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## **Soft Tissue Techniques For Upper Quadrant Range Of Motion And Pain In A Breast Cancer Survivor Following Mastectomy: A Case Report**

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1     **Soft Tissue Techniques for Upper Quadrant Range of Motion and Pain in a**  
2             **Breast Cancer Survivor Following Mastectomy: A Case Report**

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8  
9     Acknowledgements: Amy Litterini PT, DPT, for assistance with case report conceptualization,  
10    Heather Reed, PT, for supervision and guidance in management of this patient, and the patient  
11    for participation in this case report.

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14  
15    The patient signed informed consent allowing the use of medical history, information, video and  
16    photo documentation for this report, and has received information on institution policy regarding  
17    the Health Insurance Portability and Accountability Act.

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22    Key Words: manual therapy, oncology rehabilitation, preventative management

24 **ABSTRACT**

25  
26 Background and Purpose: Breast cancer treatments may cause late effects of pain, range of  
27 motion loss, and activity limitation in the upper extremity (UE). The purpose of this case report  
28 was to describe the utilization of soft tissue techniques with instrument assisted soft tissue  
29 mobilization (IASTM) in outpatient physical therapy to address decreased UE function and pain  
30 for a patient post-surgery, chemotherapy, endocrine therapy and radiation.

31 Case Description: The patient was a 61-year-old female referred to physical therapy (PT) for  
32 restricted mobility and pain in her right UE post-oncologic treatments preventing her from  
33 vocation and participating in daily activities. The initial evaluation demonstrated right UE  
34 weakness of 4/5 (*withstand light resistance*), painful right active end-range of motion pulling  
35 into the hip and trunk with corresponding right-sided tissue puckering and mottling. The patient  
36 received 26 visits over 23 weeks combining manual therapy techniques, IASTM, yoga, a foam  
37 rolling program, and therapeutic exercises.

38 Outcomes: At the recertification at week 23, she demonstrated outcome measure improvements  
39 in right UE strength 4/5 to 4+5 (*withstand moderate resistance*); increased tolerance of UE end-  
40 range AROM with decreased reported pain sensation; Quick Disability of the Shoulder Arm and  
41 Hand score decrease (27.27/100 to 11.36/100); Numeric Pain Rating Scale decrease (2/10 to  
42 1/10); and Pain Disability Index decrease (2/10 to 1/10).

43 Discussion: The prescribed treatment plan appeared to be beneficial for this patient. Orthopedic  
44 outpatient PT rehabilitation for UE conditions in breast cancer survivors should have  
45 consideration to effects of surgical, medical and radiation treatments both locally and  
46 systemically. The pursuit of therapists' continuing education for future treatment considerations  
47 of breast cancer survivors post-surgery combined with endocrine, chemotherapy and radiation  
48 may enhance efficacy of soft tissue mobilization and therapeutic exercises.

49 Manuscript Word Count: 3480

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## 51 **INTRODUCTION/BACKGROUND and PURPOSE**

52 Breast cancer is an abnormal growth (carcinoma) originating in breast tissue. Malignant  
53 breast tumors, or lesions, have the potential to spread to other areas of the body, or *metastasize*.<sup>1</sup>  
54 Breast cancer is defined pathologically by location of origin in the breast (e.g. ducts, lobes), size  
55 of the tumor, status of the nodes, and the presence of markers indicating tumor staging.<sup>1</sup>  
56 Carcinoma is pathologically staged from 0-IV based on that assessment, (stage 0 indicates  
57 carcinoma in situ and stage IV indicates late or metastatic disease).<sup>1</sup> Following biopsy, the  
58 presence of estrogen receptor (ER), progesterone receptor (PR), and human epidermal growth  
59 factor (HER) give prognostic information about the carcinoma.<sup>1</sup> Breast cancer is the second most  
60 common form of carcinoma found in women in the United States following skin cancers.<sup>1</sup> In  
61 2020, an estimated 276,480 women were diagnosed with breast cancer in the United States, and  
62 it accounted for 42,170 deaths.<sup>2</sup> Due to advances in early detection and adjuvant treatment (post-  
63 surgical chemotherapy/radiation/endocrine therapy) the incidence and mortality rates of breast  
64 cancer appear to be declining in the United States.<sup>1</sup> Treatment has evolved in various surgical  
65 techniques, adjuvant chemotherapy, pre-surgical chemotherapy (*neoadjuvant*), immunotherapy,  
66 radiation therapy (RT) and endocrine therapies (ET).<sup>1,3</sup>

67 Although treatment techniques have been found to be effective in decreasing the  
68 recurrence of breast carcinoma, the body may exhibit late effects including decreased mobility,  
69 strength and quality of life.<sup>3,4</sup> Not only are these impairments in the affected upper extremity  
70 (UE) caused by surgical procedures like axillary lymph node dissection (ALND), but these  
71 therapies significantly increase the risk of developing *lymphedema* (inability to remove  
72 accumulation of excess fluid from an area) and/or *axillary cording* (scarring or adhesion of

73 connective tissue under the skin).<sup>5,6,7</sup> In many patients following surgery, chemotherapy, and RT,  
74 limitations in returning to work, activities of daily life (ADL), and social activities are present  
75 due to pain and range of motion (ROM) decline in the UE.<sup>3,4,5</sup>

76 The rationale for this case report was to illustrate the importance of the management of a  
77 61-year-old female patient following mastectomy, with emphasis on the local and systemic  
78 results of RT, ET and chemotherapy indicating a multifaceted approach physical therapist (PTs)  
79 must take in treatment. There are few specific manual therapy techniques or parameters for ROM  
80 and pain management in this patient population outlined in literature; however, management  
81 with an approach of manual therapy and traditional strength and ROM exercises was  
82 recommended for the improvement of UE function.<sup>4,8</sup> In the management of a survivor of breast  
83 cancer, the purpose of this case report was to describe the utilization of manual therapies,  
84 instrument assisted soft tissue mobilization (IASTM) and myofascial techniques (MFT) to  
85 address ROM, strength, and pain following surgery, chemotherapy, ET and RT treatments.

