

CASE REPORT

The Use of Mobilization, Muscle Energy Technique, and Soft Tissue Mobilization Following a Modified Radical Neck Dissection of a Patient with Head and Neck Cancer

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ABSTRACT

Background and Purpose: A surgical procedure commonly performed for many patients with head and neck cancer is a modified radical neck dissection. The use of therapeutic intervention postoperatively has been shown to be beneficial; however, documented use of manual therapy techniques (ie, mobilization, muscle energy technique (MET), and soft tissue mobilization) in these cases is limited. The purpose of this case report is to describe and demonstrate the benefits of using manual therapy techniques following a modified radical neck dissection of a patient with head and neck cancer. **Case Description:** A 49-year-old man completed 3 weeks of physical therapy following a modified radical neck dissection due to head and neck cancer. The patient reported pain, decreased cervical mobility, and function at baseline. **Outcomes:** The patient experienced a 12 point reduction in the Neck Disability Index at discharge and 30 point reduction at 4 month follow-up. Subjective pain levels improved from 3/10 to 0/10. Cervical mobility increased by 7°-20° in most ranges and strength of scapular muscles improved from 4+/5 to 5/5. The patient was able to return to work without limitation. **Discussion:** The patient described in this case report experienced less pain and improved physical function and outcome measure scores after intervention and 4 month follow-up. Manual therapy techniques such as joint mobilization, muscle energy technique, and soft tissue mobilization were safely and effectively applied to this patient with head and neck cancer. Randomized controlled clinical trials are needed to evaluate the efficacy of these manual interventions following a modified radical neck dissection of a patient with head and neck cancer.

Key Words: head and neck cancer, mobilization, modified radical neck dissection, cervical spine

BACKGROUND AND PURPOSE

A surgical procedure commonly performed for many patients with head and neck cancer is a modified radical neck dissection.¹ This procedure enables the surgeon to identify and safely remove all tissues infiltrated by cancer cells. Modification from the more aggressive radical dissection is meant to preserve tissue structures such as the cutaneous and spinal accessory nerves, internal jugular veins, and sternocleidomastoid muscles yielding fewer postoperative complications and/or limitations.² Some of these may

include, but are not limited to, local lymphedema, injury to the spinal accessory nerve, impaired dermal sensation, diminished mobility, and soft tissue fibrosis.

A referral for physical therapy can be made following this procedure to assist the patient in regaining mobility, strength, and function. The use of therapeutic intervention postoperatively has been shown to be beneficial;³⁻⁶ however, documented use of manual therapy techniques (ie, mobilization, muscle energy technique (MET), and soft tissue mobilization) in these cases is limited. While the use of manual therapy has been shown to effectively improve mobility and soft tissue extensibility in various patient populations,⁷⁻¹³ it has often been overlooked as a viable choice of treatment option in patients with cancer. Reluctance to perform manual maneuvers in cases involving cancer, especially when active and/or malignant, is understandable and remains contraindicative. An enhanced physiologic response resulting in the possibilities of increased metabolic activity, metastases, or pathologic fracture has always been of concern.¹⁴⁻¹⁷ In situations, however, where cancer is inactive or no longer present, manual therapy techniques may prove as a valuable adjunct to other traditional physical therapeutic interventions. The purpose of this case report is to describe and demonstrate the benefits of using manual therapy techniques following a modified radical neck dissection of a patient with head and neck cancer.

CASE DESCRIPTION

Patient History and Systems Review

The patient was a 49-year-old man who had undergone a left, type three modified radical neck dissection and left pleural tonsillectomy for stage III squamous cell carcinoma 26 days prior to his initial physical therapy visit. During this type three dissection, the patient's spinal accessory nerve, sternocleidomastoid muscle, and internal jugular vein were spared while multiple metastatic nodes in the left neck were aggressively resected.² Submental and submandibular soft tissues including several suspicious nodes were incorporated as well as a significant portion of the submandibular gland. Margins of the surrounding resected fields were confirmed as benign after careful specimen examination by the hospital's pathology laboratory.

