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Outpatient Rehabilitation for a Post-Operative Thyroid Cancer Patient with Pectoralis Major Flap Reconstruction and Head and Neck Lymphedema: A Case Report

Sara Hahn
University of Iowa

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Sara Hahn

DPT Class of 2018
Department of Physical Therapy & Rehabilitation Science
The University of Iowa

Abstract

Background: Individuals diagnosed with head and neck cancers are often presented with a range of treatment options which may include surgery, chemotherapy, and radiation. For some with advanced cancers, this may include a form of neck dissection surgery followed by a pectoralis major pedicled flap reconstruction (PMPF). Past research has shown that such surgeries may make the individual more likely to experience cervical spine and glenohumeral pain and dysfunction along with head and neck lymphedema. Each of these surgical side effects may be managed with physical therapy rehabilitation, though there is limited research to guide decision-making with these patients. **Case Description:** A thyroid cancer patient presented to physical therapy for cervical spine and glenohumeral pain and limitations as well as head and neck lymphedema after undergoing a radical neck dissection and PMPF. He also underwent chemotherapy and radiation treatments for his cancer prior to and throughout physical therapy. **Intervention:** Progressions from passive, active assisted, active, and active with resistance range of motion (ROM) and strengthening for this patient's cervical spine and glenohumeral joint were implemented. Complete Decongestive Therapy (CDT) was also initiated and maintained in his treatment for lymphedema. **Outcome Measures:** The greatest increases in the patient's active range of motion (AROM) were in glenohumeral flexion, abduction and internal rotation (IR), as well as cervical spine extension and side bending to the surgical side. The patient subjectively described improvement in lymphedema symptoms with CDT. **Discussion:** While neck dissection and PMPF surgeries have been common for head and neck cancer patients, there are known resultant limitations on the cervical spine and glenohumeral joint on the surgical side. However, there is a lack of information or research on best physical therapy interventions for these patients. This case report describes a progression of physical therapy interventions targeting cervical and shoulder pain and dysfunction secondary to radical neck dissection, one of the first of its kind.

Keywords: Head and neck reconstruction; head and neck lymphedema, pectoralis major pedicled flap, neck dissection, orthopedics; physical therapy; rehabilitation

Background

The patient in this case study was selected based upon the unique presentation of repeated thyroid cancer diagnoses resulting in extensive surgical resection and reconstruction of his larynx, pharynx, and neck. These surgical procedures resulted in changes in this patient's active range of motion and the presence of head and neck lymphedema. Research surrounding these surgical interventions established that such occurrences are common and may be expected post-operatively. However, there is currently no literature describing treatment strategies for these patients after these surgical interventions. Therefore, the specific purpose of this report is to detail the physical therapy management of this patient's lymphedema and musculoskeletal limitations post-operatively.

Lymphedema

Lymphedema is a progressive condition involving impaired lymphatic system function and decreased transport of protein-rich lymph fluid, resulting in accumulation of this fluid in some region of the body[1]. Lymphedema may be understood as being either primary or secondary, with secondary referring to lymphedema being the more publicly prevalent of the two[1]. In secondary lymphedema, individuals were not born with the condition, but rather began to experience symptoms after some form of damage to the lymphatic system occurred[1]. Most commonly, this involves a cancer diagnosis and treatment intervention, including surgical excision and/or radiation of some aspect of the individual's lymphatic system, disrupting its normal function[1]. Lymphedema which lasts for more than three months is termed 'chronic,' and may continue to progress with time and inadequate treatment management[1]. This progression can include advancing edema, pain, neurologic symptoms, fibrotic changes to soft tissues in the region, and increased risk and prevalence of infections such as cellulitis[2]. Other additional side effects from chronic lymphedema exist, depending upon the region of the body affected. For individuals suffering from head and neck cancers, these additional side effects may consist of not only cosmetic, but functional challenges such as difficulty breathing, sleeping, eating, and speaking[3]. To date, there exists less research and analysis of management for head and neck lymphedema compared to upper or lower extremity lymphedema[3].

