A multimodal physical therapy approach to the management of a patient with temporomandibular dysfunction and head and neck lymphedema: a case report

Patricia Crane, Lauren Feinberg, John Morris

MossRehab at Castor, Philadelphia, PA, USA

Objective and importance: There is a paucity of research that investigates therapeutic interventions of patients with concurrent head and neck lymphedema and temporomandibular dysfunction (TMD). The purpose of this case report is to describe the management and outcomes of a patient with head and neck lymphedema and TMD using a multimodal physical therapy approach.

Clinical presentation: A 74-year-old male with a past medical history of head and neck lymphedema and TMD was referred to physical therapy with chief complaints of inability to open his mouth in order to eat solid food, increased neck lymphedema, temporomandibular joint pain, and inability to speak for prolonged periods of time.

Interventions: The patient was treated for three visits over 4 weeks. Treatment included complete decongestive therapy (CDT), manual therapy, therapeutic exercise, and a home exercise program. Upon discharge, the patient had improved mandibular depression, decreased head and neck lymphedema, improved deep neck flexor endurance, decreased pain, and improved function on the Patient Specific Functional Scale (PSFS).

Conclusion: Utilization of a multimodal physical therapy approach to treat a patient with a complex presentation yielded positive outcomes. Further research on outcomes and treatment approaches in patients with TMD and head and neck lymphedema is warranted.

Keywords: Head and neck lymphedema, Temporomandibular dysfunction, Physical therapy, Manual therapy

Background

Lymphedema is defined as the abnormal accumulation of protein-rich fluid due to alterations of the lymphatic system that results in tissue fibrosis.¹ Secondary head and neck lymphedema is commonly found in head and neck cancer survivors due to the disruption of the lymphatics that commonly occurs following radiation, chemotherapy or surgery.^{2,3} It is reported that 45.7% of head and neck cancer survivors in the United States develop some form of external head and neck lymphedema.⁴ Treatment for head and neck lymphedema is complete decongestive therapy (CDT) consisting of meticulous skin care, manual lymph drainage (MLD), compression therapy, and active exercise.⁵

Temporomandibular disorder (TMD) is a musculoskeletal disorder within the masticatory system and commonly presents with pain on chewing, restricted

jaw opening, muscle tenderness and intermittent joint sounds.⁶ It is reported that 5% of the general population seeks treatment for TMD.⁷ Physical therapy management of TMD including exercise, manual joint mobilization, and postural training have been effective management techniques for TMD.^{8–10}

There is no literature that has discussed the simultaneous management of TMD and head and neck lymphedema. There is also no literature linking the two diagnoses. The purpose of this case report is to describe a multimodal physical therapy treatment approach to the management of a patient with head and neck lymphedema and TMD.

Patient Characteristics

The patient was a 74-year-old male referred to physical therapy with a diagnosis of head and neck lymphedema and TMD. The patient had a past medical history of mouth cancer with resultant right maxillectomy, radical neck dissection, and radiation. The maxillectomy involved removal of the right maxilla, palatine bone, portions of the zygomatic

Correspondence to: P. Crane, MossRehab at Castor, Philadelphia, PA, USA. Email: metzerpa@einstein.edu

Figure 1 Maxillary obturator. (A) Front view; (B) right lateral view; (C) left lateral view.

and temporal bones, and all upper teeth. The patient's chief complaints included a 1-month history of neck edema, difficulty speaking for extended periods of time, and inability to open his mouth wide enough to eat solid foods. He complained of right-sided temporomandibular pain exacerbated with mouth opening. He was wearing a maxillary obturator, a prosthetic device that occluded the opening on the right side of the roof of his mouth.¹¹ The obturator consisted of a false palate, false ridge, and teeth and is pictured in Fig. 1.

The patient was employed as a motivational speaker to the blind and was out of work on medical leave due to his cancer and cancer related treatments. His goals for physical therapy included improved ability to open his mouth in order to eat solid foods, to reduce swelling in the neck in order to wear a dress shirt and tie, and to return to his job as motivational speaker.