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## 88 **Patient History and Systems Review**

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90 Consent forms were signed by the patient for usage of information for participation in this  
91 case report. This 61-year-old Caucasian female was diagnosed in the spring of 2019 with a stage  
92 II ER+, PR+ and HER-2+ invasive ductal carcinoma of the right breast. A sentinel lymph node  
93 biopsy was performed in the following month, which was positive for macro metastases resulting  
94 in a right mastectomy and complete axillary dissection where an additional 22 nodes were  
95 removed. A simple mastectomy was then performed on the left prophylactically. Six cycles of  
96 adjuvant chemotherapy/immunotherapy were then introduced in the summer of 2019 (see

97 Appendix 1). After chemotherapy concluded, external beam RT was delivered to both the  
98 anterior and lateral right chest wall and axilla for four and a half weeks in the winter of 2019.

99 The referral to physical therapy (PT) in the spring of 2020 was for the diagnosis of  
100 malignant neoplasm in unspecified right breast with primary complaints of stabbing pain in her  
101 right shoulder, scapula and arm with significant shoulder tightness. She was a divorced single  
102 mother with an adult son who lived independently, working full-time as an office administrator  
103 and part-time (eight hours/week) as a dance and yoga instructor at a local wellness gym. She  
104 described nerve “zinging” along the posterior ribcage and a pulling sensation from her armpit to  
105 her hip on the right side which limited her from teaching classes. She had been receiving three-  
106 times weekly infusions of chemotherapy and immunotherapy through a left subclavian venous  
107 access device (VAD), which remained in her chest until the summer of 2020. While she reported  
108 progress in survivorship, including gains in her strength, ability to dance, and participate in yoga,  
109 she was unsure how to address the continued pain and tightness. The primary problem in this  
110 case was decreased mobility in the right UE and trunk. She had a past medical history of  
111 osteoporosis which had not affected her daily life at that point. She had no other significant  
112 family history or comorbidities to report. Refer to Table 1 for information on the patient’s  
113 complete systems review.

114 The systems review revealed that the tissues of her right flank, breast and posterior  
115 shoulder girdle had mottled and puckered. Her surgical scars were closed and healed bilaterally,  
116 but her skin was taught, and mobilization of the right scapula caused movement and a pulling  
117 sensation into the right hip. Tissue extensibility in these areas was limited, with thickness noted  
118 in the right posterior shoulder and flank when compared bilaterally. Differential diagnoses for  
119 these findings were axillary cording, and/or myofascial post-surgical tightness. Tests and  
120 measures to be utilized were to assess strength, ROM, UE girth, tissue extensibility, and patient

121 perception of limitation. This patient was an ideal candidate for this case report to emphasize the  
122 importance of manual therapy management of this condition in the outpatient setting, as well as  
123 the patient's motivation for restoring ROM and strength to increase function in her right arm in  
124 order to return to her daily activity without restriction.

125

## 126 **Examination – Tests and Measures**

127

128         The limitations found in the history and systems review were further examined with tests  
129 and measures to determine specific impairments that were present (refer to Table 3). The Pain  
130 Disability Index (PDI), Quick Disability of the Shoulder, Arm and Hand (QuickDASH),  
131 Numeric Pain Rating Scale (NPRS), ROM testing, gross manual muscle testing (MMT), and arm  
132 circumferential girth measurements were utilized in the objective examination. At initial  
133 evaluation (IE), patient-reported outcome measures were completed (QuickDASH, PDI, NPRS)  
134 followed by assessment of vitals (heart rate, blood pressure, oxygen saturation), self-reported  
135 height in inches, and weight in pounds. The PT completed a patient history and the outcome  
136 measures of ROM, strength, palpation, and UE circumferential girth measurements (see Table 1).  
137 ROM assessments were conducted in a cervical to rostral manner into the UEs with a Jamar EZ-  
138 Read standard goniometer (Performance Health, Warrenville, IL), performed in supine as  
139 outlined by Norkin et al.<sup>9</sup> Muscle assessments of the shoulder, elbow and wrist were conducted  
140 bilaterally in sitting, utilizing UE techniques described by Kendall et al.<sup>10</sup> Two UE  
141 circumferential measurements were taken bilaterally at midrange anatomical points to the patient  
142 morphological status with the shoulder in neutral and the elbow in full extension. These points  
143 were measured to be 7cm distally from the acromion process and 12cm distally from the  
144 olecranon process. A third measure at the hand was not completed. Circumferential

145 measurements are valid with good clinical utility and were taken as baseline measurements for  
146 secondary lymphedema, an outcome measure recommended for use by Perdomo et al.<sup>11</sup>

147         The purpose of the above outcome measures was to assess the patient's functional ability  
148 and limitations restricting her daily activities. The patient reported outcome measures  
149 represented insight to the patient's experience of the condition. Assessment of the QuickDASH  
150 allowed the clinician to analyze the amount of limitation the patient experienced specific to use  
151 of their UE in various tasks of everyday life (see Appendix 2). The QuickDASH is reported to  
152 have strong validity and reliability in orthopedic populations with shoulder pain and  
153 dysfunction.<sup>12</sup> Although this outcome measure currently lacks literature psychometrically for the  
154 breast cancer population, the clinical utility remains strong in UE conditions and is  
155 recommended for use with breast cancer survivors by Miale et al.<sup>12</sup>