However, it is well-established that the basis of best care relies on early detection and management of lymphedema, including use of Complete Decongestive Therapy or CDT[4]. CDT typically includes Manual Lymphatic Drainage (MLD), use of compression bandages and/or garments, skin care, exercise and education[5]. With the combination of these interventions, the goal is to reduce and redirect the accumulated lymph fluid from the affected region in effort to decrease the risk and occurrence of the previously described negative side effects of chronic lymphedema. Despite the limited research, these interventions have been shown to best manage the symptoms and increase quality of life reports in patients with head and neck lymphedema and thus are the current standard of care[4]. Thus, early detection, education, and CDT are understood as elements of gold-standard care of head and neck lymphedema management[3].

Radical Neck Dissection

In patients with very advanced forms of head and neck cancers, doctors will typically recommend and perform a radical neck dissection, with the goal being to remove all tissues which may contain cancer cells[6]. Radical neck dissection describes the surgical removal of the sternocleidomastoid, internal jugular vein, spinal accessory nerve, submandibular gland and lymph nodes on the side of the neck affected[6]. As all of the removed structures contain or connect to the lymph system, they are sacrificed to try to slow or stop the progression of the advancing cancer. As a result, this surgery has strong implications for the occurrence and increased morbidity from head and neck lymphedema. Additionally, due to the removal of the sternocleidomastoid muscle and spinal accessory nerve, radical neck dissection has also been shown to have negative effects on both cervical and shoulder range of motion and function[7].

Research has been conducted examining the objective and subjective effects of neck dissection surgeries on patients, as well as other compounding variables influencing patient outcomes. It has been

found that individuals who have undergone a neck dissection had lower reports of Health-Related Quality of Life as well as decreased shoulder and cervical strength and active range of motion on the surgical side compared to the non-surgical side[7]. Specifically, it was found that limitations in shoulder flexion range of motion and strength, as well as the ability to reach behind his/her back had the greatest impact on subjective reports of quality of life[7]. Additionally, those individuals who had a prior history of neck dissection surgery, had subsequent chemotherapy and/or radiation therapy to the surgical site had lower quality of life reports for several years after these oncologic interventions[7]. However, for some patients, subsequent treatments may be necessary for reconstruction at the dissection site, further compounding the potential negative effects on the cervical and shoulder musculature.

Pectoralis Major Flap Reconstruction

Pectoralis major is a large, anterior chest wall muscle originating along the clavicle, sternum and upper 6 ribs before inserting onto the intertubercular groove and greater tubercle of the humerus, allowing it to function on the glenohumeral joint. As a result of its action at the glenohumeral joint, changes or damage to this muscle's original attachment sites can influence shoulder function, especially in shoulder flexion, horizontal adduction and internal rotation. The ability to perform these motions has been found to have an impact on an individual's quality of life rating[7].

However, for several decades surgeons have utilized the pectoralis major pedicled flap (PMPF) as a means of reconstruction for patients following head and neck surgeries, including neck dissection[8]. Now, research in patients following PMPF reconstruction is demonstrating negative implications for cervical spine and shoulder girdle musculature and function[8]. Specifically, limitations in shoulder flexion, internal and external rotation motion, as well as decreased shoulder flexion, abduction, and adduction strength was noted[8]. Additionally, the greatest limitation in cervical motion was found to be in extension for individuals treated with a PMPF[8]. The effect of the cervical limitation on motion is found to be further magnified in those individuals who also undergo radiation therapy[8]. Thus, the health and function of both the shoulder and cervical spine must be considered by healthcare practitioners treating patients who have undergone PMPF.

Currently, scientific literature cites potential changes to lymphatic, neurologic, and musculoskeletal system functioning in patients who have undergone head and neck cancer treatment consisting of extensive surgical interventions. However, there exists a lack of information on specific cases and rehabilitation of such patients. Therefore, the purpose of this case report is to describe physical therapy considerations in the management of a patient with advanced thyroid cancer, radical neck dissection, pectoralis major flap reconstruction, head and neck lymphedema and decreased cervical spine and shoulder girdle motion.