Examination

Active mandibular depression was measured at 19 mm using a ruler between the central incisors of the mandibular row of teeth and the maxillary row of the obturator.¹² Mandibular opening has been shown to be a valid measurement in discriminating between patients with and without TMD.¹³ A slight left sided deflection was observed at the end range of movement. All other mouth range of motion measures were deferred due to the extreme limitation of mouth opening. Circumferential measurement of the neck at the largest point measured at 46.7 cm using a tape measure. The ability to measure volume of the head and neck is challenging due to limited anatomical landmarks to utilize for reproducibility. Normal girth ranges could not be established due to anatomic individualities. To improve intrarater reliability, this measurement was taken in supine at 1 cm above the cricoid cartilage. Endurance testing of the deep neck flexors as described by Domenech *et al.*¹⁴ was measured at 13.3 seconds, revealing a moderate endurance deficit. This test has shown acceptable reliability¹⁵ with reported norms for males of 38.9 ± 20.1 seconds.¹⁴ Upon palpation, there was noted increased soft tissue density to the right submental region with pitting edema. Visual

estimation of cervical active range of motion revealed full cervical flexion, full rotation bilaterally, 50% side-bend loss bilaterally and 25% extension loss. The patient presented with a moderate forward head posture. Segmental cervical intervertebral mobility testing revealed C0-1, C1-2, and C2-3, cervical hypomobility with posterior to anterior assessment. Pain was produced to the right side of his face with posterior to anterior segmental assessment to the aforementioned spinal levels.

Intraoral palpation revealed tenderness to the right lateral pterygoid and extraoral palpation revealed tenderness to the masseter bilaterally.¹⁶ Owing to the patient's unique presentation, the author was unable to find an outcomes measure tool validated to the patient's diagnosis. As a result, the functional outcomes measure used was the Patient Specific Functional Scale (PSFS). The PSFS is a self-report outcomes measure tool in which the patient chooses functional activities that are difficult to perform due to a current condition and rates his or her ability to perform each task on an 11 point scale with zero representing inability to perform a task and 10 representing the ability to perform the task at prior level. The patient scored 13/30 on the PSFS at initial evaluation.¹⁷ The items listed on the PSFS included eating solid foods, motivational speaking, and donning a dress shirt. This tool is not validated in patients with TMD or head and neck lymphedema; however, the PSFS is valid, reliable, and responsive in persons with neck dysfunction¹⁷ and was found to be more responsive in specific rather than generic conditions.¹⁸ Pain was rated at a 9/10 on the numeric pain rating scale (NPRS).¹⁹ Objective measurements at initial evaluation and discharge are listed in Table 1.

Clinical Impression

Based on examination findings, the patient was given a physical therapy diagnosis of head and neck lymphedema and right TMD. The TMD, although influenced by posture related to the head and neck lymphedema, appeared to be a separate diagnosis resulting from the prior right maxillectomy.

Interventions

The patient was treated one time per week for 4 weeks with one cancellation at week 3 due to illness for a total of three visits over 4 weeks. Frequency of physical therapy visits was limited due to financial constraints on the patient with regards to a high copayment with each visit. Treatment consisted of CDT, myofascial trigger point massage, postural reeducation exercises, mandibular isometrics, and upper cervical joint mobilizations.

CDT was performed each session to manage the lymphedema. CDT consisted of education regarding meticulous skin care, performance of and care-giver instruction in MLD of the head and neck as described by Földi,¹ the application of a custom compression strap, and cervical active range of motion exercises. MLD is designed to increase transport of lymph fluid from areas of accumulation to intact lymph nodes. The specific strokes are applied, following the anatomy and physiology of the lymphatic system. Each stroke has a pressure phase and a relaxation phase lasting approximately 1 second and is repeated five to seven times per area. Gentle stationary circles to the head and neck regions and face with all strokes directing fluid away from areas of accumulation to intact lymph nodes were performed in this case. Following MLD, a custom compressive strap was applied to prevent re-accumulation of evacuated fluid. The compression strap comprised of high density foam cut to the shape of the edematous submental region and was anchored in place by the Velfoam® strap (Velcro industries B.V., Amsterdam, The Netherlands). During his course of care, the compressive strap was worn at all times except when eating or bathing. Active range of motion exercises in all planes were then performed twice daily with the compressive strap in place to increase lymph vessel activity.¹

To address limitations in mandibular opening, intraoral myofascial trigger point massage of the right lateral pterygoid, and extraoral soft tissue mobilization (STM) of the masseter was performed.²⁰ Each trigger point was held for 90 seconds as described by Travell.²⁰ Following myofascial trigger point massage, mandibular depression visually

improved, though objective measures were not obtained. The patient was instructed in self-application of intraoral trigger point massage of the lateral pterygoid and extraoral STM of the masseter for home use prior to eating to assist with mouth opening required to eat solid foods.