Following the surgery, the patient was referred to outpatient physical therapy to regain mobility, strength, and function before

starting chemotherapy and radiation therapy. His past medical history was unremarkable while his surgical history included a left pedal cystectomy and repair of his left fourth finger tendon, both performed in his early years. Current medications included Percocet and Tylenol taken infrequently and only as needed.

The patient's chief complaint was decreased cervical mobility and flexibility. He admitted only to mild pain and noted functional limitations in heavy lifting, driving, sleeping, and recreation. He was on sick leave for the past month that was expected to continue through his chemotherapy and radiation therapy. His concentration and ability to perform tasks as a mechanical engineer was only slightly affected. The patient's goals at the time of evaluation were to decrease neck pain, increase neck mobility, increase neck function, and perform all job related tasks as a mechanical engineer. The clinical impression of this patient was consistent with symptoms following a surgical procedure of this type. His outlook and youthful age, lack of co-morbidities, and willingness to participate in a rehabilitative program also contributed positively to his favorable prognosis. Given his current status, he was expected to tolerate well a full orthopedic assessment of his involved regions with an appropriate neurologic screen.

Examination

The patient presented with forward head and neck position, left subcranial lateral flexion, and anterior elevation of both shoulder girdles. He experienced pain ranging from 3/10 with exacerbation of symptoms to 0/10 in a non-exacerbated state. Exacerbation of pain was most associated during cervical rotation, with full pain relief, once a neutral position was reassumed. It was, therefore, determined that the patient's irritability level was minimal.¹⁸ The outcome measure used for the patient was the Neck Disability Index (NDI). It is a self-rating tool consisting of 10 items each scored from 0-5 out of a possible 50. The scoring intervals for interpretation are as follows: 0-4 no disability, 5-14 mild, 15-24 moderate, 25-34 severe, and above 34 complete. This measurement tool has been shown to be reliable, valid, and responsive in populations with neck pain and dysfunction.¹⁹ Soft tissue and myofascial hypomobility were observed with direct palpation of the scar and left mid cervical line, left scalenes, sternocleidomastoid, upper trapezius, posterior subcranial muscles, and the left posterior lingual root of the tongue. The scar, located along the left mid antero-lateral aspect of the neck, was fully closed and healthy in its appearance. Table 1 includes initial, final, and 4 month follow-up measurements of shoulder, cervical, and temporomandibular active range of motion (AROM). Active range of shoulder, cervical, and temporomandibular motion was measured using a standard goniometer, inclinometer, and a standard ruler, respectively, as described by Clarkson.²⁰ All measurements were performed in a seated position except cervical rotation. This was measured in a supine position to more easily stabilize the single inclinometer against the patient's forehead. Limitations were noted in cervical ranges in all planes while both shoulder and temporomandibular joints measured within normal limits. Cervical extension and rotation measurements were taken with open and closed mouth positions to assess the possible impact of postoperative scarring and surrounding soft tissue extensibility limitation. Observation of tongue mobility was also assessed. The patient was able to thrust his tongue forward and fully deviate to the left from midline, but was unable to devi-

ate right. This limitation was noted by the patient to negatively impact activities of both daily and nightly living. Manual muscle testing (MMT) was performed on the trapezius muscles according to procedures described by Kendall, McCreary, Provance, Rogers, and Romani during the initial evaluation, discharge, and 4 month follow-up.²¹

Table 1. Initial Examination and Reassessment Data (*limited by pain)

Physical Examination	Initial Evaluation	Discharge (8 visits)	Four Month Follow-up
Left Neck Pain	3/10	0-1/10	0/10
Neck Disability Index	30	18	0
ROM(°):			
<u>Shoulders</u>	Normal ROM	Normal ROM	Normal ROM
<u>Temporomandibular</u>	Normal ROM	Normal ROM	Normal ROM
<u>Cervical Spine</u>			
Flexion	0-65	0-65	0-68
Left Lateral Flexion	0-38	0-45	0-40
Right Lateral Flexion	0-25*	0-35	0-42
Left Rotation Closed Mouth	0-85*	0-80	0-82
Left Rotation Open Mouth	0-85*	0-80	0-82
Right Rotation Closed Mouth	0-65*	0-80	0-78
Right Rotation Open Mouth	0-70*	0-80	0-80
Extension Closed Mouth	0-25*	0-40	0-36
Extension Open Mouth	0-40*	0-55	0-60
MMT (grade 5):			
<u>Scapular Muscles</u>			
Upper Trapezius	4+/5	5/5	5/5
Middle Trapezius	4+/5	5/5	5/5
Lower Trapezius	4+/5	5/5	5/5

