 (96%)	24	0.348	
At 3 months	18 (81%)	21	20 (83%)	24	1.000	-3% (-32 – 20)
At 12 months	17 (81%)	21	18 (82%)	22	1.000	1% (-32 – 26)
Physical functioning (SF-36 0-100)						
Baseline	55 (24)	23	54 (24)	24	0.906	
At 3 months	54 (25)	22	63 (22)	24	0.017	9.60 (1.81 – 17.40)
At 12 months	51 (22)	21	64 (26)	22	0.018	11.61 (2.09 – 21.12)
Mental functioning (SF-36 0-100)						
Baseline	59 (19)	23	65 (16)	24	0.258	
At 3 months	62 (18)	22	70 (17)	24	0.641	2.44 (-8.03 – 12.91)

At 12 months	69 (18)	21	65 (22)	22	0.053	-9.94 (-20.02 – 0.14)
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ROM=Range of Motion; kg=kilogram; CI=confidence interval. Independent t-test was used for the baseline measurements.

Prevalence rates were compared using the Fisher Exact test. — For continuous outcomes difference in mean change between baseline and time point and its 95% CI is given, for binary outcomes relative risk reduction (%) and its 95% CI is given as measures of effect size.

Discussion

This randomized controlled trial showed that, compared to baseline, the changes in active shoulder ROM, relative arm volume, upper limb strength and shoulder function were comparable between the two groups over the course of one year (Table 3). Small differences between groups for certain outcome parameters of scapular statics and dynamics were found after 3 months (Acromion-Table Index in retraction position) and 12 months (scapular upward rotation in resting position and 45° scaption). However, the clinical relevance of these results is questionable. The results for quality of life were inconclusive. The control group showed an improvement in mental functioning and the intervention group in physical functioning. In general, these results indicate no additional beneficial effects of myofascial therapy for treatment of upper limb dysfunctions after breast cancer treatment. Remarkably, active shoulder ROM and shoulder function did improve significantly up to 1 year follow-up in both groups, indicating long-lasting beneficial effects of the physical therapy program itself.

This is the first RCT that examined the effectiveness of myofascial therapy in addition to a standard physical therapy program for treatment of upper limb dysfunctions in breast cancer survivors. A combination of different outcome parameters that are related to upper limb function in breast cancer survivors was chosen. Despite the beneficial effects on pain intensity reported in a previous study, no clinically relevant differences between groups were found for any of the outcome parameters related to upper limb function, indicating no added value of myofascial therapy for upper limb function in breast cancer survivors.⁶ The small differences between groups for statics and dynamics of the scapula should be interpreted with caution. For the Acromion-Table Index a decrease of 3% of body length was found in the control group

and an increase of 2% of body length in the intervention group, resulting in a better forward shoulder position in the control group at 3 months. The authors hypothesized an improvement in forward shoulder position in the intervention group because of myofascial therapy on the adhesions and tightness (trigger points) of the soft tissues at the anterior chest-wall contributing to a forward shoulder position.^{7,8,20-22} Consequently, no plausible explanation for the better results in the control group is available. Additionally, the remark should be made that changes are very small, so clinical relevance is questionable. Upper limb statics are inherently variable and the validity of the Acromion-Table Index for the evaluation of upper limb statics has not yet been investigated as well.^{17,23} For scapular upward rotation the same remarks can be made: scapular movement is inherently variable and changes in both groups are rather small. Further, no clear correlation between scapular statics and dynamics and signs and symptoms in patients with shoulder pain has been found yet.²⁴

For arm lymphedema, point prevalence rates at baseline were the same in both groups. At 3 months, the point prevalence of arm lymphedema was lower in the intervention group, however not statistically significant. This result may give the impression that myofascial techniques may have a small influence on the lymphatic transport. However, it should be noted that the two patients who dropped out from the intervention group had arm lymphedema at baseline but were discontinued from follow up analysis.

Physical functioning and mental health as indicators of quality of life did change differently between groups over time but results are conflicting. The study of Nesvold et al showed a significant relation between arm and shoulders problems and quality of life.²⁵ The previous study already showed that even an improvement in pain was not reflected in improvements

in quality of life.⁶ Besides pain and upper limb dysfunctions, quality of life may be influenced by many other factors such as general physical health, fatigue, mental health, sexual function and role limitations.²⁶ These factors were not taken into account and can explain the seemingly conflicting results.