Postural reeducation exercises including cervical retraction, scapula retraction, and supine deep neck flexor training were initiated during visit no. 2 to address the patient's forward head posture and decreased deep neck flexor endurance. Mandibular isometrics in all planes were also performed following manual therapy to improve joint position sense.²¹ The patient was instructed to include these exercises in his home exercise program three times daily.

Manual therapy techniques to restore cervical arthrokinematics at the hypomobile segments that were provocative of facial pain were performed during the second visit as well. Techniques applied included Grades III–IV posterior to anterior joint mobilizations to C0–1, C1–2, and C2–3 segments with posterior to anterior forces applied to the inferior segment. The treating therapist attempted Grades I–II mobilizations to the aforementioned segments to address the facial pain produced with mobilization. However, facial pain remained unchanged. Mobilization grades were then progressed to Grades III–IV to address hypomobility. Posterior to anterior mobilizations were applied in supine. Facial pain and active cervical extension were identified as asterisk signs prior to mobilization. Mobilizations were performed for approximately 30–45 seconds to each segment. Facial pain and active cervical extension were then reassessed. Facial pain decreased following the first bout of mobilization, but active cervical extension range of motion remained unchanged. A second bout of mobilization was performed. Cervical extension range of motion improved to within normal limits following the second bout of mobilization.

During the third visit, a re-evaluation was performed in addition to MLD. The patient stated that he was satisfied with the treatment results and would like to discontinue physical therapy due to satisfaction with results and financial constraints. The patient was provided an updated home exercise program consisting of daily self-MLD, use of the compression strap at night, self-myofascial trigger point massage performed prior to eating solid foods, cervical retraction, scapula retraction, and deep neck flexor training performed three times per day in supine and seated. Treatment progression is outlined in Table 2.

Outcomes

Upon discharge, active mandibular depression increased to 35 mm. Although still limited, the

Table 1 Objective measures at initial evaluation and discharge

	Initial evaluation	Discharge
Active mandibular depression	19 mm	35 mm
Girth of neck at largest point	46.7 cm	35.2 cm
Deep cervical flexor endurance	13.3 seconds	23.4 seconds
PSFS	13/30	27/30
NPRS	9/10	4/10

Note: PSFS= patient specific functional scale; NPRS= numeric pain rating scale.

patient was able to resume eating solid foods with the exception of sandwiches on a roll based on this improvement. Girth of the neck improved to 35.2 cm and the patient reported that he was able to don a dress shirt. The patient reported that he was able to speak for one hour bouts and would be returning to motivational speaking later that week.

Deep neck flexor endurance increased to 23.4 seconds. Despite this improvement, a deficit remained compared to the norm established. However, the norms established by Domenech¹⁴ were based on an active military population. As a result, the normative findings may not be generalizable to the civilian population.

The PSFS rating increased from 13/30 to 27/30, showing moderate improvement. A case series using the PSFS as an outcomes measure in 15 TMD patients treated with manual therapy and exercise found a mean of 3.1 points improvement on each test item of the PSFS in the studied population.²²

Pain improved from 9/10 to 4/10 on the NPRS. It has been reported that a three point change on the NPRS reflects true change based on responsiveness of this tool.²³ (See Table 1 for a summary of objective measures.)

In a 3-month follow-up phone call after discharge from physical therapy, the patient reported continued compliance with his home exercise program. He stated that he was able to wear a dress shirt, returned to motivational speaking at decreased frequency than prior to his surgery and continues to eat solid food with the exception of sandwiches on rolls. Pain was rated at that time as a 2/10 on average.

