The Efficacy of Trigger Point Pressure Release on Reducing Whiplash Associated Disorder and Chronic Daily Tension Headaches

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I would like to thank my wonderful subject of this case study for her participation in this project, for trusting me with her quality of care, and for allowing me to be a part of her journey to recovery.

Abstract

Background: Whiplash injury can result in temporary symptoms; however, often the trauma sustained creates persistent, long term problems. Chronic whiplash associated disorder (WAD) can include neck pain, headaches, and a variety of other symptoms which highly impact the patient's quality of life.

Objective: This case presentation examines a 2-year-old whiplash injury stemming from a motor vehicle collision, resulting in lingering posterior neck pain and chronic daily tension headaches. The purpose of this study is to determine if massage therapy, including General Swedish Massage (GSM) and Trigger Point (TrP) pressure release, in combination with therapeutic exercise will decrease symptoms presented by the 32-year-old female case subject.

Intervention: A total of 8 treatments were completed over 11 weeks, with technique focus on TrP pressure release to bilateral sternocleidomastoid muscles. A combination of GSM and cervical stabilization homecare was employed with the aim of reducing hypertonicity, improving forward head posture (FHP), and decreasing associated pain levels. Progress was monitored using range of motion, quality of life questionnaires, and photography.

Results: The subject experienced an increase in pain free cervical spine range of motion, as well as a decrease in duration and intensity of tension headaches. Her FHP was reduced, and questionnaire results indicated substantial improvements to quality of life.

Conclusion: Further research is suggested to determine specific massage therapy techniques most effective at reducing WAD symptoms; however, this multi-modal approach to treatment may be beneficial for lessening neck and headache pain of similar patients.

Keywords: whiplash, WAD, chronic tension headaches, massage therapy, trigger points

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Headaches are one of the most common disorders of the nervous system and cause a wide range of functional limitations; however, sufficient research, consistent categorization, and effective treatment approaches remain lacking. Though they occur most frequently, tension type headaches (TTH) remain somewhat ambiguous. Stovner et al.[(1)] and Page[(2)] estimate a global prevalence of TTH among the adult population currently experiencing headaches to be approximately 40%, with chronic daily headaches (CDH) (any headache lasting more than 15 days per month) occurring in 3%. The International Headache Society[(3)] classifies 14 categories of headaches, making differential diagnosis complex as a patient may experience more than one form at the same time[(4)]. Furthermore, headaches can be precipitated by a combination and sometimes self-perpetuating set of factors including postural dysfunction, pain, emotional stress, and trauma.

TTH are understood to be spinally mediated, meaning that the origin of pain can result from trigger points (TrPs) and dysfunctional cervical facet joints, intervertebral discs, muscles, tendons, or ligaments. When increased nerve firing occurs due to the aforementioned nociceptive sources, afferent hyperactivity allows normally benign stimuli to produce efferent firing from that spinal segment[(4)]. This leads to the correspondingly innervated skeletal muscle becoming overactive thereby producing pain, headaches, hypertonicity and related postural compensation. This is termed “spinal facilitation” and is supported by research from Olesen[(5)], who determined that in chronic TTH, nociception is primarily myofascial, and perceived headache intensity is determined by the, “sum of nociception from cephalic arteries and pericranial myofascial tissues

converging upon the same neurons". Spinal facilitation can be exacerbated by disturbances such as emotional stress, postural dysfunction, and trauma, which can lead to CDH. These daily or near daily headaches may be experienced with fluctuations in pain levels, increased tension in related musculature, and a decrease in quality of life. Stovner et al.[(1)] postulate that patients affected by CDH are "probably the most incapacitated" of all groups of headache disorders.

Whiplash is a common mechanism of injury that results in headaches. The term describes an acceleration-deceleration injury to the head and neck relative to the body, and is commonly a result of motor vehicle collisions. Three types of motor vehicle collisions can cause whiplash including front impact and side impact, with rear impact collisions resulting in more long term symptoms[(6)]. The impact causes the head to be suddenly thrust backward resulting in hyperextension of the neck and overstretching of the anterior cervical spine muscles and ligaments. This is followed immediately by a sudden thrust forward resulting in hyperflexion of the neck and possible damage to the posterior cervical spine. Any structure of the neck, upper thorax, and head may be injured including facet joints, joint capsules, intervertebral discs, vertebrae, muscles, ligaments and fascia. The trauma sustained from damage to such structures may result in temporary symptoms or more chronic, long term problems; this wide range of presentations have been collectively coined as "whiplash associated disorder" (WAD)[(7)]. The Quebec Task Force, the first body to develop recommendations regarding the categorization of WAD, outlines 4 grades from moderate to severe injury[(7)]. Many factors play into the grading classification, such as body position at the time of incident. For instance, if a patient's head is rotated, the cervical spine is biomechanically less able to extend. During impact this leads to greater compressive forces on the ipsilateral facet joints, intervertebral foramen, and cervical

