Use of orthopedic manual physical therapy to manage chronic orofacial pain and tension-type headache in an adolescent

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Temporomandibular dysfunction (TMD) is frequently associated with multiple headache types. While the efficacy of orthopedic manual physical therapy (OMPT) intervention for TMD with/without headache symptoms has been investigated, it has received less attention than other musculoskeletal conditions. This case describes the OMPT treatment and outcome of a 14 year-old female with a 2-year history of facial pain surrounding the right temporomandibular joint (TMJ), and bilateral occipital and temporal tension-type headaches (TTHs). Intervention included manual mobilization of the TMJ and surrounding cervical/facial soft tissue structures, postural re-education, and patient/family education on prevention, self-treatment, and postural adaptations.

Outcomes included pain free and maximal mouth opening (MMO), pressure pain threshold (PPT) over the masseter muscle belly, fear avoidance beliefs questionnaire-physical activity subscale (FABQ-PA), jaw pain and function questionnaire (JPFQ), visual analog pain scale (VAS) for facial pain, and headache frequency, duration, and intensity on a VAS. Results included increased pain free and MMO by 22 mm, improved PPT bilaterally by 403.05 kPa on the affected, and 360.88 kPa on the unaffected side, and decreased reported headache frequency, duration, and intensity. Score decreases of 5 points on VAS with MMO, 8 points on FABQ-PA, and 5 points on JPFQ were also noted. Further research is warranted to investigate the effects of OMPT on pain processing and functional outcomes in patients with TMD and headache.

Keywords: Headache, Temporomandibular joint, Central sensitization, Orthopedic manual physical therapy

Introduction

Temporomandibular joint (TMJ) dysfunction and headaches represent two of the most prevalent health problems globally. While prevalence estimates of each condition vary widely across the literature, it is currently understood that temporomandibular dysfunction (TMD) is present in approximately 5–33% of the western population.^{1–3} Likewise, primary headaches alone, most commonly migraine, and tension-type headache (TTH) affect approximately 80% of the world's population.^{4,5} Individually, these conditions are often under-recognized and underestimated in scope, and are undertreated by medical professionals.^{1,4} Furthermore, there appears to be significant overlap between TMD and headache presentation.

There is consistent agreement that patients who suffer from TMD are likely to also present with headache and/or neck pain.^{1,2,6–8} One source reported

the incidence of TMD with headache to be as high as 36% in children and adolescents alone.⁹ In other studies, 59% of patients with myofascial TMD also fit the diagnostic criteria for episodic TTH, and 33% fit those for chronic TTH based on the *International Classification of Headache Disorders, 2nd edition*.¹⁰ Conversely, of patients with TTH, about 40% will also have a myofascial TMD diagnosis using the research diagnostic criteria for TMD.²

Currently, both headache and TMD are considered diagnoses of inclusion, meaning specific features must be present to make the diagnosis.¹¹ The research diagnostic criteria for TMD categorizes patients into subgroups based on a pathoanatomical model (i.e. group 1 – muscle disorders, group 2 – disc displacement, and group 3 – arthralgia, arthritis, and arthrosis).^{3,12,13}

Similarly, the ICDH-2 divides headaches into primary and secondary headache disorders. In a primary headache, the headache itself is the illness and is not attributable to some other pathology. Primary headaches include migraine, TTH, cluster headache, other autonomic cephalgias, and other

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primary headache disorders. In secondary headache disorders, headache is the symptom of identifiable abnormalities, e.g. structural or metabolic causes. Cervicogenic and TMD-type headaches are both classified as secondary headaches and are thought to occur as symptoms of dysfunction relative to the cervical spine or TMJ regions respectively.^{10,14}

Numerous studies have investigated the role of orthopedic manual physical therapy (OMPT) in the treatment of cervicogenic and TMD-type headaches.^{1,11,15–18} In light of the significant overlap in symptom prevalence between TMD and primary headache types, it seems reasonable that OMPT may be similarly beneficial in the treatment of TMD and primary headache types. Recent research in pain neurophysiology has suggested that hyperexcitable central pain mechanisms, known to be a component of primary headaches and TMD,^{19–21} may be inhibited by manual therapy in conjunction with a pain education program.^{22–26}

However, there appears to be a shortage of research on the efficacy of physical therapy management aimed at reducing the prevalence of TMD and headache.²⁷ While in recent years there has been an encouraging increase in research in use of OMPT to treat TMD, headache and neck pain, there is still less information available in these areas versus other body regions.

The purpose of this case report is to describe the management and outcomes of a patient with a 2-year history of facial pain, primary headaches, and transient neck pain.

