CONSIDERING WIDER MYOFASCIAL INVOLVEMENT AS POSSIBLE CONTRIBUTORS TO UPPER EXTREMITY DYSFUNCTION FOLLOWING TREATMENT FOR PRIMARY BREAST CANCER.

Fourie W J Nat. Dip. PT

Private practitioner, Johannesburg, RSA.

Tel: + 27 (0) 11 763 6990

Email: willief@medi.co.za

Corresponding author

Willie Fourie, Private practitioner

P.O Box 209, Florida Hills, 1716, Roodepoort, Republic of South Africa.

Tel: + 27 (0) 11 763 6990

Fax no: + 27 (0) 866 180 179

Email: willief@medi.co.za

ABSTRACT

BACKGROUND Breast cancer is the most common malignancy in women. Although scarring is recognized as contributing to limited shoulder movements, compromised tissue gliding in a wider range of fascial and connective tissue structures are under-recognized.

AIM To report on soft tissue patterns in patients with upper limb dysfunction after modified radical mastectomy.

METHODS Tissue gliding was assessed in the neck, chest wall, abdomen, axilla and upper arm. Scarring, areas and directions of tightness were mapped on upper body charts.

RESULTS 18 shoulders were evaluated. All patients had combinations of restrictive tissue gliding and shoulder movements. Four dominant restrictive areas were identified - surgical scarring, axillary tightness radiating into the upper arm, lateral chest wall and posterior tightness over the teres major muscle.

DISCUSSION Breast cancer treatment results in tissues losing its shearing and gliding ability. Mapped restrictive tissue gliding clearly show wider than reported restrictions. This pattern needs further research and investigation.

BACKGROUND

Breast cancer is the most common malignancy in women in the western world and of rising concern in developing countries. In the United States of America (US) breast cancer will be diagnosed in 1 in 8 women (Kingsbury 2007), while the lifetime risk for women in the United Kingdom (UK) is currently estimated at 1 in 9 (www.cancerresearchuk.org/).

Medical treatments for breast cancer may include surgery, chemotherapy, hormone replacement therapy and radiation. Depending on the histology and the extent of the disease, combinations of surgery and adjuvant therapy may be used. The level of surgery varies greatly, from modified radical mastectomy (MRM) with removal of all the breast material as well as some supporting fascial structures, to minimal invasive breast saving operations (BSO) and sentinel lymph node biopsy (SLNB) from the axilla. Further surgery may include various breast reconstruction procedures. Although effective in treatment of cancer, the above interventions are often associated with side effects which may affect a patient's function and quality of life (Ghazinouri et al 2005).

Advances in medicine and technology, combined with improved therapy and earlier detection, yields the largest group of cancer survivors in the US today (Lash & Silliman 2000). As a result, cancer survival rates defined as a relative combined 5-year statistic in this patient group, have increased steadily over the years. Survival rates are currently reported as above 50% (Fialka-Moser et al 2003) in general, and up to 90% in certain population groups (Ghazinouri et al 2005). As a result of these factors, it is likely that progressively more patients with breast cancer may develop upper extremity dysfunction and be referred for evaluation and treatment by rehabilitation professionals (Ghazinouri et al 2005).

Quality of life strongly depends on physical function. With more women now living with their disease, issues of survivorship, both physical and psychosocial, are of increasing importance. Breast cancer treatment is often followed by a decline in upper body function, even at some time distant from therapy (Karki et al 2005). Lash & Silliman (2000) conclude that 'upper body dysfunction may arise shortly after therapy and resolve, arise, and persist for at least 21 months, or arise at some time distant from therapy'. Post-treatment impairments consist, for example, of upper limb oedema, decreased shoulder mobility, neural tissue injuries causing sensory and motor dysfunction, and pain (Karki et al 2005).