nerve roots[4]. Pain and restriction usually develops over the following 24-48 hours[6], making it difficult to determine the severity of trauma sustained immediately post incident. Chronic WAD can result in headaches, hypertonicity and TrPs in affected muscles, and reduced range of motion. Persistent neck pain and headaches after 2 years post whiplash injury are reported by more than 30% of patients[8]. Page[2] suggests that TTH can also be responsible for neck pain, making it difficult to diagnose whether the headache is of primary or secondary origin.

Rattray and Ludwig[4] describe the pain of TTH as "bilateral, diffuse and constant", with an episodic nature that may have no identifiable onset or end time. The location of pain has been described as the "referral pattern" of TrPs from specific muscles[9]. The sternocleidomastoid (SCM) muscle has often been implicated in WAD and TTH, with TrPs presenting primarily as frontal headaches accompanied with different autonomic or proprioceptive disturbances. Simons et al.[9] describe the clinical definition of a TrP as a "hyperirritable spot in skeletal muscle that is associated with a hypersensitive palpable nodule in a taut band… the spot is painful on compression and can give rise to characteristic referred pain, referred tenderness, motor dysfunction, and autonomic phenomena". The activation of such a nodule is further described as the result of a mechanical overload, and perpetuated by persistent strain caused by structural inadequacies; these inadequacies are the result of a TrP causing inhibition or excitation to functionally related muscles, thereby manifesting new TrPs and a cyclic nature of pain[9]. Current research is in favour of TrP pressure release in the treatment of TTH[10,11], finding a reduction in TrP metabolic activity, diminished patient pain sensitivity, and a decreased frequency of headache occurrence. Likewise, research from Toro-Velasco et al.[12] demonstrate the effectiveness of TrP therapy in conjunction with general Swedish massage (GSM) on reducing

autonomic nervous system responses that may serve to worsen systemic tension and patient pain. As such, this case study will explore the efficacy of TrP pressure release therapy on the SCM and affected musculature originating from WAD, and the resulting effects on chronic daily tension headaches.

Methods

Patient Profile

The subject in this case study is a 32-year-old female who is a full time business analyst with no history of neck pain or headaches. On average, she attends the gym twice per week, focusing on a mixture of weight training, aerobic exercise, and yoga. Her office job entails 40 hours per week of seated desk work, and her activities of daily living (ADL's) consist primarily of general household maintenance and outdoor leisure activities such as hiking.

In June of 2015 the subject was involved in a rear impact motor vehicle collision. She was stopped at a stop light and was struck from behind; she noted she saw the vehicle coming and tensed for impact. She was wearing her seatbelt with her head rotated to the right looking in the rear view mirror and had both hands on the wheel. Her headrest was adjusted properly to protect from cervical hyperextension. The impact was not severe enough to deploy the airbag, her head did not strike anything upon forward hyperflexion.

The subject was diagnosed by her physician with soft tissue damage. Her major complaint in the 2 days post collision was right sided shooting pain along her upper trapezius, posterior cervical spine, and suboccipital muscles, which limited all ranges of motion as well as ability to perform ADL's.

Upon initiation of physiotherapy intervention 1 month later, her pain worsened. Massage therapy also exacerbated the subject's symptoms and she discontinued both modalities after a few sessions each. Six months post incident she began exercise rehabilitation with a kinesiologist and continued for approximately 1 year; she noted that it made a significant difference wherein her resting pain was almost non-existent and would only be aggravated by excessive physical activity. She experienced no headaches during this time.

During this period the subject was on maternity leave. Upon concluding exercise rehabilitation, she settled her insurance claim and returned to work January of 2017. In April the subject began experiencing frontal headaches across her forehead. She described the intensity as a dull ache, sometimes disorienting when severe, with a daily frequency. The subject sought treatment from her general practitioner, who determined there was no identifiable cause of origin and had little in the way of recommendations. She was referred to an optometrist for glasses to lessen eye strain, however these offered no relief. The subject's desired outcomes of the study were primarily to reduce both the intensity and frequency of her headaches, as well as lessen residual posterior neck pain.