Case Description

The patient, here after referred to as Patient X, is a 74-year-old male with a pack-per-day 45-year smoking history, but ceased smoking at the age of 65. Over the course of ten years, he was diagnosed with recurrent thyroid carcinoma, requiring repeated surgical intervention as part of his treatments. Approximately three weeks after his radical neck reconstruction surgery in early 2018, he began physical therapy treatment for resultant head and neck lymphedema, right shoulder and cervical pain, weakness, and decreased range of motion.

Past Medical History

Patient X was first diagnosed with stage III papillary thyroid carcinoma and underwent a total thyroidectomy and subsequent adjuvant radioiodine therapy in 2008. In 2014, Patient X experienced a recurrence of thyroid carcinoma in his right neck and had a surgical resection of the tissue and an additional course of radioiodine ablation. Again in 2016, Patient X experienced a recurrence within the right thyroid lobe bed and underwent a selective right neck dissection and then was started on a course of Sorafenib chemotherapy treatment by a medical oncologist with a reportedly good response to this treatment. However, despite this treatment, an MRI in 2017 revealed a right neck mass again. At that

time, Patient X elected to continue the chemotherapy treatments. Several months later in 2017, a repeat MRI demonstrated the mass had increased in size. A biopsy of the mass was positive for metastatic papillary thyroid carcinoma at which point the oncologist changed the chemotherapy treatment to Lenvatinib. Further diagnostic testing in 2017 revealed the addition of two hypermetabolic supraclavicular lymph nodes, but no other evidence of disease elsewhere. Additionally, the neck tumor began to erode through the skin of the right neck with some purulent drainage.

Medical and Surgical Management

At the beginning of 2018, Patient X underwent a total laryngectomy, partial pharyngectomy, partial cervical esophagectomy, right radical neck dissection, central compartment neck dissection, wide local excision of anterior neck skin, and pectoralis major flap reconstruction. After surgical resection, Patient X began adjuvant concurrent chemoradiation as well as physical therapy. Further CT imaging several months later in 2018 revealed multiple new and enlarged bilateral lung nodules as well as a liver lesion. Biopsy of the liver lesion revealed metastatic anaplastic thyroid carcinoma and he was then started on a new course of chemotherapy (Dabrafenib and Tremetinib). Patient X experienced problematic side effects which temporarily halted his chemotherapy treatment until his side effects had lessened while continuing physical therapy as able. Patient X then experienced a fever after restarting chemotherapy treatment and was hospitalized with pneumonia. After discharge, Patient X continued to battle lingering side effects, resulting in missed physical therapy visits.

Physical Therapy Initial Evaluation

His chief complaints at the time of initial evaluation, approximately 3 weeks after his radical neck dissection surgery, were neck stiffness and right shoulder weakness, and he also described the presence of neck swelling with pressure throughout the day. Patient X also began radiation treatment shortly after the initial physical therapy evaluation. Thus, formal lymphedema treatment was postponed until after radiation had concluded and his skin had sufficiently healed to begin lymphedema management. Table 1 (below) demonstrates objective cervical and glenohumeral range of motion data gathered at Patient X's initial evaluation.

Patient X demonstrated limitations in shoulder flexion and abduction, as would be expected based upon previous research in individuals with neck dissection and PMPF[8,9]. Patient X demonstrated the greatest limitation in right shoulder AROM abduction, aligning with data which indicate that individuals who have both a neck dissection and PMPF reconstruction surgery performed on the ipsilateral side tend to have the greatest deficit in shoulder abduction AROM[9]. Additionally, Patient X had painful and limited cervical AROM in extension, rotation, and side bending, with the left side being most affected. This also correlates with past research in which it was found that patients with neck dissection and PMPF had significantly decreased cervical extension and limited cervical motion overall[9]. Based upon Patient X's initial AROM measurements, his treatment began with exercises targeting cervical and shoulder range of motion progressions.

In addition to Patient X's cervical and shoulder AROM limitations, he also presented with submental lymphedema and was preparing to begin radiation treatment. The submental region has been found to be one of the more common sites for lymphedema with head and neck cancers[3]. As radiation treatments are known to have a potential impact on local skin health, sensation, and edema, Patient X was not initially fitted for or given compressive garments to address this concern at his initial treatment sessions.