For decades, reduced shoulder range of movement (ROM) and functional impairment have been recognized as a problem after breast cancer surgery and treatment (Lash & Silliman 2000; Box et al 2002; Ghazinouri et al 2005; Karki et al 2005; Lauridsen et al 2005; Wyrick et al 2006). The presence of impaired shoulder ROM shows a lot of variability, ranging from a 1.5% incidence to as high as 50% (Rietman et al 2002; Box et al 2005; Karki et al 2005; Wyrick et al 2006). A significant relationship is reported between oedema and restricted range of motion, and impaired activities of daily living and influencing quality of life. Activities such as pulling a sweater over the head, fastening a bra, carrying a heavy bag, sleeping on the operated side, reaching out, working with the ipsilateral arm, housework**,** leisure and sporting activities or handicraft are reported as compromised (Rietman et al 2002). Shoulder-arm morbidity is a complex syndrome which cannot be adequately described by single symptoms (Karki et al 2005), or rely on single-therapy treatment strategies for optimal results.

Breast and axillary scarring is commonly recognized as contributing to limited shoulder movements and some of the impaired activities above (Lash & Silliman 2000; Karki et al 2005). In contrast to reporting on impairments in body functions and structures, little is known about compromised tissue gliding and shearing ability between supporting fascial and connective tissue structures as a possible source of restrictive musculoskeletal syndromes in this patient group. Limited reporting on tissue glide could possibly be attributed to a lack of objective information on the psychometric properties of palpating restrictions in fascial glide by manual therapies.

AIM:

The primary aim of this study is to describe observed soft tissue mobility patterns in a group of breast cancer patients with upper body dysfunction, subsequent to modified radical mastectomy. We hope that this may add to understanding as to how restricted tissue gliding in one area, may contribute to dysfunction in another area.

METHODS

Patients:

The clinical records and evaluation charts of 16 consecutively referred breast cancer patients were reviewed retrospectively. All patients had undergone a modified radical mastectomy (MRM) as the primary surgical procedure for breast cancer, as well as varying combinations of other medical treatments and procedures prior to referral to physiotherapy. In all cases, the reason for referral was for the management of upper body and shoulder impairments and functional deficits. Referrals included patients from both the early post-operative period (0 to 6 months) to patients with established chronic dysfunction many years post breast cancer treatment **(table 1).**

Recorded data: patient records:

Documented data included primary breast cancer treatment (surgery, chemotherapy, radiotherapy, number of lymph nodes removed and breast reconstruction procedures), time of first referral (0 to 6 months or 6 months +), shoulder range of motion (ROM), presence of lymphoedema, pain, neck ache, methods of early rehabilitation and soft tissue mobility. Recorded data were analysed for patterns of dysfunction, catagorised and grouped in table form (tables 1-3).

Shoulder range of movement (ROM):

ROM was assessed both actively and passively using abduction in the plane of the scapula as the movement of choice for recording and measuring treatment progress. This was recorded as degrees of elevation of the arm. A limitation in recorded ROM data is that some of our early referrals in this patient group were only measured subjectively by observation rather than with the use of measuring equipment. Recorded ROM data (table 2) should therefore be interpreted accordingly. During active shoulder movement, changes in scapulohumeral rhythm were noted and recorded. Observations on internal rotation, external rotation and adduction of the shoulder, as well as neck and thoracic spine movements were also recorded, but not included in this study as it was incompletely recorded for all cases.

Soft tissue mobility:

Soft tissue gliding was manually assessed by applying gentle shearing stretch to the skin over the neck, chest wall, abdomen, axilla and upper arm. Tissues in tested areas were taken to the limits of its available range of gliding. Where soft tissue gliding was felt to come to a premature end, tissue mobility were considered as restricted. Areas where mobility was restricted by scarring or tethering and where reduced tissue flexibility could be palpated, were mapped on upper body charts (Figure 1). Mapping included all surgical scars, areas of tissue tightness as well as the directions of palpated tissue restriction. Tissue mobility would be graded either as normal or restricted.