Observation

A postural assessment of the subject in the anterior view revealed asymmetry of shoulder heights, with the left glenohumeral complex slightly elevated. Laterally, she exhibited a forward head posture (FHP), with her external auditory meatus sitting anterior to her humerus, a slight thoracic hyperkyphosis, and internally rounded shoulders. Her SCM muscles projected vertically instead of posteriorly. A posterior view confirmed the raised left shoulder and revealed mild scapular winging bilaterally.

Palpation

Hypertonicity of the upper trapezius was palpated bilaterally with some point tenderness. The left infraspinatus, latissimus dorsi, and teres major and minor were noticeably more toned compared to the right. Bilateral SCM muscles were palpated for TrPs, and presented taut, tender, and referred on palpation which mimicked the subject's headache pain complaints. Restricted mobility of the fascia was present overlying the anterior neck.

Movement

Active range of motion (AROM) of the cervical spine was obtained using a goniometer. Details of degrees obtained pre and post study can be found in Figure 1 below and details of reported pain during these tests can be found in Figure 2. Isometric testing in each range was performed to determine general strength as well as possible locations of TrPs, as pain is likely to be experienced when muscles with active TrPs are strongly contracted against fixed resistance[9].

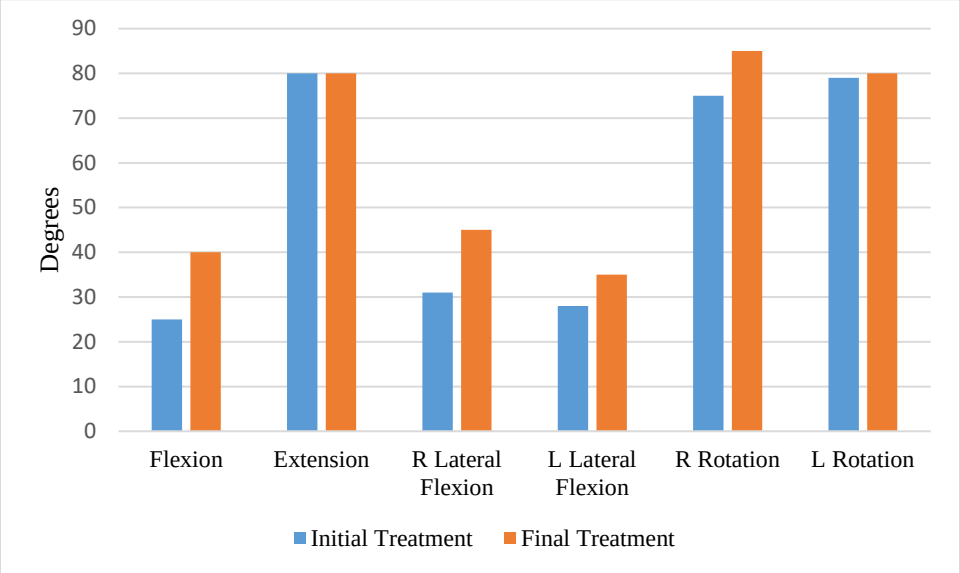

Figure 1. Cervical spine AROM data from initial and final treatment.