Discussion

This case report presents the outcomes of a multimodal physical therapy approach utilized for a patient with concurrent head and neck lymphedema and TMD. After performing a thorough literature search, no research was found discussing the management of a patient with a similar presentation. There is evidence to support the use of deep soft tissue mobilization to the cervical musculature and joint mobilizations of the temporomandibular joint to

increase mouth opening;²⁴ however, the patient's presentation at the time of treatment prevented the use of these interventions. The patient's skin to the anterior cervical spine and the anterior chest wall was fragile following radiation treatments. Therefore, deep soft tissue mobilization to this region was deferred by the treating therapist. The right maxillectomy prevented the use of this joint mobilization to the temporomandibular joint due to the altered bony articulation following surgery. The patient's maxillectomy resulted in resection of the right maxilla, palatine bone, portions of the zygomatic and temporal bones, and all upper teeth causing an altered resting position of the mandible. As a result, an impairment based treatment approach was implemented utilizing evidence based practice.

CDT consisting of meticulous skin care, MLD, the application of compression, along with exercise was utilized to treat the patient's lymphedema.^{25,26} CDT significantly reduces lymphedema volume by redirecting the flow of lymph through intact lymphatics.^{25,26} Volume reduction is maintained through patient compliance with wearing a properly fitted compression garment and performance of a home exercise program consisting of self-MLD and meticulous skin care.^{25,26}

Myofascial trigger point massage was utilized to address proposed muscular limitations that were potentially limiting active mouth opening. There is a paucity of evidence to support this intervention.²⁷ However, when using a test-retest method following myofascial trigger point massage, active range of motion of mouth opening improved post myofascial trigger point massage.

Postural exercises were utilized for this patient. Two studies support the use of postural exercises to improve oral opening and to reduce pain.^{28,29} There are reports in the literature supporting a relationship between head posture and masticatory muscle activity.^{30,31}

Multilevel Grades III–IV posterior to anterior joint mobilizations as described by Maitland³² were performed to the upper cervical spine to address

Table 2 Summary of treatment progression

Visit	Subjective reports	Intervention
Evaluation	Head and neck lymphedema Decreased mouth opening	Complete decongestive therapy Cervical active range of motion exercises Intra/extraoral myofascial trigger point massage
Follow-up 1	Head and neck lymphedema Improved mouth opening to eat semisolid foods Decreased endurance with speaking Facial pain	Complete decongestive therapy Myofascial trigger point massage Postural exercises Mandibular isometrics Deep neck flexor training Posterior to anterior joint mobilizations C0–3
Discharge	Improved mouth opening/improved ability to eat solid foods Improved neck girth measurements Return to limited public speaking	Myofascial trigger point massage Complete decongestive therapy Re-evaluation

hypomobility found at vertebral segments that reproduced facial pain. Studies have found that both interrater and intrarater reliability are poor to moderate with regards to segmental testing of the cervical spine for hypomobility.^{33–35} Following Grades III–IV joint mobilization to the upper cervical spine, the patient's facial pain was decreased. Several authors have reported findings consistent with a possible neurophysiological effect of cervical joint mobilizations with an initial hypoalgesia and concurrent excitation of the motor and sympathetic nervous system that would explain this effect.^{36–38} There is research to suggest that mouth opening improves following atlanto-occipital mobilization.³⁹

Deep neck flexor training has been recently reported in the literature to address weakness and endurance deficits in the cervical spine.^{14,15} It is reasonable to hypothesize that the deep neck flexors would be weak following a radical neck dissection. Deep neck flexor training was incorporated to address the decreased endurance found with the deep neck flexor endurance test. This intervention also addresses postural alignment of the spine and temporomandibular joint.

Following the implementation of this multimodal physical therapy treatment approach, the patient had improved pain on the NPRS, improved maximal mouth opening, improved deep cervical flexor endurance, improved girth volume, and improved function measured via the PSFS. Self-reported functional improvements included improved eating ability, improved ability to speak, and return to work in a limited capacity. This report reinforces the importance to treat both primary and secondary diagnoses utilizing evidence based practice in order to improve overall function.

A number of limitations should be recognized with this case report. Although spontaneous healing is unlikely, causation cannot be inferred from a case report. The PSFS was administered by the author during the initial evaluation and discharge visit. This could potentially introduce bias to the patient when reporting results. Finally, the author attempted to provide treatment utilizing current literature supporting evidence based practice. However, the interventions utilized were studied in either a TMD population or a lymphedema population, but not in a population with concurrent diagnoses.