RESULTS

Our patient sample consisted of 16 consecutively referred patients between the ages of 45 and 68 (mean age: 53) with upper body morbidity after treatment of primary breast cancer. Patients were from the same demographic area within the Greater Johannesburg Metropolitan Council. The sample period was between January and December 2006. Time of first referral varied between 4 weeks post surgery to 10 years after the initial treatment (mean: 2.8 years). Only the three patients referred within the first 6 weeks after surgery did not have additional treatment procedures prior to referral. The remaining 13 patients had varying combinations of adjuvant medical treatments and surgical procedures prior to referral for physiotherapy (Table 1).

Three factors were shared by all the patients, i.e. type of primary surgery (modified radical mastectomy), upper body dysfunction and tissue restriction. Additional surgery, before or after the breast cancer, were reported by 11 patients and 12 patients received adjuvant therapy after the MRM (Table 1).

Eighteen shoulder girdles were evaluated in sixteen patients (two patients had bilateral mastectomies). Fifteen patients had restricted shoulder movements and all sixteen presented with changes in scapulohumeral rhythm when moving the arm. The average ROM, measuring abduction in the plane of the scapula, was 130 degrees (range, 40 – 180 degrees). Underlying glenohumeral pathology was evident in only one shoulder and confirmed and treated by her orthopaedic surgeon. Although restrictions in shoulder movements were evident in 95% of the study group, lymphoedema of the arm (8/16), neck ache (8/16) and pain in the chest, shoulder and arm (11/16) co-existed with the restricted shoulder movements (Table 2).

Restrictions in normal gliding between the skin and subcutaneous tissue were evident in the entire sample group (Table 3). Evaluation of tissue gliding on the neck, chest wall, abdomen, axilla and upper arm identified tightness in a wide range of tissues. The two most prominent areas of identified restriction were the surgical scarring on the anterior chest wall and donor sites for reconstructive surgery (14/18 = 77.7%) and axillary tightness radiating into the medial upper arm (15/18 = 83%). Additional combinations of tightness on the lateral chest wall radiating into the axilla (11/18 = 61%), from the drain sites (5/18 = 29%), the posterior axillary border over the teres major and infraspinatus muscles (10/18 = 55%), above the clavicle (6/18 = 33%) and around other surgical sites (7/18 = 39%) were also found (Figure 1).

DISCUSSION

All the patients in this study had undergone a modified radical mastectomy as the primary surgical procedure for breast cancer, while 12 patients received varying combinations of other medical treatments and procedures prior to referral to physiotherapy. In all cases, the reason for referral was for the management of upper body and shoulder impairments and functional deficits. Although restrictions in shoulder movements were evident in 95% of the study group, this was not always the primary reason for referral. Co-existing problems such as lymphoedema of the arm, neck ache and pain in the chest, shoulder and arm often dominated as the more severe symptoms of upper body dysfunction. On evaluating of the upper body and shoulder impairments, all patients shared varying degrees of restricted soft tissue mobility contributing to dysfunction.

Treatment for breast cancer leads to a number of well known and documented sequelae of which restricted shoulder movements, pain and oedema are the most debilitating. Both Rietman et al (2002) and Karki et al (2005) report that dysfunction may persist for extended periods, with some patients experiencing a progressive decline in activities of daily living, work and leisure activities following mastectomy. It is therefore suggested that appropriate interventions should be planned for at least 2 years after treatment for primary breast cancer (Lash & Silliman 2000; Karki et al 2005). Patients in this study group were still experiencing limitations in the above activities for as long as 10 years after primary treatment. This continued long term dysfunction and impairment cause feelings of frustration and anger (personal comments from patients). Some patients in the present study group even suggested that they have stopped complaining to their doctors about the experienced limitations, pain and dysfunction and that they are “just getting on with life, regardless of quality”.