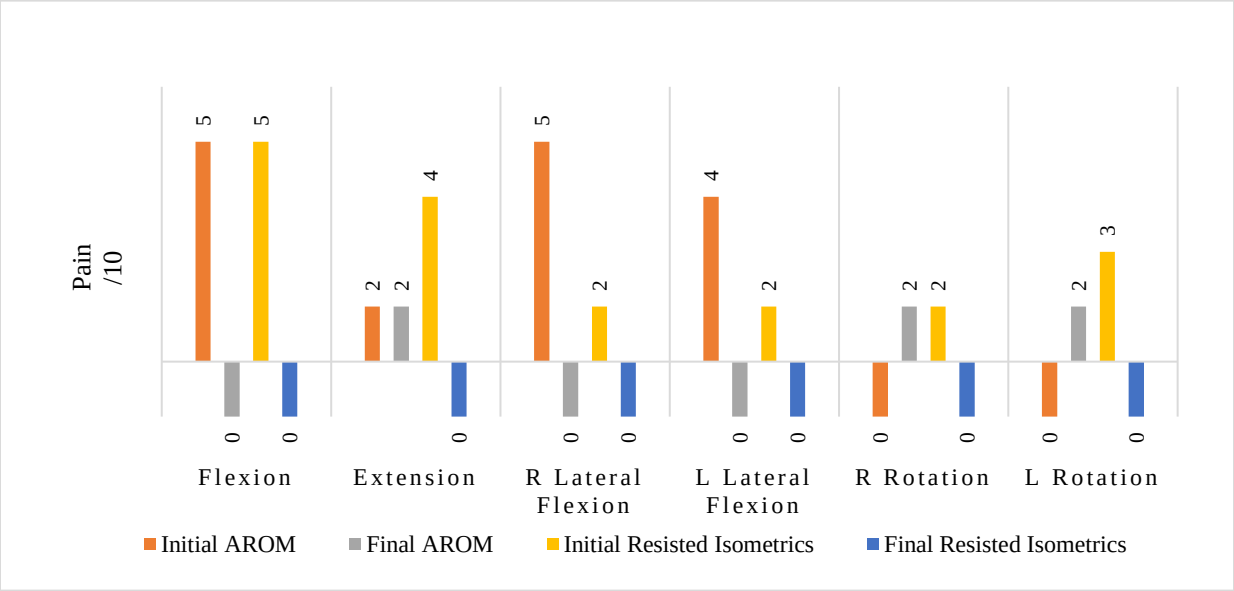

Figure 2. Pain results of cervical spine AROM from initial treatment and final treatment.

Manual muscle tests (MMT) of all major cervical spine movers were assessed to determine any weakness. Details of grades achieved and elicited pain responses can be found in Table 1. All MMT were performed as described in Kendall[13].

Table 1

Manual Muscle Test Strength and Pain Results

Manual Muscle Test	Initial Treatment	Pain (/10)	Final Treatment	Pain (/10)
Anterior Neck Flexors	5	5	5	3
Anterolateral Neck Flexors				
Right	5	5	5	0
Left	4	1	5	0
Posterolateral Neck Flexors				
Right	5	1	5	0
Left	5	1	5	3
Upper Trapezius/Levator Scapula				
Right	5	0	5	0
Left	5	0	5	0
Mid Trapezius/Rhomboids				
Right	5	0	5	0
Left	5	0	5	0
Lower Trapezius				
Right	4	0	5	0
Left	4	0	5	0

Note: Anterior neck flexors include longus capitis, longus colli and rectus capitis anterior. Anterolateral neck flexors include SCM and scaleni. Posterolateral neck flexors include splenius capitis and cervicis, semispinalis capitis and cervicis, and cervical erector spinae.

Neurological Symptoms

The subject reported no signs of neurological involvement during this case study.

Referral Pain

The subject described her headaches as frontal, above her eyebrows, and across her forehead. Upon pressure palpation of her SCM muscles, the subject felt referral pain consistent with her headaches, and agreed that her pattern fit with the visual representation of the SCM documented referral pattern (Figure 3). Simons et al.[9] note that if the patient recognizes the elicited sensation, the TrP is considered active; this is, “one of the most important diagnostic criteria available when palpable findings are also present”.

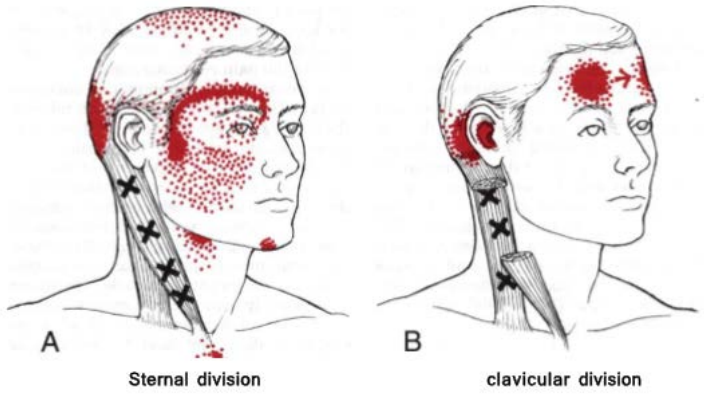

Figure 3. Referred pain patterns (in red) and locations of common trigger points (Xs) in the right sternocleidomastoid muscle[(9)].