Conclusion

This case report describes the management and outcomes of a patient with a unique presentation of TMD and head and neck lymphedema. This patient was successfully managed using CDT, manual therapy, and exercise. This case report affords the opportunity to present a clinical decision making

process that yielded positive results for a medically complex patient. Further research on outcomes and treatment approaches in patients with TMD and head and neck lymphedema is warranted. It is important to utilize evidence based practice in a variety of modes of physical therapy to address impairments that can impede upon function.

References

- 1 Földi M, Földi E, Kubik S, editors. Textbook of lymphology. Münche: Urban & Fischer; 2003. p. 232, 496–501.
- 2 Lymphoedema framework. Best practice for the management of lymphoedema: an international perspective. London: Medical Education Partnership Ltd; 2006.
- 3 Zimmermann T, Leonhardt H, Kersting S, Albrecht S, Range U, Eckelt U. Reduction of postoperative lymphedema after oral tumor surgery with sodium selenite. *Biol Trace Elem Res*. 2005;106:193–203.
- 4 Deng J, Ridner SH, Dietrich MS, Wells N, Wallston KA, Sinard RJ, et al. Prevalence of secondary lymphedema in patients with head and neck cancer. *J Pain Symptom Manag*. 2012;2:244–51.
- 5 Piso DU, Eckardt A, Liebermann A, Gutenbrunner C, Schafer P, Gehrke A. Early rehabilitation of head-neck edema after curative surgery for orofacial tumors. *Am J Phys Med Rehabil*. 2001;4:261–9.
- 6 Dimitroulis G. Temporomandibular disorders: a clinical update. *BMJ*. 1998;317:190–4.
- 7 Schiffman EL, Fricton JR, Haley DP, Shapiro BL. The prevalence and treatment needs of subjects with temporomandibular disorders. *J Am Dent Assoc*. 1990;120:295–303.
- 8 Nicolakis P, Erdogmus B, Kopf A, Djaber-Ansari A, Piehslinger E, Fialka-Moser V. Exercise therapy for craniomandibular disorders. *Arch Phys Med Rehabil*. 2000;81:1137–42.
- 9 Meldicott MS, Harris SR. A systematic review of the effectiveness of exercise, manual therapy, electrotherapy, relaxation training, and biofeedback in the management of temporomandibular disorder. *Phys Ther*. 2006;7:955–73.
- 10 McNeely ML, Olivo SA, Magee DJ. A systematic review of the effectiveness of physical therapy interventions for temporomandibular disorders. *Phys Ther*. 2006;7:10–25.
- 11 Keyf F. Review: obturator prostheses for hemimaxillectomy patients. *J Oral Rehabil*. 2001;28:821–9.
- 12 Dworkin SF, LeResche L, DeRouen T. Reliability of clinical measurement in temporomandibular disorders. *Clin J Pain*. 1988;2:89–99.
- 13 Walker N, Bohannon RW, Cameron D. Discriminate validity of temporomandibular joint range of motion measurements obtained with a ruler. *J Orthop Sports Phys Ther*. 2000;8:484–92.
- 14 Domenech MA, Sizer PS, Dedrick GS, McGalliard MK, Brismee JM. The deep neck flexor endurance test: normative data scores in healthy adults. *PM R*. 2011;3:105–10.
- 15 Harris KD, Heer DM, Roy TC, Santos DM, Whitman JM, Wainner RS. Reliability of a measurement of neck muscle endurance. *Phys Ther*. 2012;12:1349–55.
- 16 Kraus SL, editor. Physical therapy management in TMJ dysfunction. TMJ disorders management of the craniomandibular complex. New York: Churchill Livingstone; 1988. p. 139–74.
- 17 Horn KK, Jennings S, Richardson G, VanVliet D, Hefford C, Abbott JH. The patient-specific functional scale: psychometrics, clinimetrics, and applications a clinical outcome measure. *J Orthop Sports Phys Ther*. 2012;1:30–40.
- 18 Stratford PW, Binkley FM, Riddle DL. Health status measures: strategies and analytic methods for assessing disability and change on individual patients: a report of a patient specific measure. *Physiother Can*. 1995;47:258–62.
- 19 Kahl C, Cleland J. Visual analogue scale, numeric pain rating scale and the McGill pain questionnaire: an overview of psychometric properties. *Phys Ther Rev*. 2005;10:123–8.
- 20 Travell JG, Simons DG. Myofascial pain and dysfunction: the trigger point manual: upper half of the body. Vol. 1, 2nd ed. Atlanta (GA): Emory University; 1998.
- 21 Santiesteban AJ. Isometric exercises and a simple appliance for temporomandibular joint dysfunction: a case report. *Phys Ther*. 1989;69:463–6.