Breast and axillary scar tightness remain one of the most common impairments after mastectomy even at 12-month follow up (Karki et al 2005). Patients after mastectomy also report higher levels of limited shoulder movements than patients after tissue preserving procedures (Rietman et al 2002). Although breast saving operations are increasingly advocated by surgeons, modified radical mastectomy is still performed more commonly in elderly patients (Karki et al 2005) and accepted as the standard surgical treatment for breast cancer (Pendergrast 1989). All the patients in our study group, except one, had varying degrees of restricted shoulder movement upon referral. The major tight areas were identified over the anterior chest wall radiating into the axilla (78%), and medial upper arm (83%). This is consistent with described tightness and scarring contributing to shoulder morbidity in literature

(Box 2002; Karki et al 2005). The tightness found in the lateral chest wall radiating into the axilla in 11 (61%) of our patients could be added to the group with anterior chest wall scarring.

Understanding the extent of tissue dissection during surgery may explain the large percentage of patients in our study with the above patterns of tissue restriction. During a modified radical mastectomy, not only the breast tissue and lymph nodes in the axilla are removed, but important supporting fascial structures as well. The surgical procedure involves the careful mobilisation, dissection and removal of breast tissue and the underlying fascia/epimysium from the pectoralis major muscle. Continuing around the lateral edge of pectoralis major, the fat pad and the lymph nodes between pectoralis major and pectoralis minor are removed by sharp dissection. Further surgical removal or sampling of lymph nodes involve careful dissection of varying numbers of nodes from the axilla, together with its supporting fat and areolar connective tissue (Dao & Patel 1984). The fascia extending from the lateral edge of pectoralis major is continuous with the deep fascia covering serratus anterior. Further posterior this fascial sheet splits to ensheathe latissimus dorsi as deep fascia/epimysium (Warwick & Williams 1976). Dissection for removal of the axillary tail of the breast and the subscapular and lateral thoracic groups of lymph nodes continues over the subscapularis muscle until the edge of the latissimus dorsi muscle is reached (Dao & Patel 1984). Surgery can therefore be seen to contribute substantially to observed tissue tightness – even in areas not directly visible as surgical scarring on the body surface.

A viable explanation as to why surgery creates such a wide range of restrictions in tissue, even at sites distant from the direct surgical scarring, could possibly be found in the fascial arrangements between the pectoralis major muscle and the brachial fascia of the arm. The fascia covering pectoralis major is continuous with the brachial fascia in two distinct ways (Stecco et al 2007):

- The fascia overlying the clavicular part of pectoralis major continues into the anterior brachial fascia.
- The fascia covering the costal part is continuous with the axillary fascia and then with the medial brachial fascia.

Furthermore, abundant amounts of fat and loose areolar connective tissue protect and bind the numerous structures within the axilla together. By virtue of its extensibility and elasticity, a considerable amount of tissue movement is simultaneously allowed for arm elevation (Warwick & Williams 1976). It could be reasoned that damage to the pectoralis major fascia and the protective axillary connective tissue may contribute to limited arm and shoulder movement.

From our documented results, restrictions were however wider than described above and reported in the literature. This refers specifically to the tightness found over the posterior axillary wall and over the teres major muscle and the long head of triceps (Figure 2). The relatively large number of shoulders with posterior axillary wall tightness (10 or 55%) was unexpected. This tissue restriction is felt as an area of distinct fascial tethering (Figure 3), and not usually associated with surgical scarring. Only in two patients with breast reconstructions using a latissimus dorsi flap could tightness here be explained as part of direct surgical procedures. The identified area of tethering corresponds to the teres major and minor trigger spots according to Travell and Simons (1992) and the centre of coordination for humeral extension as described by L Stecco (2004). Posterior axilla and teres major muscle tightness may be associated with restricted shoulder elevation, changes in scapulohumeral rhythm and changes in glenohumeral biomechanics.