Special Tests

In addition to the orthopedic testing mentioned above, a number of special tests were employed which confirmed the subject's SCM musculature and related postural dysfunction as the primary contributor to her headaches (See Appendix A).

Secondly, as neck pain is reported in up to 95% of clients with WAD, disability questionnaires are often used for assessing the extent of functional impact experienced by the patient[(14)]. Four questionnaires were filled out by the subject during the assessment and final treatment, with higher scores indicating a greater level of impairment. These tests measured subjective variables of the physical and cognitive effects of both WAD and headaches on ADL's.

Lastly, the subject was instructed to fill out a daily headache diary, tracking variables of frequency, intensity, and duration.

Treatment Plan

An initial assessment, 8 massage therapy treatments, and a final assessment were conducted over an 11 week period, at a duration of approximately 50 minutes each. The majority of treatments occurred once weekly, however 3 bi-weekly modifications were made to suit the

subject's work commitments. GSM to the upper back and neck as well as diaphragmatic breathing were employed due to their beneficial effects on the nervous and musculoskeletal system. These include increased circulation and decreased sympathetic nervous system firing, both equating to decreased pain perception[4]. Treatment focus to bilateral shoulder girdles was included to reduce hypertonicity associated with compensatory patterns from her FHP. TrP pressure release was performed as outlined in Simons et al.[9] bilaterally to the SCM, upper trapezius, and posterior cervical muscles; these muscles can be easily overloaded when head position must adjust to level eyes in compensation for a tilted shoulder girdle[4]. Joint play to individual cervical spine vertebrae intended to increase mobility to hypomobile segments and passive cervical range of motion was used to maintain joint health. Treatments concluded with suboccipital decompression and long axis cervical traction for their valuable effects on tension release[4].

Treatment Details

Treatments were designed to be consistent. Modifications were made to treatment 3 to explore potential TrPs in the masseter and temporalis muscles, as well as treatment 6 where a full body relaxation massage was performed to reduce emotional distress and sympathetic nervous system firing as the subject had experienced a personal tragedy days prior.

The subject was positioned in prone for 20 minutes, applying GSM to the full back including techniques such as longitudinal stroking, c-scooping, and thumb kneading. Muscle stripping was applied bilaterally to the paraspinal, levator scapulae, upper trapezius and infraspinatus muscles. Attachment release was performed at the tendinous insertions on the greater tubercle of the humerus. Active myofascial release was applied to the left latissimus dorsi

and teres major and minor complex for 8 repetitions of internal and external glenohumeral rotation. By treatment 3, there was a notable decrease in the subject's left scapular winging. TrP pressure release was applied to 1 tender point in the upper trapezius muscles bilaterally, using slowly increasing, non-painful pressure until reaching a barrier of tissue resistance. Contact was maintained until the barrier released to eliminate the TrP tension. Increased pressure was required in each subsequent treatment to elicit the same pain response. The subject was then positioned in supine for 30 minutes. A sternal facial shear was employed inferiorly for 90 seconds until the anterior neck fascial resistance lessened. Palmar stroking was applied to the anterior chest and posterior neck. Stripping was applied to the posterior cervical muscles, and the aforementioned TrP pressure release technique was applied to a tender nodule on the right side. This was followed by bilateral stripping to the scaleni and golgi tendon release to the SCM muscles. TrP pressure release was performed to 2 areas on each of the clavicular and sternal portions of the SCM, ensuring any radiating pain was eliminated before releasing pressure. By treatment 4, the SCM attachment and muscle belly were remarkably more pliable, and radiating pain was of less intensity, especially on the right side. Attachment release was performed to the mastoid process and tendinous attachments of the clavicle. The treatments were concluded by applying segmental joint play to the cervical vertebrae, where it was noted that the spinous process of the most sensitive segment, C4, felt slightly rotated to the right. This was followed by suboccipital decompression with active myofascial release utilizing 10 repetitions of cervical retraction, concluding with 60 seconds of long axis cervical traction.

Home Care

Cervical spine treatment in combination with exercise has been exhibited to significantly decrease neck pain, while simultaneously increasing range of motion, strength, and endurance[15]. Jull[16] estimates that 15-20% of chronic TTH are related to musculoskeletal impairments. As such, home care exercises were prescribed to increase strength of the deep cervical flexors, mid-back stabilizers and external glenohumeral rotators, with stretching exercises targeted at pectoralis major and minor (See Appendix B for exercises and rationale).