Flexibility of the regional postural muscle was evaluated using muscle length testing techniques described by Kendall, McCreary, Provance, Rogers, and Romani.²¹ Muscle tightness was determined in the left scalenes, sternocleidomastoid, upper trapezius, and posterior subcranial muscles as compared to the right. Sensory testing was performed and revealed diminished sensation to both sharp and soft touch along the patient's left anterior neck and supraclavicular region. Left upper extremity reflexes (ie, biceps brachii, brachioradialis, and triceps) were weak (+1) compared to a brisk, strong response on the right (+2).

Vigilance against negative complications from treatment was monitored through the recorded vitals of weight, body temperature, blood pressure, and oxygen saturation.²² Any adverse change in these constitutional values would have warranted immediate consult with the referring oncologist. Recorded values are provided in Table 2.

Table 2. Recorded Vitals

	Initial Evaluation	Visit 4	Discharge Visit 8
Weight (kg)	82.1	83.55	84.05
Temperature (C°)	36.11	36.78	36.22
Blood Pressure (mm HG)	119/76	115/78	110/68
O ₂ Saturation (%)	97	94	98

Clinical Impression

After referencing the *Guide to Physical Therapist Practice*,²³ it was determined the preferred practice pattern for this patient was Musculoskeletal: Impaired Joint Mobility, Motor Function, Muscle Performance, and Range of Motion Associated with Bony or Soft Tissue Surgery (4-I). This decision was based upon both the pertinent medical history and clinical findings listed in Table 1. His postsurgical status had left him with a treatable peripheral nociceptive mechanism of pain without further central sensitization or irritability. Clinical reasoning supported the use of manual therapy techniques for assisting this individual in returning to his prior level of function.²⁴ While fatigued and genuinely concerned about his medical prognosis, he maintained a positive attitude and continued to engage in as many home and family activities as possibly able. He felt comforted by his family's support and guidance from his team of health care providers.

Intervention

The patient was seen for a total of 8 visits over a 3 week period for physical therapy intervention. Interventions for his plan of care included: external/intra-oral soft tissue mobilization, graded joint mobilization, muscle energy technique, progressive resistive exercise training, and patient education for postural alignment.

Soft Tissue Mobilization

External soft tissue mobilization was applied to the left antero-lateral structures of the neck and postero-lateral structures of the left subcranial region.²⁵ Initial contact in both regions was broad and superficial. This was progressed accordingly to a deeper, perpendicular application in order to more appropriately address the various soft tissue fibrosis and bony contour attachments. This progression of techniques was directed by continuous patient feedback. Manual muscle lengthening was performed using contract-relax principles described by Ylinen, to the left scalenes, sternocleidomastoid, upper trapezius, and posterior subcranial muscles.²⁶ Each muscle lengthening procedure was performed while the patient was supine. The individual muscles were placed at a comfortable length using verbal feedback provided by the patient. The patient was then asked to contract the lengthened muscle against manual resistance for 5 seconds followed by relaxation, and finally, further lengthening. This sequence was repeated 3 to 5 times per muscle.

Intra-oral soft tissue mobilization was performed in the area of the left posterior lingual root of the tongue and its surrounding structures.²⁵ A transverse friction technique, as described by

Cyriax,²⁷ was applied to the area of greatest soft tissue restriction. Sustained pressure techniques to the same area were assisted with active lingual movement into right lateral deviation performed by the patient. Vinyl gloves were worn by the therapist to help maintain proper hygiene and minimize risk of infection.