156         The patient reported outcomes utilized for the measurement of pain in this case were the  
157 NPRS and the PDI. The PDI is utilized to measure the level of disability one experiences due to  
158 pain during seven various activities (see Appendix 3). The scoring represents the level of  
159 disability (a higher score indicates more disability due to pain restriction) that the individual  
160 experiences with daily tasks.<sup>13</sup> The PDI is highly recommended for use by Harrington et al<sup>12</sup> in  
161 the measurement of pain levels and disability. It is shown to have excellent construct validity and  
162 test-retest validity, although not specific to breast cancer populations.<sup>13</sup>

163         The NPRS also is highly recommended for use in this population for measurement of  
164 pain in the experience of breast cancer by Harrington et al.<sup>13</sup> This outcome measure has been  
165 validated for breast cancer pain as well as other musculoskeletal conditions.<sup>14</sup> The NPRS has  
166 excellent reliability in many populations including cancer-related pain.<sup>14</sup>

167

168



169 **Clinical Impression: Evaluation, Diagnosis, Prognosis**

170  
171 At IE, she experienced painful ROM, tightness, and loss of strength in the right arm that  
172 persisted since returning to her daily routines of dance and yoga. The problem list in this case  
173 included pain with use of the right shoulder, stiffness in the tissues of the right chest wall and  
174 breast, and loss of strength in the right UE. Although symptoms of cording were reported in her  
175 trunk, palpation of the axilla and antecubital fossa during shoulder abduction did not demonstrate  
176 signs of roping cords which is the most common presentation in evaluation of axillary web  
177 syndrome.<sup>7</sup> Due to the elevated risk of lymphedema following ALND, ongoing monitoring must  
178 be considered in the plan of care (POC). Following examination, the initial impression was the  
179 loss of glenohumeral ROM was due to myofascial and tissue restrictions which deemed the  
180 patient an appropriate client for treatment. She was an ideal candidate for this case report to  
181 demonstrate the utilization of MFT due to UE pain and tissue restriction related to her cancer  
182 treatments. The medical diagnosis of this IE was ICD-10 code: C50.911 (*malignant neoplasm of*  
183 *unspecified site of right female breast*). The PT diagnosis was classified as ICD-10 codes L90.5  
184 (*scar conditions and fibrosis of skin*), and R53.1 (*weakness*).

185 The prognosis for her rehabilitation was evaluated to be good. Positive prognostic factors  
186 included her history of an active lifestyle of dance and yoga routines maintained prior to and  
187 with therapy, as well as her determination to improve with therapy and maintain her health.<sup>15</sup>  
188 Treatments of MFR and soft tissue mobilization also show positive utility as an additional  
189 modality for treatment of UE limitation in breast cancer survivors,<sup>3,6,16</sup> as well as in the Ascent  
190 Physical Therapy philosophy of clinical practice to increase tissue pliability along adhesions of  
191 scarring in UE conditions.<sup>17</sup> No consultations or referrals were warranted at the time of IE to  
192 start the POC. Additional testing to be implemented were recertification notes with repeated  
193 outcome measures every four weeks. Visits at the time of IE were scheduled for 40-minute

194 sessions twice a week for 12 weeks. The planned PT sessions consisted of treatments of  
195 therapeutic activities of: foam rolling activities using a 36” length, 6” width AmazonBasics  
196 Foam Roller (Amazon, Seattle, WA); therapeutic exercises including manual self-stretching;  
197 yoga; manual therapies such as soft tissue mobilizations; IASTM with Zabrina hot stones  
198 (Qincheng Liu, Minzhi, CN.); MFR; education of self-care strategies of lymphedema risk  
199 reduction; and a home exercise program instruction with self-massage techniques. Long- and  
200 short-term goals and timelines are outlined in Appendix 4. Re-certifications and evaluations of  
201 the POC with consultation with her referring physician were completed at every four-week  
202 progress note visit.

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## 206 **Intervention and Plan of Care**

### 207 Communication, Coordination and Documentation

208 Communication was consistent between the patient, PT student, PT, and rehab aides  
209 regarding the POC and patient responsiveness to treatment. Progress notes at every four weeks  
210 were electronically signed and confirmed with her referring physician throughout the duration of  
211 care. The PT student coordinated with the PT on all aspects of care prior to the patient’s  
212 treatment sessions. The patient’s case was documented using WebPT (WebPT, Phoenix, AZ.)  
213 electronic medical record service.

### 214 Patient Education

215 Education of findings in the IE was provided to the patient to ensure understanding of the  
216 present condition including treatment effects on ROM and strength. Consent to the POC was  
217 received from the patient and further education was also provided throughout her care on  
218 increased risk of lymphedema.

219 The patient was seen twice a week for 12 weeks in 40-minute durations. Visits were  
220 decreased to once weekly after eight weeks as she progressed and became independent with self-  
221 management between sessions. There were three missed appointments throughout the duration of  
222 care due to pain and fatigue. A total of five progress notes were completed every four weeks  
223 until the most recent recertification was obtained in the fall of 2020. Treatments provided for the  
224 patient's presentation were manual therapies, therapeutic exercises and a home exercise program  
225 (HEP) to improve right shoulder ROM, strength and pain management.<sup>4,8</sup> The co-intervention  
226 provided in the duration of this treatment was the surgical removal of the VAD from her left  
227 subclavian after 10 weeks.