Table 1. Patient X's glenohumeral and cervical range of motion and manual muscle test (MMT) measurements at initial evaluation.

Shoulder Motion	Right	Left	Manual Muscle Test (R)
Flexion	110° (painful)	160°	4-/5
Abduction	45° (painful)	170°	--
Internal Rotation	Able to reach upper lumbar spine	Able to reach upper lumbar spine	3+/5
External Rotation	--	--	4+/5
Scaption	--	--	4-/5
Cervical Motion	**Right**	**Left**	**Manual Muscle Test**
Flexion	40°	--	--
Extension	15° (painful)	--	--
Rotation	45°	35° (painful)	--
Side Bending	10° (painful)	10° (painful)	--

Physical Therapy Interventions

Patient X attended physical therapy one to two days per week for roughly two eight-week periods over a period of five months. Treatment initially focused on a progression for increased active range of motion (AROM) exercises for his rotator cuff and scapular muscles. The patient was instructed to work on a home exercise program (HEP) once per day in addition to the therapy session exercises to maximize improvement. The interventions for Patient X were progressed as tolerated, as outlined in Table 2. Light strengthening was added progressively, using elastic Theraband. Gradually the resistance was increased and Proprioceptive Neuromuscular Facilitation diagonal patterns (D1 and D2) were added to address his muscles' ability to stabilize and function outside of single coordinate movement planes.

Manual scar mobilization was added at the second visit and progressed as he was able to tolerate throughout his radiation treatments. This was part of the management and assessment of Patient X's head and neck lymphedema throughout his physical therapy treatments. In addition, after his radiation treatments had concluded and his skin was sufficiently healed (approximately 3 months after beginning physical therapy treatments), he was measured for a compressive garment. This garment was mailed to Patient X, along with instructions for its wear time, instructing that it should never be painful. Such garments are an important component in CDT, and was begun for Patient X when it was most appropriate in the progression of his overall cancer treatment and skin health. Patient X reported subjective improvements in his lymphedema symptoms while self-managing its progression.

Table 2. Treatment interventions and home exercise programs with each physical therapy visit.

Visit	Treatment	Home Exercise Program (HEP)
1	• Supine shoulder passive ROM • Cervical active ROM • Patient education: exam findings and plan of care • Educated patient on lymphedema and its management	• Supine bilateral cervical rotation, 10x10 sec holds • Supine AAROM right shoulder flexion with cane, 10x10 sec holds • Supine AAROM of right shoulder abduction with cane, 10x10 sec holds
2	• Passive ROM of right shoulder flexion and abduction without holding at end-range, x5 min • Scar and soft tissue mobilizations: along R lateral neck incision with manual tacking of clavicle. Patient performed active ROM left cervical rotation with 10 sec holds and manual tacking • Patient education for manual tacking with cervical rotation • Active ROM bilateral cervical rotation with 10 sec holds	• Self-manual tacking of clavicle in place while performing left cervical rotation, 10x10 sec holds
3	• Supine shoulder flexion with yellow Theraband, 2x10 • Seated bilateral shoulder external rotation (ER) with green Theraband, 2x10 • Standing internal rotation (IR) with yellow Theraband, 2x10 • Scar mobilization along R lateral neck incision x10 min	• Supine shoulder flexion with yellow Theraband, 2x10 • Seated bilateral shoulder external rotation (ER) with green Theraband, 2x10 • Standing internal rotation (IR) with yellow Theraband, 2x10
4	• Supine passive ROM of right shoulder in flexion, abduction, Scaption, and ER at 90 deg of abduction x5 min • Side lying active ROM of right shoulder abduction, 2x10 with tactile cues for scapular stabilization • Side lying active ROM of right shoulder ER 2x15 with tactile cues for scapular stabilization • Supine PNF of right shoulder D2 flexion/extension with AAROM-AROM and manual resistance x10	**--**
5	• Seated flexion/abduction pulleys x5 min prior to strengthening exercises and x3 min after strengthening for joint ROM • Standing bilateral shoulder rows with green Theraband 2x10 • Standing right shoulder ER with arms at 60 deg abduction and red Theraband, 2x10 • Right shoulder horizontal abduction with hands on wall and red Theraband around wrists, 2x10	--