Results

The results of this study had very positive results in duration and intensity of TTH however there was little change in the frequency of the subject's CDH (Figure 4).

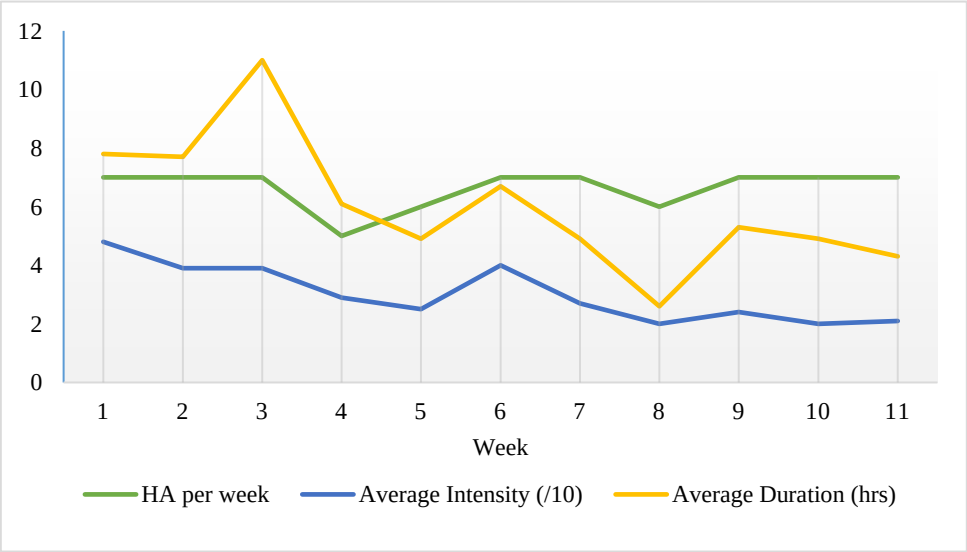

Figure 4. Headache frequency in number of days per week (green), intensity in pain /10 (blue), and duration in number of hours per day (yellow) over an 11 week period.

Her cervical spine range of motion increased in all areas except extension, which was initially of normal range (Table 2). The subject made considerable improvements in all

questionnaires (Table 3), indicating an improvement from moderate to mild disability. There was no change bilaterally in pectoralis major, minor, or latissimus dorsi length tests. The MMT of her right anterolateral neck flexors as well as bilateral lower trapezius muscles improved from a 4 to a 5, indicating full strength, and cervical pain decreased in most MMT from initial to final treatment. The most notable change occurred after treatment 3 where, for all subsequent post treatment TTH, the subject reported a rating of 0/10.

Table 2

Active Range of Motion of the Cervical Spine in Degrees

Range of Motion	Normal Range	Initial Treatment	Final Treatment	Degree Difference	% Value Change
Flexion	45-50	25	40	+15	+60%
Extension	85	85	85	0	0
Lateral Flexion					
Right	40	31	40	+9	+29%
Left	40	28	35	+7	+25%
Rotation					
Right	90	75	85	+10	+13%
Left	90	79	80	+1	+1%

Table 3

Initial and Final Assessment Scores of WAD and Headache Questionnaires

Questionnaire	Initial Assessment Score	Final Assessment Score	Value Change	Clinical Improvement
Neck Disability Index	17/50	9/50	-8	47%
Headache Disability Index	48/100	28/100	-20	42%
Whiplash Disability Questionnaire	33/130	14/130	-19	58%
Bournemouth Neck Pain Questionnaire	19/70	5/70	-14	74%

Note: Questionnaires were retrieved from the following sources: Neck Disability Index[(14)], Headache Disability Index[(17)], Whiplash Disability Questionnaire[(18)], Bournemouth Neck Pain Questionnaire[(19)].

In addition to headache and cervical pain improvements, the subject also made significant improvements in posture and work biomechanics awareness as shown below in Figure 5.

Figure 5. Postural improvements. Blue lines from left to right indicate apex of thoracic kyphosis, line of gravity through humeral head, and tip of nose, respectively. Top left: initial assessment posture. Top right: initial assessment work biomechanics. Bottom left: final assessment posture. Bottom right: final assessment work biomechanics.