228

### 229 **Manual Therapy**

230 During the IE, the tissues of the right pectoral, axillary, trunk and flank regions demonstrated  
231 observable tightness and discomfort with overhead motions. Upon palpation, the soft tissues  
232 were taught, potentially due to the late effects of surgical trauma and RT. Manual techniques  
233 were selected to address the loss of tissue pliability, and to decrease pain (See Table 2).<sup>3,4</sup>  
234 Although no research indicates the use of thermal IASTM for the treatment of UE limitation due  
235 to breast cancer treatments, it was utilized for patient comfort as introduction to manual  
236 therapies. Myofascial unwinding was selected as the clinical utility in a randomized control trial  
237 was demonstrated in breast cancer survivors to decrease pain and increase ROM of the neck and  
238 shoulder (refer to Appendix 5).<sup>20</sup> Trigger point releases were completed in side-lying and held  
239 until tissue release with passive scapular mobilization to decrease nerve pain and sensitivity to  
240 overhead motions.<sup>8</sup> MFR was performed in left side lying, prone, and supine with sustained  
241 holds utilizing pin and stretch techniques.<sup>5</sup> Patient positioning during various manual therapies  
242 was selected based on presentation, chief complaint of the visit, and loss of tissue extensibility

243 assessed by palpation. Initial sessions included 30 minutes of manual therapy with 10 minutes of  
244 HEP instruction. After three sessions, the patient demonstrated competence with her HEP and  
245 sessions were transitioned to full 40-minute manual sessions to maximize the patient's benefit of  
246 treatment (see Table 3).

### 247 **Therapeutic Exercise**

248 Throughout the POC, the patient continued a home yoga routine daily, which was  
249 encompassed into her home program for strengthening due to the adherence and approval from  
250 the therapist to continue. It has been shown that in those at risk for lymphedema post-ALND and  
251 RT, performance of yoga results in small gains of strength and ROM in the UE.<sup>21</sup> Due to the  
252 patient's motivation for continued exercise at home, manual therapy was the primary focus for in  
253 clinic treatments with the HEP continued independently.

### 254 **Home Exercise Program**

255 The patient's HEP was introduced in the third visit, designated to improve her UE and  
256 thoracic ROM. She utilized various yoga positions with thoracic mobilization and UE stretches  
257 with a foam roller parallel to the thoracic spine daily to increase thoracic mobility, UE ROM and  
258 tolerance for various overhead positions. The HEP also included manual lymph drainage to the  
259 right axilla and trunk that the patient completed independently at home for between-session  
260 management (see Appendix 6).

261

### 262 **TIMELINE**

263 See Appendix 7.

264

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267

### 268 **OUTCOMES**

269 Over the duration of treatment, the patient was seen by the student PT for a total of 22 visits

270 over 16 weeks. The care of the patient was then continued by the in-house therapist for 26 visits  
271 over the next 23 weeks. While the patient expressed reduction of pain with treatment sessions,  
272 she reported increased sensations of tightness with longer durations between visits. At visit 26, it  
273 was agreed to alter the POC to continue treatments in bi-monthly sessions for eight weeks to  
274 encourage further self-management between visits.

275 Final measurements of outcome measures were assessed at visit 26. Her ROM was  
276 unchanged, however, perceived symptoms of pulling at terminal UE ranges had decreased.  
277 Circumferential girth measures were unchanged, presumably due to no presence of edema noted  
278 in the UE at the IE, and no new onset during the episode of care. Her strength in the right UE  
279 increased from 4/5 to 4+/5 at week four, but remained consistent from that time forward.  
280 Although no data was found to support a significant change in strength, she reported functional  
281 ability to continue teaching classes without pain or perceived weakness. This was represented in  
282 the patient-reported values of the PDI decreasing from 4/10 to 1/10. The QuickDASH score  
283 decreased from 27.27/100 to 11.36/100, indicating a change greater than the minimal clinically  
284 important difference of 10 in UE patient populations.<sup>22</sup> She reported decreased pain from 2/10  
285 with movement to 1/10 experienced only at terminal ranges of overhead motions on the NPRS  
286 scale. See Table 3 for complete outcome measure data throughout the duration of care.

287 Anticipated follow-up measures will include those of continued circumferential girth  
288 measures of the UE to monitor for the possibility of lymphedema onset, as well as continued  
289 measurements of UE ROM and soft tissue changes for continued sensations of tightness to  
290 monitor for axillary web syndrome. The patient was last seen by her referring medical  
291 oncologist in the summer of 2020 during this POC with future follow-ups scheduled. She  
292 demonstrated physical and verbal self-efficacy with her HEP and stretching routines as well as  
293 manual self-techniques prescribed in the clinic, however she reported days between visits with

294 the inability to complete her HEP due to fatigue and malaise. There were no adverse or  
295 unanticipated events related to her treatment.

296

## 297 **DISCUSSION**

298 This case report was intended to illustrate a multifocal approach of manual therapy and  
299 therapeutic exercise shown in the literature to increase ROM, strength, and manage pain in a  
300 breast cancer survivor post-surgery and adjuvant therapies<sup>4,6,8</sup> At the time of discharge, the  
301 patient made minimal gains in right UE strength and tolerance for terminal overhead motions  
302 with decreased pain, which may be attributed to the elevated level of function the patient  
303 presented at baseline. Follow-up continued to be important as tightness and restriction persisted  
304 in her right UE, indicating bi-monthly visits prioritizing self-management for symptoms of  
305 potential axillary web syndrome.<sup>7</sup> Outcomes may indicate the utility of manual treatments  
306 accompanied by therapeutic exercise in PT to manage limitations experienced in the treatment of  
307 a patient post-breast cancer treatment.