Case Description

Patient description and history

The patient was a 14 year-old right-hand dominant female with a chief complaint of a 24-month history of worsening unilateral facial pain, and ‘pressing’ type bilateral headaches that were occasionally associated with photophobia, phonophobia, and posterior neck and upper back tension pain. She initially sought treatment from her pediatrician who diagnosed her with migraines, prescribed medication, and eventually referred her to her dentist for evaluation of persistent right orofacial pain. After examining her, the dentist referred her to PT with a diagnosis of myofascial pain of the right masseter.

Previous treatment included medication from her pediatrician and her dentist, including non-steroidal anti-inflammatories and muscle relaxants including Baclofen, Sumatriptan, Naproxen, and Albuterol, all as needed. She denied orthodontic treatment or use of an oral night guard.

Subjective red flag screening for cancer and cervical artery dysfunction was negative. She also denied numbness, tingling, or weakness in any extremity,

previous history of surgery or trauma to the head, neck, or face, or injuries in other regions of the body. Her medical history was unremarkable except for asthma. No radiology studies were available for review.

Two years prior to her initial evaluation, the patient described an insidious onset of jaw pain, followed 2–3 months later by headaches. Yawning and biting into large food items were the first activities to be painful for the patient. Over time, her pain worsened, particularly when eating tough, crunchy, or chewy foods. She modified her diet, and by the evaluation date, she could only tolerate soft foods and liquids, and was occasionally unable to eat anything due to pain severity.

Parafunctional habits included sleeping prone in left cervical rotation, nocturnal bruxism, nail biting, and gum chewing. She also habitually tossed her head to the right side to keep her hair out of her visual field, and preferred to rest her face against the desk while writing and drawing at school. She noted difficulty finding a comfortable sleeping position, woke up two to three times a week due to facial pain, and felt fatigued during the day.

The patient’s headaches occurred twice weekly immediately after school, lasted the rest of the day, and typically resolved by the following morning. She described them as a pressing, tension-type pain in bilateral frontal and temporal areas, and along her posterior nuchal line. With severe headaches, photophobia, phonophobia, and blurry vision were present; taking her prescribed medication partially reduced the intensity of her headache, but did not shorten the duration. Lying down in a dark, quiet place helped. Her goals for therapy included reducing her facial pain and headache frequency, and being able to eat her favorite foods without pain.

Self-report outcome measures included the physical activity subscale of a fear avoidance beliefs questionnaire (FABQ)²⁸ and the jaw pain and function questionnaire (JPFQ).²⁹ The FABQ is a two-subscale outcome that inquires about levels of fear associated with physical activity and work. While the FABQ is validated for use with chronic low back pain patients, recent studies have indicated that it also demonstrates reliability when used for other areas of the body.²⁸ The physical activity subscale was adapted by instructing the patient to replace the word ‘back’ with ‘face’, and the work subscale was left blank. The JPFQ was originally developed and validated for use in measuring post-surgical outcomes in patients undergoing arthroscopic surgery of the TMJ.²⁹ It consists of three subscales: pain, function, and a visual analog scale and has been validated in relation to maximal jaw opening.³⁰ This outcome was used to identify the specific tasks that were most limiting to the patient.

Pain Location	Pain Description	Current Pain	Range	Present Since:
■ Right TMJ/cheek	Sharp/deep/achy/clicking	3/10	3/10-8/10	2011
▨ Posterior Nuchal line/temples	Pressing/tension, Phono/photophobia present	0/10	0/10-10/10	2012
▩ Upper traps/mid-back	Intermittent achy/tension	2/10	0/10-7/10	2012

(b)

Figure 1 a Pain diagram at Initial Evaluation; b Pain descriptions

Salient Physical Exam Findings

At initial evaluation, the patient's major functional complaint was impaired maximal mouth opening (MMO) due to her facial pain. This was assessed prior to the start of the exam (22 mm, pain rated at 4/10 at end ROM).³¹ During opening, deviation of the mandible to the left was observed. Simultaneous palpation over both TMJs revealed a palpable click on the right only, which the patient reported as her familiar clicking. Figures 1 and 2 demonstrate the location and pain descriptions that match her affected regions.

Observation

The patient's deficits included excessive upper cervical extension, loss of cervical lordosis and thoracic kyphosis, bilaterally protracted scapulae, internally rotated shoulders, bilateral genu recurvatum, and narrow base of support. Facial asymmetries included swelling or possible masseter hypertrophy on the right, and redness of her right cheek. At rest, the patient performed normal nasal breathing. Her occlusion demonstrated central and lateral incisor contact but a posterior open bite.