Stecco et al. (2007) further describe a fibrous lamina between the fascia of latissimus dorsi and the triceps brachial fascia creating a thickening in the posterior axilla. This thickening is fan-shaped, with the apex directed towards the axilla and the base towards the postero-medial side of the brachial fascia. With the extent of dissection described during axillary clearance extending to the edge of latissimus dorsi (Dao & Patel,1984), it seems feasible to assume that direct anterior and lateral fascial damage may well influence the fascial structures as far as the posterior axilla and teres major as well.

CONCLUSIONS.

Breast cancer treatment results in a range of supporting connective tissues losing its normal shearing and gliding ability. In this limited sample, mapped restrictive tissue gliding clearly show wider than reported restrictions. The wider extent of limitation in tissue gliding was somewhat unexpected. This pattern needs further research and investigation.

Shoulder-arm morbidity is a complex syndrome which cannot be adequately described by single symptoms, or rely on single-therapy treatment strategies for optimal results. In our practice, adding mobilization of all tissue gliding restrictions resulted in improved upper limb function, reduced pain and increased exercise tolerance. We therefore propose that the entire upper quarter be assessed and treated for tissue gliding restrictions as part of the long term rehabilitation plan for patients after treatment for breast cancer.

REFERENCES.

Box RC, Reul-Hirche HM, Bullock-Saxton JE, Furnival CM 2002 Shoulder movement after breast cancer surgery: results of a randomized controlled study of postoperative physiotherapy. Breast Cancer Res Treat 75:35-50

Cancer Research UK (2006). www.cancerresearchuk.org/cancerstats/types/breast/incidence/ (accessed 25.9.06).

Dao TL, Patel J 1984 Modified radical mastectomy. In: Nyhus LM, Baker RJ. (eds.) *Mastery of Surgery: Volume I.* Brown and Company, Boston/Toronto

Fialka-Moser V, Crevenna R, Korpan M, Quittan M 2003 Cancer rehabilitation. Particularly with aspects on physical impairments. J Rehabil Med 35: 153-162

Ghazinouri R, Levy C, Ben-Porat L, Stubblefield MD 2005 Shoulder impairments in patients with breast cancer: a retrospective review Rehabil Onc 23: 5-8

Kärki A, Simonen R, Mälkiä E, Selfe J 2005 Impairments, activity limitations and participation restrictions 6 and 12 months after breast cancer operation. J Rehabil Med 37: 180-188

Kingsbury K 2007 The changing face of breast cancer, Time 170:36-43

Lash TL, Silliman RA 2000 Patient characteristics and treatments associated with decline in upper-body function following breast cancer therapy. J Clin Epidemiol, 53: 615-622

Lauridsen MC, Christiansen P, Hessov I 2005 The effect of physiotherapy on shoulder function in patients surgically treated for breast cancer: a randomized study. Acta Oncol 44:449-457

Pendergrast WJ 1989 Surgical management of breast cancer. In: Lewis JR (Ed) The Art of Aesthetic Plastic Surgery. Volume II. Little, Brown and Company, Boston

Rietman JS, Dijkstra PU, Hoekstra HJ, et al 2002 Late morbidity after treatment of breast cancer in relation to daily activities and quality of life: a systematic review. EJSO 29:229-238.

Stecco C, Gagey O, Macchi V, et al 2007 Tendinous muscular insertions onto the deep fascia of the upper limb first part: anatomical study. Morphologie, doi:10.1016/j.morpho.2007.05.001

Stecco L 2004 Fascial Manipulation for Musculoskeletal Pain. Piccin Nuova Libraria S.p.A., Padova.

Travell J G, Simons D G 1992. Volume 2. Myofascial pain and dysfunction. The Trigger Point Manual. The Lower Extremities.Williams and Wilkins, Baltimore.

Warwick R, Williams PL 1976 ed. *Gray's Anatomy.* 35th ed. Longman

Wyrick SL, Waltke LJ, Ng AV 2006 Physical therapy may promote resolution of lymphatic cording in breast cancer survivors. Rehab Onc 24:29-34.