308 The symptoms of axillary cording and the relation of systemic and local effects of  
309 adjuvant medical and radiation oncology following surgery should be considered clinically in  
310 this case. Although etiology is unclear, and pulling sensations at the hip with UE motion without  
311 palpable cords is not the most common presentation, these symptoms should be considered and  
312 addressed appropriately in the outpatient PT management of breast cancer survivors.<sup>3,7,25</sup> PT  
313 interventions for UE pain and limitation may need to include distal treatments in the hip or trunk  
314 to prevent inactivity due to pain. Physiologically, the late effects of breast cancer treatments may  
315 cause pain, fatigue, and weight gain. As elevated body mass index has been shown to be the  
316 primary risk factor for lymphedema in those post-ALND, it should be addressed as well in PT  
317 care and patient education in this high-risk population.<sup>3,4,5,7,24,26,27</sup>

318           Limitations in this case include lack of evidence indicating the safe use of thermal  
319 IASTM in this population, as this has the potential to increase the risk of lymphedema post-  
320 ALND and on radiated tissue. Another limitation was that the degree of fatigue and malaise was  
321 not measured, even though it impacted HEP adherence. The strength in this case was the  
322 extremely motivated and otherwise healthy patient who continued to be as active as possible  
323 throughout her care, as she utilized yoga as a form of strengthening and HEP, which enabled  
324 manual therapy to be the focus for PT sessions in the clinic.

325           Outpatient PTs will continue to be utilized in the management breast cancer survivors as  
326 medical innovations continue to increase the population of those potentially experiencing UE  
327 limitation in ROM, strength, and mobility. The treatment of survivors should be considered more  
328 specifically to fatigue, pain, lymphedema and axillary cording monitoring, as well as  
329 cardiovascular and bone health. This results in the need for outpatient PTs to dedicate time  
330 through continuing education for meaningful lifelong function and risk management in this  
331 population. Future research in this area of expertise should focus on treatment parameters for  
332 both therapeutic exercises to promote UE function, and manual therapy to reduce the risk of  
333 lymphedema and axillary cording in those post-ALND, chemotherapy, ET and RT treatments.  
334 The understanding and implementation of this may help patients experience a more effective  
335 reduction of post-oncologic symptoms, increased UE functioning, and quality assistance in  
336 reducing risk for future concomitant conditions for a meaningful life in survivorship.

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434 **TABLES and FIGURES Table 1: Systems Review**

<b>Cardiovascular/Pulmonary</b>	Not impaired. Heart rate: 75 Beats per minute, radial pulse Blood Pressure: 120/95mmHg in upper arm in sitting Oxygen Saturation: 97% on room air
<b>Musculoskeletal</b>	Gross Cervical ROM: No impairments Gross Shoulder ROM: Impaired on right, painful at end ranges Gross Elbow ROM: No impairment Gross Wrist ROM: No impairment Height: 62 inches Weight: 115 pounds
<b>Neuromuscular</b>	Impaired: Numbness and tingling periodically into the lower extremities, as well as into her 3 <sup>rd</sup> , 4 <sup>th</sup> , and 5 <sup>th</sup> digits on her right hand. Nerve pain experienced into her posterior right flank.
<b>Integumentary</b>	Bilateral mastectomy scarring. Scars are clean, closed, and fully healed. No other radiation therapy changes noted. No edema or upper extremity circumferential changes noted. Mottling and puckering of right flank, breast and posterior shoulder girdle tissues.
<b>Communication</b>	No impairments.
<b>Affect, Cognition, Language, Learning Style</b>	Affect: Quiet, friendly Language: English Cognition: No impairments Learning Style: Tactile, or Visual learning

435 Abbreviations: mmHg = millimeters of Mercury

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437 **Table 2: Manual Therapy Techniques**

Manual Therapy	Phase 1: Visits 1-9 Weeks 1-4	Phase 2: Visits 10-18 Weeks 5-12	Phase 3: Visits 19-26 Weeks 13-23
Goals of Phase	Mobility, Education	Tissue Extensibility, Pliability and Scapular Mobility	Self-Management and ROM Maintenance
IASTM – hot stone	Trunk, chest, axilla to UE	Trunk, chest, axilla to UE	Trunk, lateral chest wall, axilla to UE, peri-scapular area
MFR	Lateral R trunk, chest scapula, to hip	Lateral R trunk, scapula, to hip	R lateral flank, hip, abdominal wall, anterior R pectorals, inferior and posterior scapular borders
MF Unwinding	RUE PROM, distraction to hip on R	RUE PROM, distraction to hip on R	
TrP Releases	Subscapular release	Inferior and medial boarder of scapula	
STM	Trunk, chest, axilla to UE	Trunk, chest, axilla to UE	Axilla to anteriolateral flank, R abdominal and hip
Scapular Mobilization		Protraction and elevation	

438 Abbreviations: Tx: treatment. IASTM: instrument assisted soft tissue mobilization. MFR: myofascial release. MF: myofascial.

439 TrP: trigger point. STM: soft tissue mobilization. UE: upper extremity. RUE: right upper extremity. PROM: passive range of

440 motion: R: right. ABD: abduction. Lat: lateral

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452 **Table 3: Test and Measures Timeline of Outcomes**