Visit	Treatment	Home Exercise Program (HEP)
6	• Seated flexion/abduction pulleys x5 min prior to strengthening exercises • Seated bilateral shoulder horizontal abduction with red Theraband x10 • Standing bilateral shoulder horizontal abduction in diagonal pattern, x20 each direction • Standing scapular stabilization with ball on wall: up/down, side-to-side, and clockwise/counter-clockwise, x10 each direction	--
Missed appointments due to hospitalization for pneumonia		
7	• Seated flexion/abduction pulleys x5 min prior to strengthening exercises • Standing PNF D1 and D2 patterns with red Theraband, x10 each direction	
8	• Seated flexion/abduction pulleys x5 min prior to strengthening exercises • Right shoulder overhead press with 4 pounds, 3x10 • Right shoulder Scaption with 3 pounds, 2x10 • Bilateral shoulder horizontal abduction with green Theraband, 2x10 • Measured for and ordered patient's compression garment for submental swelling	• Patient will receive his compression garment, foam, and instructions on wear time in the mail
9	• Fitted patient with dense foam for patient to alternate use with soft, grey foam to assist with lymphatic drainage • Reviewed HEP and its importance for continued strengthening	--
~6 weeks passed - Patient diagnosed with metastatic anaplastic thyroid carcinoma		
10	• **Re-evaluation:** AROM re-assessed (see Table 3) • PROM R shoulder flexion and abduction for joint nutrition x5 min • Supine R AROM shoulder abduction, 2x10 • AROM R shoulder IR/ER with arm at 90 deg of abduction, 2x10 • Supine R shoulder serratus anterior ceiling punches, 2x15	• Serratus anterior ceiling punches, 2x10 • Supine AROM shoulder flexion, abduction, and IR/ER with arm at 90 deg abduction, 2x10 each

Visit	Treatment	Home Exercise Program (HEP)
11	• Supine abduction with yellow Theraband x10 • Supine D2 PNF diagonal pattern with yellow Theraband, x10 • Standing D2 PNF diagonal pattern with yellow Theraband, x10 • Swiss ball R scapular strengthening program: Scaption x5, horizontal abduction attempted but increased pain • Scapular retractions, x10 • Supine D2 PNF pattern in PROM-AAROM-AROM with manual resistance x3 min • Supine rhythmic stabilization at 90 deg and 120 deg shoulder abduction, 2x30 sec each	• Scapular retractions, 2x10
Patient re-hospitalized for pneumonia		
12	• Supine R shoulder PROM, progressing abduction to ~170 deg • Supine D2 PNF pattern in PROM-AAROM-AROM with manual resistance x3 min • Supine shoulder abduction with yellow Theraband, 2x10 • Supine D2 PNF diagonal with yellow Theraband, 2x10 • Seated IR/ER with red Theraband and arm resting on tabletop at 90 deg shoulder abduction, 2x10 each	
Patient frequently ill and unable to attend Physical Therapy.		

Outcomes

Table 3 (below) shows Patient X's shoulder and cervical AROM and strength testing measurements at the 10th visit, which was approximately four months after his initial visit. These values can be compared to his initial values (Table 1). While this case only covers the first five months that Patient X was being treated by physical therapy, there were marked increases in both cervical and shoulder AROM. Patient X had improvements in nearly all recorded measurements for both his cervical and shoulder AROM. The greatest gains in AROM were seen in his shoulder flexion, shoulder abduction, and cervical extension, as indicated in Table 4.

The patient had a complex and variable progression in part due to the medical complications associated with chemotherapy, radiation treatment, and the large surgical reconstruction he underwent. He developed pneumonia twice, requiring hospitalization. Despite these challenges and numerous set backs, progress was observed overall. Additionally, Patient X subjectively reported improvements in strength, AROM, and lymphedema with physical therapy interventions.