- 22 Furto ES, Cleland JA, Whitman JA, Olson KA. Manual physical therapy interventions and exercise for patients with temporomandibular disorders. *J Craniomandib Pract.* 2006;4:283–91.
- 23 Finch E, Brooks D, Stratford PW, Mayo N. Physical rehabilitation outcome measures—a guide to enhanced clinical decision making. 2nd ed. Baltimore (MD): Lippincott, Williams & Wilkins; 2002.
- 24 Carmeli E, Sheklow SL, Bloomfield I. Comparative study of repositioning splint therapy and passive manual range of motion techniques for anterior displaced temporomandibular discs with unstable excursive reduction. *Physiotherapy.* 2001;87:26–36.
- 25 Dicken S, Ko C, Lerner R, Klose G, Cosimi AB. Effective treatment of lymphedema of the extremities. *Arch Surg.* 1998;133:252–8.
- 26 Weiss JM, Spray BJ. The effect of complete decongestive therapy on the quality of life of patients with peripheral lymphedema. *Lymphology.* 2002;35:45–68.
- 27 Rickards LD. The effectiveness of non-invasive treatments for active myofascial trigger point pain: A systematic review of the literature. *Int J Osteopath Med.* 2006;9:120–36.
- 28 Komiyama O, Kawara M, Arai M, Asano T, Kobayashi K. Posture correction as part of behavioral therapy in treatment of myofascial pain with limited opening. *J Oral Rehabil.* 1999;26:428–35.
- 29 Wright EF, Domenech Ma, Fischer JR Jr. Usefulness of posture training for patients with temporomandibular disorders. *J Am Dent Assoc.* 2000;131:202–10.
- 30 Bazzotti L. Mandible position and head posture: electromyography of sternocleidomastoids. *J Craniomandib Pract.* 1998;16:100–8.
- 31 Miralles R, Palazzi C, Ormeno G, Giannini R, Verdugo F, Valenzuela S, et al. Body position effects on EMG activity of sternocleidomastoid and masseter muscles in healthy subjects. *J Craniomandib Pract.* 1998;16:90–9.
- 32 Maitland G, hengeveld E, Banks K, English K. Maitland's vertebral manipulation. Oxford: Butterworth-Heinemann; 2001.
- 33 Riddle DL. Measurement of accessory motion: critical issues and related concepts. *Phys Ther.* 1992;12:865–74.
- 34 Streder LE, Lundil M, Nell K. Interexaminer reliability in physical examination of the neck. *J Manipulative Physiol Ther.* 1997;8:516–20.
- 35 Nilsson N. Measuring passive cervical motion: a study of reliability. *J Manipulative Physiol Ther.* 1995;5:293–7.
- 36 Sterling M, Jull G, Wright A. Cervical mobilization: concurrent effects on pain, sympathetic nervous system activity and motor activity. *Man Ther.* 2001;6:72–81.
- 37 Zusman M, Edwards B, Donaghy A. Investigation of a proposed mechanism for relief of spinal pain with passive joint movement. *J Manual Med.* 1989;4:58–61.
- 38 Petersen N, Vincenzino B, Wright A. The effects of a cervical mobilization technique on sympathetic outflow to the upper limb in normal subjects. *Physiother Theory Pract.* 1993;9:149–56.
- 39 Mansilla-Ferragut P. Immediate effects of atlanto-occipital joint manipulation on active mouth opening and pressure pain sensitivity in women with mechanical neck pain. *J Manipulative Physiol Ther.* 2009;2:101–6.