Measures	Initial Evaluation	Progress 1	Progress 2	Progress 3	Progress 4	Progress 5
Pain Disability Index	2/10. <i>0 - mild pain with activity. 10 - total disability</i>	4/10	3/10	3/10	3/10	1/10
QuickDASH	27.27/100. <i>A lower score indicating less difficulty with activity.</i>	18.18/100	13.64/100	9.09/100	11.36/100	11.36/100
Numeric Pain Rating Scale	2/10, a “tight” pain experienced with activity only. <i>10 indicates maximum level of pain experienced.</i>	2/10, a “tight” pain experienced with activity only	2/10	2/10	1/10	1/10
Girth Measurement	<b>R Upper Arm:</b> 25.5cm. Measured 7cm distally from acromion <b>R Lower Arm:</b> 18cm. Measured 12cm distally from olecranon <b>L Upper Arm:</b> 26 cm. Measured 7cm distally from acromion <b>L Lower Arm:</b> 18cm. Measured 12cm distally from olecranon	25.5cm  18cm 26 cm 18cm	25.5cm  18cm 26 cm 18cm	25.5cm  18cm 26 cm 18cm	25.5cm  18cm 26 cm 18cm	25.5cm  18cm 26 cm 18cm
ROM	WNL all UE motions BL, pain in axilla to R flank and hip experienced in mid-ranges/motions of shoulder flexion and abduction	WNL, pulling in back of shoulder R flank and hip with over- head RUE motion	WNL, continued tightness in R scapula, flank	WNL, end range “pulling” on R with overhead reach	WNL, complaint of pull along R posterior shoulder and flank	WNL, slight pull present in flank with terminal overhead ROM
Shoulder Strength		R L	R L	R L	R L	R L
	Flexion:	4/5 4/5	4+/5 4+/5	4+/5 4+/5	4+/5 4+/5	4+/5 4+/5
	Abduction:	4/5 4/5	4+/5 4+/5	4+/5 4+/5	4+/5 4+/5	4+/5 4+/5
	Internal Rotation:	4/5 4/5	4+/5 4+/5	4+/5 4+/5	4+/5 4+/5	4+/5 4+/5
	External Rotation:	4/5 4/5	4+/5 4+/5	4+/5 4+/5	4+/5 4+/5	4+/5 4+/5
Elbow Strength	Flexion:	4/5 4/5	4+/5 4+/5	4+/5 4+/5	4+/5 4+/5	4+/5 4+/5
	Extension:	4/5 4/5	4+/5 4+/5	4+/5 4+/5	4+/5 4+/5	4+/5 4+/5
Wrist Strength	Flexion:	4/5 4/5	4+/5 4+/5	4+/5 4+/5	4+/5 4+/5	4+/5 4+/5
	Extension:	4/5 4/5	4+/5 4+/5	4+/5 4+/5	4+/5 4+/5	4+/5 4+/5

Abbreviations: WNL–within normal limits. Cm=centimeters. R=right. L=left. UE=upper extremity. BL=bilaterally. 4/5 indicating ability to hold contraction against gravity with minimal resistance. 4+/5 indicating ability to hold contraction against gravity with moderate resistance.

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456 **APPENDICES Appendix 1: Medication List**

<b>Medication</b>	<b>Indication</b>
Anastrozole	Endocrine Therapy
Calcium	Osteoporosis
Carboplatin	Chemotherapy
Cetirizine Hydrochloride	Allergies
Fozomax	Osteoporosis
Herceptin	Immunotherapy
Multivitamin	Dietary Supplement
Pegfilgrastim	Bone Marrow Stimulant
Perjeta	Immunotherapy
Taxotere	Chemotherapy
Vitamin D	Osteoporosis

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466 **Appendix 2: QuickDASH<sup>18</sup>**

QuickDASH - Initial Patient name: \_\_\_\_\_ Date: \_\_\_\_\_

**INSTRUCTIONS**

This questionnaire asks about your symptoms as well as your ability to perform certain activities. Please answer every question, based on your condition in the last week, by circling the appropriate number. If you did not have the opportunity to perform an activity in the past week, please make your best estimate of which response would be the most accurate. It doesn't matter which hand or arm you use to perform the activity; please answer based on your ability regardless of how you perform the task.

**1. Please rate your pain level with activity: NO PAIN = 0 1 2 3 4 5 6 7 8 9 10 = VERY SEVERE PAIN**

	NO DIFFICULTY	MILD DIFFICULTY	MODERATE DIFFICULTY	SEVERE DIFFICULTY	UNABLE
1. Open a tight or new jar	1	2	3	4	5
2. Do heavy household chores (e.g., wash walls, floors).	1	2	3	4	5
3. Carry a shopping bag or briefcase.	1	2	3	4	5
4. Wash your back	1	2	3	4	5
5. Use a knife to cut food.	1	2	3	4	5
6. Recreational activities in which you take some force or impact through your arm, shoulder or hand(e.g., golf, hammering, tennis, etc.).	1	2	3	4	5
	NOT AT ALL	SLIGHTLY	MODERATELY	QUITE A BIT	EXTREMELY
7. During the past week, to what extent has your arm, shoulder or hand problem interfered with your normal social activities with family, friends, neighbors or groups?	1	2	3	4	5
	NOT LIMITED AT ALL	SLIGHTLY LIMITED	MODERATELY LIMITED	VERY LIMITED	UNABLE
8. During the past week, were you limited in your work or other regular daily activities as a result of your arm, shoulder or hand problem?	1	2	3	4	5
Please rate the severity of the following symptoms in the last week. (circle number)	NONE	MILD	MODERATE	SEVERE	EXTREME
9. Arm, shoulder or hand pain.	1	2	3	4	5
10. Tingling (pins and needles) in your arm, shoulder or hand.	1	2	3	4	5
	NONE	MILD	MODERATE	SEVERE DIFFICULTY	SO MUCH DIFFICULTY THAT I CAN'T SLEEP
11. During the past week, how much difficulty have you had sleeping because of the pain in your arm, shoulder or hand? (circle number)	1	2	3	4	5

QuickDash © Institutes for Work and Health, 1996, All rights reserved.