Active cervical side flexion ROM produced contralateral stretch bilaterally, which she identified as her familiar neck pain (P3). Cervical extension quadrant³² to the left with over pressure produced her familiar right-sided facial pain. All other planes of cervical AROM were pain free with overpressure.

External palpation

Allodynia was noted with static light touch to the right side of her face and along the right sternocleidomastoid. Her facial pain (P1) was reproduced with minimal light touch over the right masseter and parotid gland. Familiar headache (P2) and P1 were elicited with manual palpation of all fibers of the right temporalis. P3 was produced with palpation of the posterior cervical soft tissue structures, near the suboccipital insertions along the nuchal line.

Internal palpation

Palpation of the right masseter, and in the region of the lateral pterygoid produced P1, with increased

muscle bulk noted on the right masseter versus the left. Good reliability for palpation of the lateral pterygoid has not yet been established. While manual palpation is the most commonly used qualitative assessment for musculoskeletal hyperalgesia,³³ pressure pain threshold (PPT) provides a quantifiable outcome measure that can be used to monitor progression of tissue tenderness throughout treatment. Pressure pain threshold testing was performed over bilateral masseters at visit 2 using the protocol described in a recent study.⁶ Using a handheld pressure algometer with a circular 1 cm² rubber tipped head, three measurements were taken, 30 seconds apart, at each site to calculate a mean. Measurements were recorded in kg/cm² and converted to KPa (Table 1). The reliability of PPT testing has been reported to be high (ICC=0.91) [95% confidence intervals (CI): 0.82–0.97].³⁴

Joint mobility

Passive physiologic and accessory assessment of the right and left TMJ was limited by pain.

Passive accessory intervertebral motion assessment

Pain and muscle guarding limited assessment of joint mobility with central and unilateral passive accessory intervertebral motions (PAIVM) at all levels except C2. Production of familiar neck pain was produced with central PAIVM to C2. The cervicothoracic junction and upper thoracic spine (T1–T5) were observed to be hypomobile compared to lower segments of the thoracic spine (T6–T12). No cervical ROM or PAIVM assessment produced her headache symptoms. Recent studies suggest that long term cervical and cervicothoracic joint dysfunction may influence the function of the temporomandibular region and vice versa, thus contributing to a variety of headache types.^{15,35–37} Screening the cervical spine for dysfunction allows the clinician to assess the relevance of cervical dysfunction in the entire patient presentation. In this case, cervical dysfunction did not reproduce her TMD or headache symptoms.

Table 1 Treatment outcomes by visit

Objective measures utilized	Visit 1	Visit 2	Visit 3	Visit 4	Visit 5	Visit 6
Pain free jaw opening pre-Tx	23	25	35	40	45	47
Pain free jaw opening post-Tx	30	30	40	45	45	47
Maximal jaw opening pre-Tx	23	27	40	42	45	47
Maximal jaw opening post-Tx	30	31	41	47	47	47
Right laterotrusion		5		12	9	15
Left laterotrusion		7		12	11	15
Right PPT (kPa)		52.96		305.97	456.01	
Left PPT (kPa)		106.89		327.54	467.78	
JPDQ	15			9		6
FABQ-PA subscale	18/24			10/24		4/24
Worst pain (NPRS): facial pain	8			6	2	4
Worst pain (NPRS): headache	10			7	4	3
Worst pain (NPRS): neck pain	7			2	0	0
Headache frequency	2/week	5/week	1/week	0–1/week	1/month	None
Headache duration	>10 hours	2 hours	20 minutes	10 minutes	10 minutes	n/a

PPT: Pressure pain threshold; jaw opening and laterotrusion measured in (mm); JPDQ: jaw pain and dysfunction questionnaire; FABQ-PA: fear avoidance beliefs questionnaire-physical activity subscale.

Clinical impression

Differential diagnoses considered throughout the subjective and physical exam included: myofascial TMD with TTH, TMD disc displacement with reduction, cervical postural dysfunction, cervicogenic headache, TMD-type headache, trigeminal neuralgia, migraine headache, mixed headache type, complex regional pain syndrome, and impacted molar. Consideration of migraine headache was given based on her reported medical diagnosis, and effective treatment with triptans. However, the bilateral location of her headaches, the description of pressing type pain, and the onset of aching bilateral neck pain, photophobia and phonophobia with increased headache intensity, better match the ICDH-2 criteria for TTH. According to the ICHD-2, a diagnosis of TMD-type headache is made retrospectively only if all headache symptoms resolve with treatment of the TMD symptoms.¹⁰ Therefore, TMD-type headache alone, or overlapping a tension-type primary headache remained likely. After reassessing the patient's response to the initial manual therapy, myofascial TMD with overlapping TTH versus TMD-type headache were the primary hypotheses.