Discussion

The subject of this case study presented with chronic WAD and daily TTH. Through a combined treatment approach of GSM, TrP pressure release, and exercise therapy, significant improvements were made in intensity and duration of CDH, as well as posterior cervical pain. Unfortunately, this study could not control for numerous variables. As mentioned, emotional stress plays a large role in provoking WAD symptoms. After treatment 4, the subject experienced 2 weeks wherein she did not report headaches on a daily basis. Just prior to treatment 6 she experienced a personal tragedy, and in all following weeks her TTH resumed to a daily frequency. However, intensity continued to diminish as treatments continued and the importance of continuing steady home care was reiterated. Research by Jull[(20)] supports this integrative approach to rehabilitation; 2000 individuals with cervical headaches who engaged in manipulative therapy and a low load exercise program focusing on stabilizing longus colli, a deep cervical flexor, had a reduction in headache frequency and intensity, as well as diminished neck pain. These muscles have been shown through EMG studies to be strong flexors of the neck, providing stabilization and also serving a strong proprioceptive role[(21)]. Maintaining proper function is therefore integral as partial tears of the longus colli and SCM muscles are the most common after an acceleration-deceleration accident[(6)]. Without the synergistic contractions of these deep flexors, isolated bilateral contraction of the SCM leads to unfavourable capital extension, thereby perpetuating FHP and related postural dysfunction[(22)]. Jaeger[(23)] found 12 out of 12 CDH patients had at least 3 myofascial trigger points on their symptomatic side which reproduced their headaches over 50% of the time. Therefore, encouraging proper strengthening

exercises to combat FHP and performing TrP pressure release on associated musculature appears to be an effective treatment option for those suffering from WAD.

Limitations

Firstly, this study could have been improved by spending increased treatment time on possible TrPs in the masseter and temporalis muscles as active TrPs in the SCM can manifest secondary TrPs in these locations and contribute to TTH[4]. This strong association was not fully understood prior to the beginning of this case study, and as such was not a primary focus. One treatment was reserved for investigation of these possible TrPs, and indeed the subject's right masseter included tender nodules on palpation, however this course of treatment was not continued through subsequent sessions so as to maintain consistency.

Secondly, although necessary for the purpose of this study, the use of pain diaries has been researched as detrimental to positive treatment outcomes[24]. Accurately assessing intensity, duration, and nature of pain is important for managing WAD and evaluating treatments, however Ferrarri & Louw[24] suggest that pain diaries encourage patients to be more cognisant of symptoms. Because pain is subjective, the feeling of recovery is partly based on perception. Consequently, the use of a diary may significantly alter results in a negative manner.

Conclusion

WAD is a condition that comprises a wide range of symptoms and can lead to many dysfunctional compensatory patterns. Evans[8] argues that rather than debating the classifications and categorizations of WAD, it is more beneficial to determine which current treatments are most successful and develop new treatments to help whiplash victims with chronic pain. Three quarters of headache patients experience dissatisfaction when seeking medical treatment; Cady

& Fox[25] postulate that physicians view headaches as a symptom rather than the primary condition. When diagnostic tests fail to reveal an underlying pathology the physicians feel that they cannot offer further guidance to their patients. Further research is required to determine specific massage therapy approaches most beneficial for these clients, however a combination of manual therapy, therapeutic exercise, and stress reduction appears to be the best multi-modal approach effective at treating WAD and chronic headaches.

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Appendix A: Special Tests

A number of special tests were employed to confirm or deny the involvement of the subject's SCM musculature and related postural dysfunction as the primary contributor to her headaches (Table A1). Alar ligament tests ruled out cervical instability and the vertebral artery test ruled out vascular insufficiency. The scalene cramp test was negative for active TrPs. A pectoralis major length test revealed shortness of the sternal fibres bilaterally, and a latissimus dorsi length test was also positive bilaterally, with both tests marked by abducted arms being unable to drop to table level while supine. A pectoralis minor length test was conducted with the subject lying supine and observing the position of each shoulder girdle, revealing a positive test for shortness on her left side. All tests were performed as described in Magee[26] and Kendall[13].