Therapist Use Only	
Comorbidities:	<input type="checkbox"/> Cancer <input type="checkbox"/> Diabetes <input type="checkbox"/> Heart Condition <input type="checkbox"/> High Blood Pressure <input type="checkbox"/> Multiple Treatment Areas <input type="checkbox"/> Neurological Disorders (e.g., Parkinson's, Muscular Dystrophy, Huntington's, CVA, Alzheimer's, TBI) <input type="checkbox"/> Obesity <input type="checkbox"/> Surgery for this Problem <input type="checkbox"/> Systemic Disorders (e.g., Lupus, Rheumatoid Arthritis, Fibromyalgia)
ICD Code: _____	

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## Pain Disability Index

Pain Disability Index: The rating scales below are designed to measure the degree to which aspects of your life are disrupted by chronic pain. In other words, we would like to know how much pain is preventing you from doing what you would normally do or from doing it as well as you normally would. Respond to each category indicating the overall impact of pain in your life, not just when pain is at its worst.

For each of the 7 categories of life activity listed, please circle the number on the scale that describes the level of disability you typically experience. A score of 0 means no disability at all, and a score of 10 signifies that all of the activities in which you would normally be involved have been totally disrupted or prevented by your pain.

**Family/Home Responsibilities:** This category refers to activities of the home or family. It includes chores or duties performed around the house (e.g. yard work) and errands or favors for other family members (e.g. driving the children to school).

No Disability 0 \_\_. 1 \_\_. 2 \_\_. 3 \_\_. 4 \_\_. 5 \_\_. 6 \_\_. 7 \_\_. 8 \_\_. 9 \_\_. 10 \_\_. Worst Disability

**Recreation:** This disability includes hobbies, sports, and other similar leisure time activities.

No Disability 0 \_\_. 1 \_\_. 2 \_\_. 3 \_\_. 4 \_\_. 5 \_\_. 6 \_\_. 7 \_\_. 8 \_\_. 9 \_\_. 10 \_\_. Worst Disability

**Social Activity:** This category refers to activities, which involve participation with friends and acquaintances other than family members. It includes parties, theater, concerts, dining out, and other social functions.

No Disability 0 \_\_. 1 \_\_. 2 \_\_. 3 \_\_. 4 \_\_. 5 \_\_. 6 \_\_. 7 \_\_. 8 \_\_. 9 \_\_. 10 \_\_. Worst Disability

**Occupation:** This category refers to activities that are part of or directly related to one's job. This includes non-paying jobs as well, such as that of a housewife or volunteer.

No Disability 0 \_\_. 1 \_\_. 2 \_\_. 3 \_\_. 4 \_\_. 5 \_\_. 6 \_\_. 7 \_\_. 8 \_\_. 9 \_\_. 10 \_\_. Worst Disability

**Sexual Behavior:** This category refers to the frequency and quality of one's sex life.

No Disability 0 \_\_. 1 \_\_. 2 \_\_. 3 \_\_. 4 \_\_. 5 \_\_. 6 \_\_. 7 \_\_. 8 \_\_. 9 \_\_. 10 \_\_. Worst Disability

**Self Care:** This category includes activities, which involve personal maintenance and independent daily living (e.g. taking a shower, driving, getting dressed, etc.)

No Disability 0 \_\_. 1 \_\_. 2 \_\_. 3 \_\_. 4 \_\_. 5 \_\_. 6 \_\_. 7 \_\_. 8 \_\_. 9 \_\_. 10 \_\_. Worst Disability

**Life-Support Activities:** This category refers to basic life supporting behaviors such as eating, sleeping and breathing.

No Disability 0 \_\_. 1 \_\_. 2 \_\_. 3 \_\_. 4 \_\_. 5 \_\_. 6 \_\_. 7 \_\_. 8 \_\_. 9 \_\_. 10 \_\_. Worst Disability

Signature \_\_\_\_\_ Please Print \_\_\_\_\_

Date \_\_\_\_\_

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474 **Appendix 4: Short and Long-Term Goals**

Length	Status	Goal
Short-term: 4 weeks	Goal Met  Independent with HEP.	Client will be independent with home exercise program of a self-thoracic mobilization and foam rolling program for self-management between visits.
Short-term: 4 weeks	90%  Minimal complaints of stiffness at end range.	Client will no longer have reported stiffness at end range of motion overhead when compared bilaterally for improved AROM in activity.
Short term: 4 weeks	Goal Met  Trigger points have resolved.	Client will present with resolved trigger points in the right scapula upon palpation for pain reduction with movement.
Long-term: 12 weeks	Goal Met  No longer experiencing nerve pain.	Client will report no nerve pain along the right ribcage for tolerance for yoga and dance classes.
Long-term: 12 weeks	85% Met  Progressing strengthening exercises to patient tolerance.	Client will demonstrate strength approaching normal as compared bilaterally (5/5) for participation in long-term strengthening program.
Long-term: 12 weeks	90% Met  Progressing tissue extensibility and flexibility	Client will present with increased tissue mobility in right shoulder, flank and scapula as compared bilaterally for participation in overhead activity.

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476 **Appendix 5: Myofascial Unwinding Technique<sup>20</sup>**



477 The patient relaxes, while the therapist applies  
478 traction to the upper extremity in various  
479 positions of flexion, abduction with combined  
480 internal and external rotations. Held for 30 to  
481 60 seconds per clinical expertise of tissue  
482 response.  
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485 **Appendix 6: Home Exercise Program**



486 **6a: Standing Tree Hug**

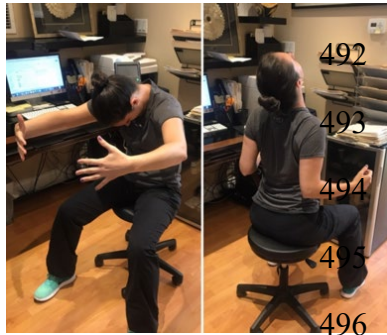
487 2x30 second hold

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492 **6b: Sitting Tree Hug**