TABLES.

***Table 1**:* Patient Details

Number of Patients	16	
Mean age in years (Range)	53	(45-68)
Surgical procedures: -		
Primary Modified radical mastectomy (%)	16	(100%)
Right operative arm (%)	4	(25%)
Left operative arm (%)	10	(62.5%)
Bilateral MRM (%)	2	(12.5%)
Axillary node clearance (%)	14	(87.5%)
Breast reconstruction (%)	10	(62.5%)
Other surgical procedures (%)	12	(75%)
Adjuvant therapy (%)	12	(75%)
Radiotherapy (%)	2	(12.5%)
Chemotherapy (%)	6	(37.5%)
Radiotherapy & Chemotherapy (%)	4	(25%)
Time of referal		
Early: 0-6 months (%)	6	(37.5%)
Late: 6 months and later (%)	10	(62.5%)
Mean (Range)	2.8 yrs (4 weeks to 10yrs)	

Table 2: Impairment and complaints (reason for referral)

Number of Shoulders	18	
Shoulder ROM restrictions (%)	17	(95%)
Mean Abduction ROM (Range)	130°	(40 - 180)
Changed Scapulo-humeral rhythm (%)	18	(100%)
Pain in chest, shoulder or arm (%)	11	(61%)
Neckache (%)	8	(44%)
Lymphoedema (%)	8	(44%)

Table 3: Sites of tisssue restriction.

Tissue gliding Restrictions (%)	18	(100%)
Surgical scar (%)	14	(78%)
Drain sites (%)	5	(29%)
Axilla and upper arm (%)	15	(83%)
Axilla and lateral chest wall (%)	11	(61%)
Posterior axilla / Scapula (%)	10	(55%)
Neck, above clavicle (%)	6	(33%)
Tightness from other surgical sites (%)	7	(39%)

FIGURES.