A remarkable result was the long-lasting significant improvement in active shoulder range of motion (abduction and forward flexion) and shoulder function in both groups after the end of the supervised treatment program, indicating the beneficial effects of the physical therapy program itself. Improvement in forward flexion ROM in the intervention group was smaller and only noticed after 3 months. This may be declared by the already significantly better forward flexion ROM in the intervention group at baseline (Table 3). The physical therapy program applied in the present study consisted of mobilizations and the combination of stretching and exercises, which are proven to have beneficial effects on shoulder ROM.²⁷ It might be that myofascial therapy is less suitable for treatment of impaired shoulder ROM. The first possibility is that maximal recovery of active shoulder ROM and shoulder function may have been achieved by the standard physical therapy program alone and further improvement with myofascial therapy was not possible anymore. A second hypothesis could be that the additional benefits of myofascial therapy to a standard physical therapy are not large enough to detect statistical significance. In agreement with our study, in the study of Bron et al about the effect of myofascial therapy in chronic shoulder pain, passive ROM did not differ between the intervention group and control group after 12 weeks.¹⁰

Strengths and limitations

The present study has several **strengths**. First, this randomized controlled trial was well designed, randomization was concealed and both assessors and patients were blinded. Second, only 2 patients (4%) dropped out. Third, both patients in the intervention as in the control group received on average 12 sessions of myofascial or placebo therapy and 16 or 17 sessions of physical therapy, respectively and all therapists performed treatments in the intervention and the control group. So, treatment programs were very similar between groups. Additionally, all patients had myofascial dysfunctions with both trigger points and adhesions. Therefore, both groups were very similar at baseline. At last, the present study combined different outcome parameters to capture all factors related to upper limb function in breast cancer survivors.

The study also has **limitations**. First, participants in the study were not entirely representative for all breast cancer survivors because non-participants were on average 5.6 years older, however this is not clinically relevant. Second, patients in the intervention group had a higher BMI and better forward flexion shoulder ROM compared to the control group. Third, not all participants filled out the DASH and SF-36 completely and so they could not be used for analyses. Hereby, the number of subject available for analyses were lower for these outcomes (Table 3). Fourth, no power analysis for the outcome parameters reported in the present study was performed. The results of the primary outcome parameter (i.e. pain intensity) are reported elsewhere.⁶

Clinical implications

For shoulder ROM a minimal clinical important change of 15° has been reported in literature.^{14,28} In both groups shoulder ROM improved significantly over 1 year but only for

abduction ROM this improvement was clinically relevant. Additionally, between 20 and 30% of patients had a clinical relevant improvement in active shoulder forward flexion ROM and between 35 and 52% for active shoulder abduction ROM. For shoulder function, long-lasting significant improvements were found as well. However, these improvements were rather small and not reaching the clinical relevant improvement of 15%.¹⁸ The present study indicates that active shoulder ROM, in particular abduction ROM, and shoulder function can be improved with the combination of certain physical therapy modalities in a relatively large amount of breast cancer survivors. Based on the results of the present study and the previous study in the same cohort, the authors recommend to apply myofascial release techniques in breast cancer survivors with pain caused by myofascial dysfunctions such as active trigger points and adhesions, in addition to standard physical therapy consisting of mobilizations and the combination of stretching and active exercises.²⁷

Further research

Further research should explore the prevalence rate of myofascial trigger points and/or adhesions in breast cancer survivors. This may increase the knowledge on the contribution of myofascial dysfunctions to the etiology of upper limb dysfunctions in breast cancer survivors and may help to increase the efficacy of certain physical therapy modalities such as myofascial therapy, passive mobilizations, stretching and exercises.

Conclusion

Myofascial therapy, in addition to a standard physical therapy program, has no additional beneficial effects on upper limb function in breast cancer survivors. However, long-lasting

beneficial effects of the standard physical therapy program for active shoulder ROM and shoulder function were found.

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Conflict of interest

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