Mobilization and Muscle Energy Technique

Grade III and IV mobilizations and muscle energy techniques were used either separately, or in combination, to assist in the restoration of mobility where limited.^{18,28} Each technique was performed while the patient lay comfortably in supine. Manual mobilization was applied through the left posterior articular pillars of the mid and lower cervical vertebrae in order to increase right rotation. Contact along the left posterior articular pillars was made through the lateral aspect of the therapist's second metacarpophalangeal joint. Appropriate posterior to anterior force was directed along the left zygapophyseal joint plane of the cervical segment to enhance right rotation. Manual mobilization was also applied to the right lateral aspect of the mid and lower cervical vertebrae in order to increase right lateral flexion. Contact along the vertebral lateral borders was made through lateral aspect of the therapist's second metacarpophalangeal joint. Appropriate transverse force was then imparted toward the left to enhance right lateral flexion. In both techniques, the head was supported using a traditional chin cradle grip for technique ease and patient comfort (Figure 1). The choice to use graded mobilizations of III and IV, as described by Maitland,¹⁸ was determined based on the low irritability and stiff dominance of the patient. Initial mobilizations were dosed at 3 bouts of 30 second intervals and progressed according to patient response.

Muscle energy technique, as described by Greenman,²⁸ was used toward the end range of newly acquired motion after mobilization. This was accomplished by instructing the patient to perform contralateral rotation and/or lateral flexion for approximately 5 seconds against an unyielding resistance imparted by the therapist. After the isometric contraction was completed, and relaxation of the muscle tissues had occurred, the patient was taken further into his range of limitation. Continuous feedback was ascertained from the patient with each technique's application to ensure localization and appropriateness of force.²⁹ Initial METs were dosed at 3 to 5 repetitions and progressed according to patient response.

Therapeutic Exercise

The patient performed resistance exercise in the clinic under the therapist's direct supervision, and as part of his home program. The primary goal was to restore strength and function to his mid and lower trapezius muscles. The initial strength training consisted of resisted seated rows and dumbbell exercises (flexion, scaption, abduction) for the shoulders. Resisted short bar pull downs were added later to target the lower trapezius muscles. Appropriate resistance for each exercise was determined based on the patient's ability to fully perform 10 repetitions with mild fatigue. Each exercise was performed at a dosage of 2 sets of 10 repetitions with one minute rest period between sets. All exercises were progressed in both resistance and repetitions as tolerated by the patient.



Figure 1. Mobilization to enhance rotation (left) and lateral flexion (right).

Patient Education

A home exercise program was provided on the first day of intervention. The patient was asked to perform active stretches for the left antero-lateral musculature and soft tissues. He was instructed to manually depress his left clavicle as he rotated, laterally flexed, and extended his head and neck to the right. The position was held for 10 seconds and was performed for 5 repetitions. He was to perform this at least 3 times daily and especially during exacerbations of muscle stiffness.

Postural re-education was also provided to assist in decreasing his forward head and elevated shoulder girdles. The importance of relaxation, postural adjustment, teeth/tongue/lip position, and breathing (RPTTLB) was emphasized for proper balance of the upper quarter structures.³⁰ It was suggested he practice his realignment exercises in front of a mirror for visual feedback.

OUTCOME

Table 1 shows the results of tests and measures administered at initial evaluation, discharge, and 4 months after his discharge. A mutual decision for discharge after 8 visits was agreed upon due to the approaching commencement of chemotherapy and radiation. The patient was satisfied with his current status and wanted to focus on his upcoming treatments. Throughout intervention and 4 month follow-up, the patient experienced decreased levels of pain from 3/10 to 0/10. The NDI measurement and calculation revealed scores reflecting diminished levels in functional limitation from 30 to 18, and finally to 0. The patient regained full capacity for personal care, lifting, reading, driving, and recreation where, at initial evaluation, his scores implicated moderate to severe limitation.

Measurable improvement in active cervical mobility was also observed during his care. All ranges initially associated with painful end ranges were, at discharge and follow-up, able to be performed without pain. While gains (7°-15°) were made in most ranges, only open mouth extension at the 4 month follow-up (20°) was determined as being significant. This is based on research suggesting changes in cervical mobility are to be considered significant only when exceeding 15° in accordance with accepted range values for measurement error.³¹

Strength of the trapezii also showed improvement after manual muscle testing from 4+/5 to 5/5. The patient was able to perform all household tasks and recreational activities without complication.