Table 3. Patient X's glenohumeral and cervical range of motion and manual muscle test (MMT) measurements at his 10th physical therapy visit (~4 months after initial evaluation)

Shoulder Motion	Right AROM	Right PROM	Manual Muscle Test (R)
Flexion	143° (painful)	150°	4/5 (pain)
Abduction	68° (painful)	150°	--
Internal Rotation	Able to reach T7	--	--
External Rotation	--	--	4+/5 (pain)
Scaption	--	--	4-/5 (pain)
Cervical Motion	**Right**	**Left**	**MMT**
Flexion	34°	--	--
Extension	45°	--	--
Rotation	32°	32° (painful)	--
Side Bending	22°	11° (painful)	--

Table 4. Changes in Patient X's glenohumeral and cervical range of motion from initial evaluation to his 10th visit (~4 months after initial evaluation).

Shoulder Motion	Right AROM	--
Flexion	+33°	--
Abduction	+23°	--
Internal Rotation	Able to reach 4-5 vertebrae higher	--
External Rotation	--	--
Scaption	--	--
Cervical Motion	**Right**	**Left**
Flexion	-6°	--
Extension	+30°	--
Rotation	-13°	-3°
Side Bending	+12°	+1°

Discussion

Currently, there is limited research detailing best physical therapy management practices for patients who have undergone a neck dissection and PMPF reconstruction surgeries. As previously described, the present data can detail the most common limitations in AROM and function that these patients may experience and how best to quantify these changes. However, there are no other case reports or prior studies relating intervention strategies to target these limitations. As such, it is difficult to predict objective and subjective final outcomes for such patients as there is a lack of literature documenting what influence physical therapy interventions may have.

The physical therapy management of this patient addressed Patient X's musculoskeletal limitations as well as his head and neck lymphedema symptoms. To begin, this included targeting increases in glenohumeral passive range of motion with progression to active assisted range of motion with use of pulleys. As his pain-free passive and active assisted range of motion increased, active and active with resistance motions were added to his treatment and home exercise programs. This is meant to be a progression towards increased practical function for Patient X, building toward strengthening through an increased shoulder active range of motion as is required for many activities of daily living. This shoulder strengthening often began with Patient X supine to reduce some of the effects of gravity until he had sufficient strength, control, and decreased pain for seated or standing strengthening. These

progressions can be used as markers to demonstrate decreasing pain and increasing function in Patient X's glenohumeral joint with time in physical therapy.

Patient X's head and neck lymphedema care utilized the current gold-standard practice of Complete Decongestive Therapy (CDT). Patient X was educated on skin care, especially during and after radiation therapy. When his skin was healed from radiation, Patient X was fitted for a compression garment. Patient X was also taught self-mobilization for his incisional scar as part of his manual lymphatic drainage. Finally, Patient X performed AROM cervical motion along with exercise progressions for his affected shoulder. Patient X subjectively reported improvement in his lymphedema symptom burden with physical therapy interventions. This patient was also able be treated by a Certified Lymphedema Therapist at this site, and so his lymphedema could be recognized, assessed and treated soon after his surgical interventions. This early detection is an additional aspect of best treatment for all forms of lymphedema, allowing the treating therapist greater chance of slowing the progression of the disease with proper management.

Limitations

There are additional functional measurement tools to further objectively quantify limitations and quality of life ratings for various patient populations that could have been used for this patient. Table 5 lists several quality of life assessment questionnaires that may be most appropriate for use with head and neck cancer, neck dissection, and PMPF populations. These measures allow practitioners to better document the impact that shoulder or neck pain may be having on a patient's function, and how this impact changes with time and interventions. This, combined with strength and ROM measurements over time can be used to quantify and qualify the impact that the patient experiences prior to, during, and after physical therapy interventions.

Table 5. Quality of life and disability assessments used in head and neck cancer, neck dissection, and pectoralis major pedicled flap reconstruction patients.