493 2x30 second hold

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498 **6c: Pec Minor Stretch on Foam Roll**

499 2x30 second hold

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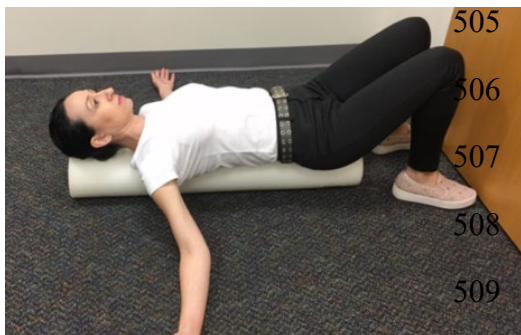


501 **6d: Foam Roll Snow Angels**

502 2x30 second hold in overhead position

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505 **6e: Foam Roll Pec Stretch 1**

506 2x30 second hold

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**6f: Foam Roll Pec Stretch 2**

2x30 second hold



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**6g: Core Claps on Foam Roll**

2x30 second hold

521 Physical Therapist instructed patient to incorporate above stretches into her daily yoga routine.

522 Photos taken from HEP2go.com

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536 **Appendix 7: Timeline of Care**

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Patient was a 61-year-old female with a past medical history of right ER+, PR+ and HER2+ invasive ductal carcinoma and osteoporosis

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Initial diagnosis of stage II invasive ductal carcinoma of the right breast

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Positive right sentinel lymph node biopsy leading to complete axillary node dissection was performed. Prophylactic mastectomy of left breast.

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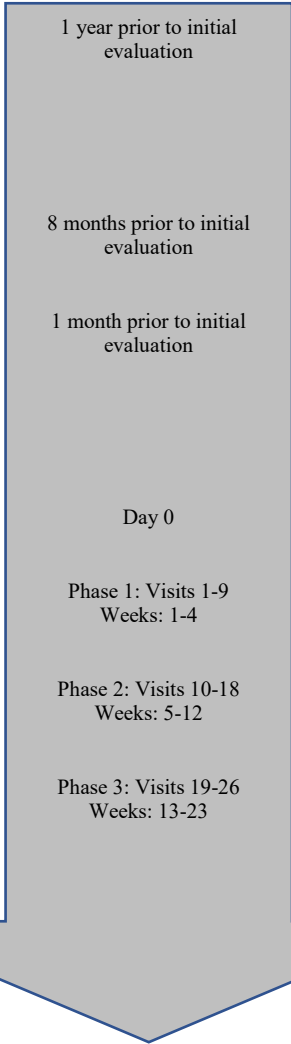
Adjuvant chemotherapy and radiation initiated

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Onset of symptoms of right UE restriction, tightness, and pain with daily activities and yoga

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Initial Evaluation in Physical Therapy Clinic

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Interventions focused on patient education, addressing pain and ROM deficits

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Interventions focused on tissue extensibility, scapular mobility and strength

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Interventions focused on self-management, ROM and strength maintenance

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Patient continued therapy 2x/month for maintenance of ROM during transition to independent management

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562 **CARE Checklist**

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<b>CARE Content Area</b>	Page
1. <b>Title</b> – The area of focus and “case report” should appear in the title	1
2. <b>Key Words</b> – Two to five key words that identify topics in this case report	1
3. <b>Abstract</b> – (structure or unstructured) <ul style="list-style-type: none"> <li>a. Introduction – What is unique and why is it important?</li> <li>b. The patient’s main concerns and important clinical findings.</li> <li>c. The main diagnoses, interventions, and outcomes.</li> <li>d. Conclusion—What are one or more “take-away” lessons?</li> </ul>	2
4. <b>Introduction</b> – Briefly summarize why this case is unique with medical literature references.	3-4
5. <b>Patient Information</b> <ul style="list-style-type: none"> <li>a. De-identified demographic and other patient information.</li> <li>b. Main concerns and symptoms of the patient.</li> <li>c. Medical, family, and psychosocial history including genetic information.</li> <li>d. Relevant past interventions and their outcomes.</li> </ul>	4-5
6. <b>Clinical Findings</b> – Relevant physical examination (PE) and other clinical findings	6-7
7. <b>Timeline</b> – Relevant data from this episode of care organized as a timeline (figure or table).	27
8. <b>Diagnostic Assessment</b> <ul style="list-style-type: none"> <li>a. Diagnostic methods (PE, laboratory testing, imaging, surveys).</li> <li>b. Diagnostic challenges.</li> <li>c. Diagnostic reasoning including differential diagnosis.</li> <li>d. Prognostic characteristics when applicable.</li> </ul>	8-9
9. <b>Therapeutic Intervention</b> <ul style="list-style-type: none"> <li>a. Types of intervention (pharmacologic, surgical, preventive).</li> <li>b. Administration of intervention (dosage, strength, duration).</li> <li>c. Changes in the interventions with explanations.</li> </ul>	9-11
10. <b>Follow-up and Outcomes</b> <ul style="list-style-type: none"> <li>a. Clinician and patient-assessed outcomes when appropriate.</li> <li>b. Important follow-up diagnostic and other test results.</li> <li>c. Intervention adherence and tolerability (how was this assessed)?</li> <li>d. Adverse and unanticipated events.</li> </ul>	12-13
11. <b>Discussion</b> <ul style="list-style-type: none"> <li>a. Strengths and limitations in your approach to this case.</li> <li>b. Discussion of the relevant medical literature.</li> <li>c. The rationale for your conclusions.</li> <li>d. The primary “take-away” lessons from this case report.</li> </ul>	13-14
12. <b>Patient Perspective</b> – The patient can share their perspective on their case.	5
13. <b>Informed Consent</b> – The patient should give informed consent.	4

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