Initial treatment

Following examination, the working hypothesis was impaired TMJ mobility due to capsular and myofascial restrictions of the right TMJ, with underlying tension-type headaches and cervicothoracic postural dysfunction. Initial treatment focused on improving her functional mouth opening. A grade III medial/lateral glide with distraction of the right TMJ was performed for 1 minute.³⁸ Re-assessment of functional mouth opening revealed an increase from 22 to 23 mm, and a decrease in pain at end ROM to 2/10. Mandibular deviation to the left and painful click of the right TMJ were still present with opening. The same technique was then performed on the left side

for 3 minutes. Mouth opening increased to 30 mm, pain at end range decreased to 1/10, mandibular deviation was no longer present, and the palpable click was less prominent. The patient was educated on postural adaptations to her sleeping and sitting positions, to help reduce symptom aggravation. She was also instructed in performing a self-medial/lateral TMJ glide with left TMJ distraction.

Treatment

The patient attended six visits of physical therapy, which included manual therapy, therapeutic exercise, patient and family education on neurophysiology of pain, and home exercise program (HEP) development and progression.

Manual therapy

Intraoral and extraoral manual techniques were utilized to maximize TMJ mobility, regulate pain in isolated tissues involved, release active and latent trigger points, and to reduce fear of tactile stimuli.^{6,7,15,16,23} Descriptions and pictures of technique choice, dosage, and patient response by visit are summarized in Table 2.

Education

Education included discussion on pathophysiology of the TMJ and cervical spine using a 3-dimensional atlas, the neurophysiologic relationship between her stress levels, anxiety, and pain regulation, and postural correction.

Therapeutic exercise

In previous research, patients with high pain-related fear have been shown to develop spinal compensatory motions to reduce spinal movement and avoid pain.³⁹ Table 3 summarizes exercises she was given by visit, to increase her paraspinal muscle activity to encourage more upright posture at school, and to regulate her resting pain levels.^{40,41}

Table 2 Treatment provided

Picture	Treatment	Immediate response	Visit
Gr. III medial/lateral glide with and without distraction – bouts lasted 2–7 minutes	Increased jaw opening; decreased EROM pain	1–2: bilaterally; 3–4: L only
AAROM with and without jaw distraction and anterior glide in pain free ROM	Increased pain free jaw opening	3–5
STM and gentle CFM to: temporalis, R masseter, SCMs – bouts lasted 3–6 minutes	Production of familiar headache (temporalis) and facial pain (masseter) during treatment. Over time: perceived tissue adaptation, decreased resting pain	2–5
TrG point release to the R masseter – bouts lasted 2 minutes	Production of familiar facial pain, reduction of perceived tissue restrictions, no change to resting pain levels	2–3
Patient education on	Relationship between mastication, head/neck and thoracic posture, and headache symptoms		1–2
	Positional adaptations for: sleeping, riding in car, writing at her desk, and drawing in bed		1–3
	Neurophysiology and relationship between stress, anxiety, fear, and pain mediation		2–4
	Reducing nail biting, hair tossing, and using night guard to assist with nocturnal bruxism		2–4
	Reintroducing varied food textures to adapt back into normal eating habits		4–5

Home exercise program

The patient was instructed in self-mobilization of the TMJ, soft tissue mobilization of the masseter, and postural exercises to encourage improved postural alignment. Her HEP is summarized by visit with dosage and pictures of each task in Table 3.

Outcomes

Measurable outcomes collected over multiple treatment visits are summarized in Table 1.

Discussion

This case described the treatment of a patient who presented with symptoms consistent with myofascial TMD and TTHs. She responded to OMPT treatment directed at improving her jaw ROM, reducing pain and allodynia, decreasing trigger points present in the masseter, improving her postural awareness and alignment, and educating her on parafunctional habit adaptation to prevent recurrence. After five treatment sessions, the patient's TMD symptoms and headache appeared to have resolved. The follow-up period with this patient was 3 months. According to the research diagnostic criteria for TMD, she consistently fit into axis-1, myofascial TMD,^{12,13} though her headache type is not considered with these criteria.