Table 2 shows the recorded vitals at initial evaluation, visit 4, and discharge. No significant changes in weight, body temperature, blood pressure, or oxygen saturation were noted. This was interpreted as indicating the absence of any active metabolic process or infection.²²

The patient had also resumed full duties at work. He had expressed no loss of concentration or lack in job performance as a result of his oncologic care. The patient unfortunately required placement of a percutaneous endoscopic gastrostomy (PEG) tube due to the anticipated difficulty of eating following his radiation therapy. The PEG tube had not been removed because of his difficulty in regaining his pre-chemo/radiation therapy weight. It is not uncommon for weight loss to occur during both therapies but consideration for proper nutrition and sustenance must be maintained.³² The PEG tube will be used until he is able to demonstrate a maintained weight increase through oral consumption.

DISCUSSION

In this case report, a patient was referred to physical therapy presenting with pain, limited mobility, strength, and function following a modified radical neck dissection due to head and neck cancer. After careful evaluation, a plan of care was developed that incorporated the use of manual therapy techniques to decrease pain and increase mobility, strength, and function of this patient. Joint mobilization, MET, and soft tissue mobilization were applied using sound clinical reasoning coupled with a basic understanding of cancer pathology in conjunction with other traditional forms of physical therapy with a positive outcome. Traditional physical therapy interventions including the use of both active and passive range of motion exercises with resistive training have been shown to provide good outcomes for patients with head and neck cancer.³⁻⁵ Applications of scapular taping and soft tissue mobilization have also proved beneficial in this patient population.⁶

The manual therapy techniques used in this case report were chosen based on findings in supportive literature.⁷⁻¹³ Soft tissue mobilization was chosen due to its reported ability to reduce pain and increase tissue extensibility.^{11,25,26} Suggested physiologic benefits include aiding in the removal of pain mediators, tissue revascularization, and easing of muscle guarding.^{12,13,25} The combination of both superficial and deep tissue techniques were used externally with these goals in mind. While a direct cause and effect correlation cannot be inferred, the author believes the selected soft tissue techniques assisted in minimizing the

recorded variance in open mouth versus closed mouth mobility measurements at discharge.

Transverse friction massage was applied intra-orally to the left lingual tongue root. It has been shown to minimize the approximation and cross-linking of collagen tissue throughout the proliferative and remodeling phases of tissue repair.^{25,27,33-36} At discharge and 4 month follow-up, the patient was observably able to thrust his tongue forward and equally deviate left and right.

Grade III and IV mobilizations were implemented to assist in mobility restoration where limited. Literature suggests mobilization can reduce pain, increase range of motion, and restore normal arthrokinematic motion of the cervical spine.^{18,37-39} Enhancement of passive physiologic motions with mobilization was used to address the patient's loss of right cervical rotation and right lateral flexion. At discharge and 4 month follow-up, measurable gains of cervical mobility were present.

Muscle energy technique was also used in this case report. Like mobilization, it too has been shown to reduce pain, increase range of motion, and normalize arthrokinematic motion of the cervical spine.^{9,10,28,40} Application of MET at the range of mobility limitation was applied to enhance both right rotation and right lateral flexion. In this case study, measurable gains in mobility were evident at both discharge and 4 month follow-up.

This case report sought to illustrate how manual therapy may prove a valuable adjunct to traditional physical therapeutic interventions when treating a unique patient as the one described. It is not uncommon for a therapist to become reluctant in applying safe and effective manual therapy techniques when treating a patient with cancer. As noted previously, prudent judgment against harmful interventions in situations of active and/or malignant cancers should always be exercised. However, in cases where the cancer has been completely eradicated through surgery, appropriate manual therapy techniques may be helpful in aiding and enhancing the patient's recovery. The therapist can further limit the concern of negative complications by monitoring the patient's vitals for any constitutional changes.

Current literature already demonstrates benefits through the use of physical therapy for this patient population; however, new research is needed in a larger, controlled design to further determine a true cause and effect relation between or among the chosen interventions presented. While the subject of this case report has nearly returned to his prior level of function, the author is limited in suggesting the patient has done so solely as a direct result of the manual therapy interventions he received.

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