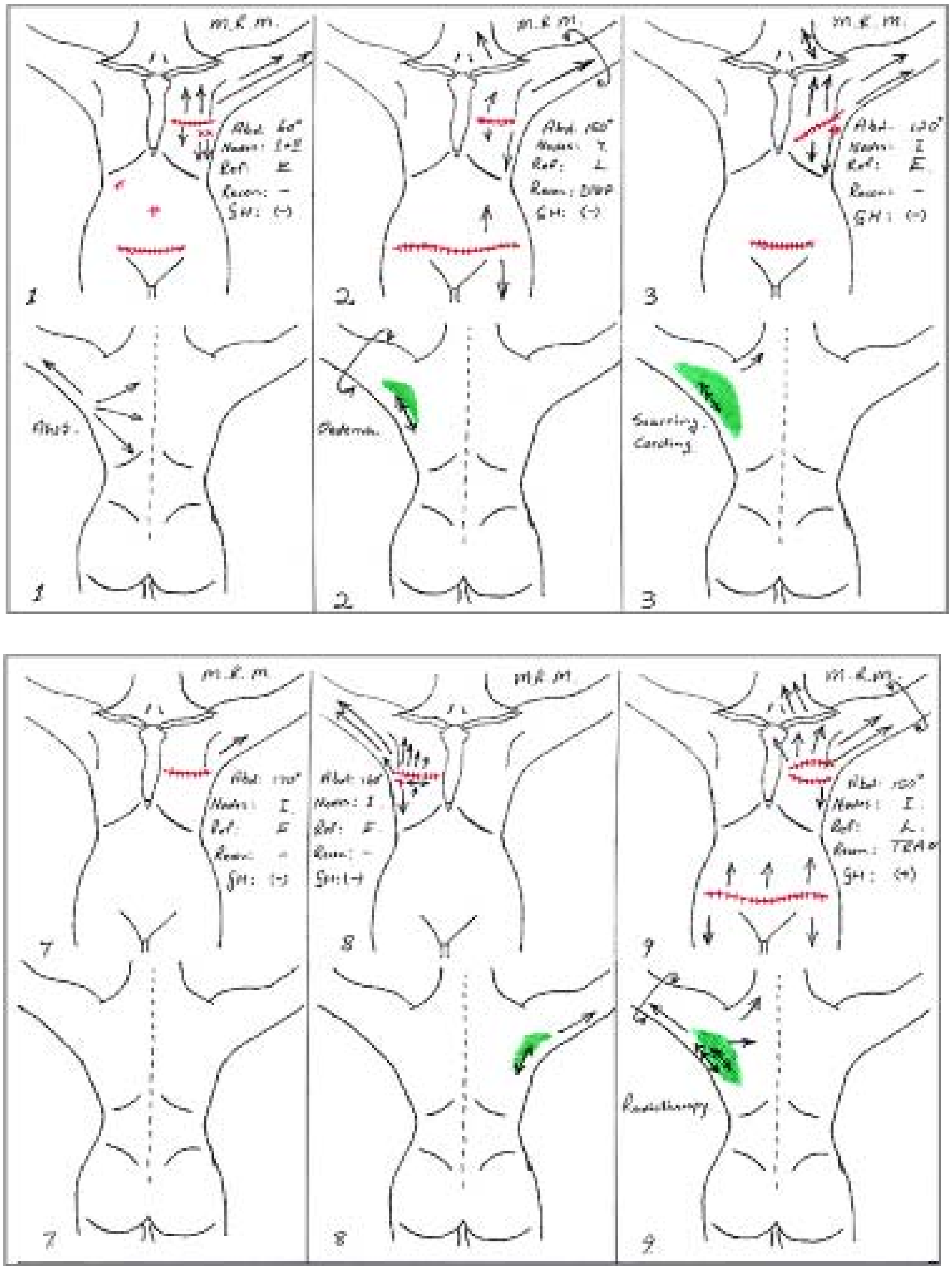

Figure 1: Body chart with scarring, area and direction of tissue tightness recorded.

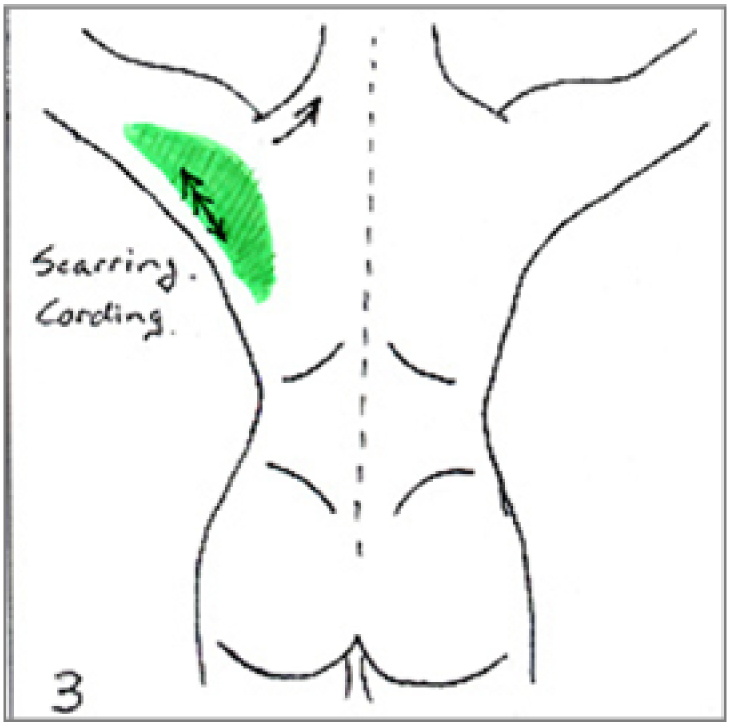

Figure 2: Posterior axillary wall and teres major tightness

Figure 3: Fascial tethering over teres major muscle.