Identifying her headache diagnosis was more complex. If she continued to remain headache free over time, it is likely that she had TMD-type headaches

instead, and was misdiagnosed with primary headaches prematurely. Migraines and TMD pathologies are among the most frequently misdiagnosed causes of headache.⁴² Additionally, some authors report that primary headache types such as migraines may present differently in children and adolescents than in adults.^{9,14}

However, she did not clearly fit the criteria for secondary headaches either. The presence of photophobia and phonophobia and visual changes she reported as part of her headache history are atypical of pure secondary TMD headaches.¹⁴ Similarly, aside from tenderness to palpation to the neck musculature, which may have been due to secondary hyperalgesia, there were no salient findings that would suggest cervicogenic headache. She received no treatment to her neck outside of postural education and chin tucks on visit 3. Consequently, it is likely that this patient had a dual presentation of true myofascial TMD, with an overlapping primary tension-type headache.

The presence of central sensitization of nociceptive pathways has been identified in patients with TMD in addition to patients with TTH and myofascial trigger points.^{7,19,43} This patient demonstrated side-to-side differences at initial measurement of PPT over the masseter muscle, suggesting hyperalgesia of the affected side. Over time, these values equalized, and increased bilaterally at each consecutive visit, demonstrating bilateral normalization of PPT and decreased

Table 3 Home exercise program (HEP)

Figure	HEP	Recommended dose	Issued on visit
Self-medial/lateral glide with distraction toward the right	1–2 minutes, 2/daily	1
Jaw anterior glide with distraction assisted opening	2–3 minutes, 2/daily	2
Soft tissue mobilization to the masseter/temporalis	2 minutes, 2/daily, R side only	2
Chin tucks and scap squeeze (cervical retraction with scapular retraction/depression)	10 × 2 seconds hold, 2–3/daily	3–5
Foam roller thoracic self-mobilization and foam roller cervical self-mobilization	2 minutes, 1–2/day	5
Foam roller supine pectoralis stretches	30 inches each position, 'T', 'Y', 'I'	5

hyperalgesia. Her headache intensity, frequency, and duration also improved over time. In the presence of a primary headache presentation, these findings suggest that her course of treatment with OMPT may have altered the centrally mediated facial pain.^{19,22}

Physical therapy research on headaches has focused on management of cervicogenic headaches, that is, headaches arising from musculoskeletal dysfunction in the cervical spine.⁴⁴ In a recent study, patients with cervical dysfunction were treated with OMPT either directed at the orofacial and cervical regions, or the cervical region alone.¹⁵ The study found significant improvements in all aspects of cervical impairments in patients who received the combined treatment. In this specific case however, the patient received orofacial OMPT and indirect treatment of the cervical spine through postural re-education, with the effect of improved TMJ function, decreased headache intensity, frequency, and duration, and improved cervical impairments. Treatment was directed at her jaw primarily, suggesting that treatment of the orofacial region can impact the cervical region and headache presentation.

In other body regions, OMPT has been shown effective in down-modulating centrally mediated pain.²² The neurophysiologic mechanisms that explain the pain regulating effect of OMPT are currently not fully understood.²³ However, this patient demonstrated features consistent with central sensitization including regional allodynia and hyperalgesia. Further PPT testing of distal sites may have aided in determining the extent of central sensitization. While OMPT may not directly treat the cause of primary headaches, it may affect the duration and/or intensity of them by altering the nociceptive input mechanism. Bilateral and widespread decreases in PPT in joint, nerve, and muscle tissue in patients with myofascial TMD versus healthy controls have been associated with impairments in descending inhibitory systems and central sensitization.¹⁹ Increased peripheral nociceptive input is thought to contribute to continued impairments of these pain modulation systems, and potentially cause central amplification of nociceptive inputs. If sources of peripheral nociceptive input like TMD joint restrictions and trigger points are treated successfully with OMPT, the reduction of input into the somatosensory system may potentially reduce central amplification and thus reduce centrally mediated primary headache intensity, duration, and/or frequency.¹⁹ Further research into the effect of orofacial OMPT on centrally mediated headaches is necessary to establish the full potential of the physical therapist's role in TMD and primary headache management.

Limitations to this case include the lack of reliable, validated outcome measures for use with patients

with TMJ dysfunction, particularly in the adolescent population. Alternative outcome measures that could have been used are the Jaw Functional Limitations Scale^{45,46} or the Oral Health Impact Profile-TMD,⁴⁷ however the original versions of both measures are difficult to obtain. Additionally, the single case design limits the generalizability of these findings to larger populations.

Conclusion

This case describes a patient who was evaluated and treated for chronic orofacial pain diagnosed as myofascial TMD, and tension-type headaches. Orthopedic manual physical therapy to the orofacial region was utilized as part of a multimodal approach to improve her jaw function, facial pain, and reduce her headache frequency and intensity. Her positive outcomes demonstrate the positive utility of OMPT, in conjunction with significant patient education on pain science, to treat patients with primary headaches and TMD.

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