Table A1

Special Test and Length Test Results from Initial and Final Treatment

Test		Initial Treatment	Final Treatment
Alar Ligament Rotational Stress Test		(-)	(-)
Alar Ligament Lateral Flexion Stress Test		(-)	(-)
Vertebral Artery Test		(-)	(-)
Scalene Cramp Test			
	Right	(-)	(-)
	Left	(-)	(-)
Pectoralis Major Length			
Sternal Fibres	Right	(+)	(+)
	Left	(+)	(+)
Clavicular Fibres	Right	(-)	(-)
	Left	(-)	(-)
Pectoralis Minor Length			
	Right	(-)	(-)
	Left	(+)	(+)
Latissimus Dorsi Length			
	Right	(+)	(+)
	Left	(+)	(+)

Appendix B: Home Care Exercises

The following exercises (Figure B1, B2) were prescribed with the intent of combating precipitating factors of chronic TTH, including dysfunctional posture, spinal facilitation leading to ischemia, and improper mobility of vertebral segments. The subject was instructed to alternate each set of exercises daily for 3 sets of 10 repetitions, and while in supine, maintaining slight cervical retraction and a neutral spine (midway between the extremes of an anterior and posterior pelvic tilt) for proper stabilization. As Houglum[21] states, "as with shoulder performance and stability of the scapula, motions of the trunk and extremities are executed more accurately and safely when the trunk stabilizers perform their role of providing a stable base for functional activities". Likewise, Kisner & Colby[15] describe the addition of simple upper extremity motions to segmental and spinal stabilization in initiating training of the global stabilizers. Pectoralis major and minor were to be stretched daily against a door frame with arms abducted to 45^{o}, 90^{o}, and 120^{o}, holding each range for 30 seconds and performing 3 repetitions of each stretch, as described in Kisner & Colby[15].

The subject adhered to the program very well by completing the stretches and exercises 4-5 times per week. She was instructed to discontinue any exercises which provoked pain, or if cervical or headache discomfort worsened significantly post session. She was also encouraged to continue with her general strengthening and aerobic conditioning program at the gym twice weekly as these modalities strengthen the neck through accessory muscles of respiration[4].

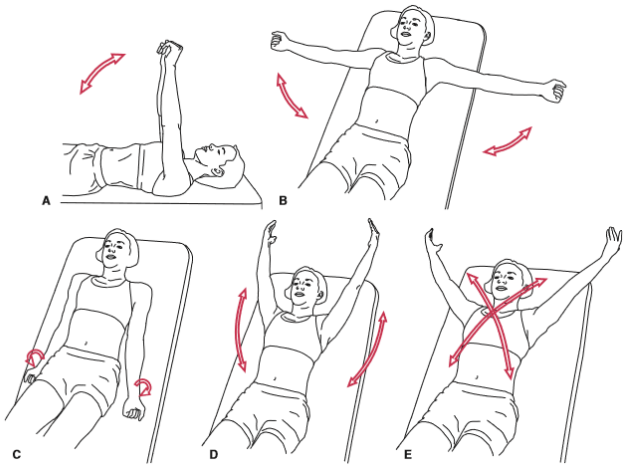

Figure B1. Stabilization of cervical musculature in the supine position with limb loading progressions as follows: (A) shoulder flexion to 90º, (B) shoulder abduction to 90º, (C) shoulder external rotation, (D) shoulder flexion and abduction to end rage, (E) diagonal patterns[15].

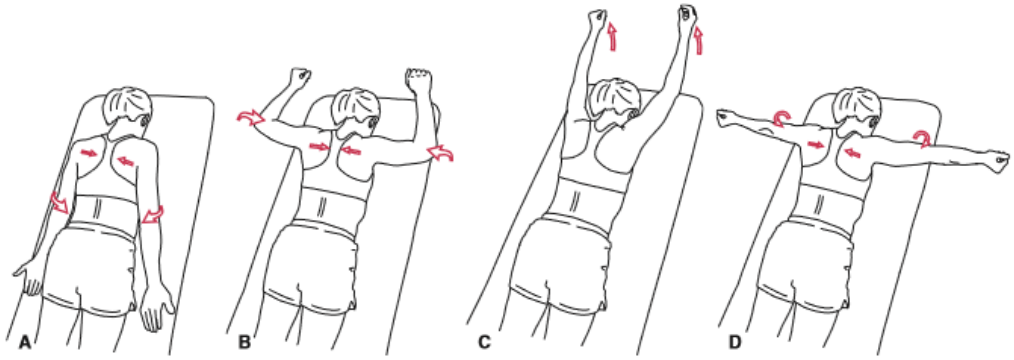

Figure B2. Stabilization of cervical musculature in the prone position with limb loading progressions as follows: (A) shoulder eternal rotation and scapular adduction, (B) horizontal abduction and scapular adduction, (C) shoulder elevation to full range, (D) shoulder external rotation, horizontal abduction and scapular adduction[15].