Head and Neck Cancer[10]	Neck Dissection Surgery[7]	PMPF Reconstruction Patients[8,9]
University of Washington Quality of Life scale (UWQOL)	Neck Dissection Impairment Index	Shoulder Pain and Disability Index (SPADI)
Functional Assessment of Cancer Treatment (FACT)	Neck Disability Index (NDI)	Neck Disability Index (NDI)
Functional Assessment of Cancer Therapy Additional Concerns for Head and Neck (FACT-HN)	Quick Disabilities of the Arm, Shoulder, Hand, and Neck Disability Index (Quick DASH)	Shoulder Disability Questionnaire
Performance Status Scale for Head and Neck (PSS-HN)	--	--
Activities of Daily Living (ADL) questionnaire	--	--

Steps to better objectively quantify Patient X's symptoms, limitations, and strength could have been utilized for more detailed progress with physical therapy interventions over time. As previously described, there are a variety of quality of life assessments that could have been used with Patient X to denote the extent his symptoms affected his symptoms and functional disability, though with this patient none were. Additionally, a handheld dynamometer could provide a more specific and objective means of recording Patient X's glenohumeral and cervical strength throughout his treatment. Similarly, formal circumferential measurements of Patient X's face, head, and neck could have been used to better document lymphedema changes with physical therapy intervention.

Conclusion

This case reports describes the approach to treatment for a complex patient, for which there is very little evidence available in the literature to drive physical therapy decision-making. This patient, while experiencing several set-backs and complications, demonstrated notable progress in both cervical spine and glenohumeral active range of motion. This case suggests that progressions in joint of range of motion, strengthening and proprioceptive training can benefit neck dissection and PMPF patients. However, the extent of the strength and range of motion increases is not fully known from this report, nor are the long-term outcomes as his physical therapy care continued beyond the data collection period of this case report. Nonetheless, it supports the role of physical therapy in post-surgical rehabilitation to address joint, soft tissue, and lymphatic changes for patients following complex head and neck reconstruction.

References

1. Tiwari, P., Coriddi, M., Salani, R., & Povoski, S. P. (2013). Breast and gynecologic cancer-related extremity lymphedema: a review of diagnostic modalities and management options. *World journal of surgical oncology*, *11*, 237. doi:10.1186/1477-7819-11-237
2. Lawenda, B. D., Mondry, T. E. and Johnstone, P. A. (2009), Lymphedema: A primer on the identification and management of a chronic condition in oncologic treatment. CA: A Cancer Journal for Clinicians, 59: 8-24. doi:10.3322/caac.20001
3. Smith, B. G., Hutcheson, K. A., Little, L. G., Skoracki, R. J., Rosenthal, D. I., Lai, S. Y., & Lewin, J. S. (2015). Lymphedema outcomes in patients with head and neck cancer. *Otolaryngology--head and neck surgery: official journal of American Academy of Otolaryngology-Head and Neck Surgery*, *152*(2), 284-291.
4. Nettles MK, Pishgou M, Solares CA, et al. Head and neck lymphedema: Reducing a growing problem. *International journal of radiation oncology, biology, physics*. 2016; 96(2): E507. doi: 10.1016/j.ijrobp.2016.06.1899
5. Smith, B. G., & Lewin, J. S. (2010). Lymphedema management in head and neck cancer. *Current opinion in otolaryngology & head and neck surgery*, *18*(3), 153-8.
6. Vasan N, Joshi A. *Neck Dissection*. American Head & Neck Society. https://www.ahns.info/neck-dissection/. Published January 22, 2016. Accessed November 29, 2018.
7. Gane E, McPhail S, Hatton A, Panizza B, O'Leary S. The relationship between physical impairments, quality of life and disability of the neck and upper limb in patients following neck dissection. *Journal of Cancer Survivorship*. May 2018. doi:10.1007/s11764-018-0697-5
8. Moukarbel R, Fung K, Franklin J, Leung A, Rastogi R. Neck and shoulder disability following reconstruction with the pectoralis major pedicled flap. *The laryngoscope*. 2010;120. doi: 10.1002/lary.20900
9. Refos J, Witte B, de Goede C, de Bree R. Shoulder morbidity after pectoralis major flap reconstruction. *Head & neck*. 2016; 38(8). doi:10.1002/HED
10. Eickmeyer, S. M., Walczak, C. K., Myers, K. B., Lindstrom, D. R., Layde, P., & Campbell, B. H. (2014). Quality of life, shoulder range of motion, and spinal accessory nerve status in 5-year survivors of head and neck cancer. *PM & R : the journal of injury, function, and rehabilitation*, *6*(12), 1073-80.