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A Case Study Involving Myofascial Symptoms Following a Motor Vehicle Collision and Their Treatment with Manual Therapy and Intramuscular Stimulation

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Introduction

This patient is a 27 year old female who was involved in a multiple vehicle collision (MVC) at 3:30pm on November 19, 2012. At the time of the accident, she was the seat-belted driver of a vehicle that was stopped. Both of her hands were on the steering wheel and she was looking forward when her vehicle was struck from behind. There was a headrest in place and she could not recall if she hit her head against it. She denied any loss of consciousness at the time of the accident. The patient noticed immediate stiffness in her neck and felt generally stiff and sore. She developed a headache later in the evening for which she took Tylenol. The day after the MVC, she indicated that her neck hurt and she felt like something was "out". She did not seek immediate medical intervention or diagnostic testing. She had an appointment with her family doctor three days after the accident and was subsequently booked for a physiotherapy assessment within seven days of her injury.

At the time of the assessment, the patient's main subjective complaints were neck pain, upper thoracic pain and headaches. She did not have any radicular or neurological symptoms and did not have any cardinal signs and symptoms (including dizziness, tinnitus, vertigo, nausea, diplopia, dysphagia, dysarthria, dysphasia or drop attacks). Outcome measures were implemented with the following results: Yellow Flags Questionnaire = 63 (a score of 62-77 is a moderate risk for chronicity); Neck Disability Index (NDI) = 18% (a score of 9-28% is a mild disability); Headache Disability Index = 42% (a score of 31-60 is a moderate disability).

The patient was a single mom of two young children. She worked as an insurance broker. She was healthy with no history of medical problems. She was involved in a car accident 12 years prior to the subject MVC, which resulted in neck and thoracic pain as well as headaches. The patient received physiotherapy for the injuries sustained in the first MVC, including manual and manipulative therapy, over a period of two years. During this time, her neck and thoracic pain improved, with only mild and intermittent residual symptoms. She had discontinued treatment because she could not afford to continue once her MVC claim was closed. Both areas of pain were re-aggravated by the subject MVC.

Seven years after completing the treatment from her first MVC, the patient returned to full time work. When she returned to work, she started to develop headaches that would last for two to three days at a time and would occur approximately one time per week. There was no other specific precipitating trigger that caused the recurrence of these symptoms. Her headaches were in two distinct areas located at the back of the head and in her forehead. She indicated that the headache would change from the left to right and her neck was typically tender at the time of the headache. Aggravating factors included keeping her head turned for 20 minutes (e.g. in conversation with someone) and looking down or bending down (bending down in particular caused a pulsing headache). Easing factors included looking straight forward (e.g. facing the person she was talking to), heat, hot showers, spinal manipulation, massage and sometimes medication such as Tylenol, Advil or Excedrin would help. She had a contour pillow which helped her sleep and she had a lumbar support for sitting in her car and at work.

The patient had started physiotherapy again for her headaches before the subject MVC. Treatment consisted of manual therapy including spinal manipulation. She had one treatment per week over a six-week period and was then referred to another physiotherapist for Intramuscular Stimulation (IMS) treatment. Her headache started to resolve after two IMS treatments and she had no headache for one full week between the 4th and 5th IMS treatments. She had a total of six IMS treatments before the second MVC occurred during which her neck pain, thoracic pain and headaches were re-aggravated. Aggravating and relieving factors were the same as those prior to the subject MVC with the exception that medication no longer seemed to help.

Activity Limitations and Participation Restrictions

The patient described several Activity Limitations following the recent MVC. Shoveling sidewalks, swimming and her usual exercise activities all aggravated her neck pain and headaches. She eventually had someone else shovel the sidewalks and limited her swimming and exercise activities. The patient

continued to have increased neck pain and headaches if she had her head turned to talk to someone (within 10 minutes of performing this movement) and activities such as vacuuming and sweeping also had to be limited. She had difficulty bending over while gardening, a limitation that persisted up to seven months after the MVC.

In the initial two weeks after the MVC, the patient had to leave work on one occasion due to a severe headache. Since this was not a recurring issue, it was not considered a Participation Restriction. However, the patient did have to have her mom come to help her with her kids on a few occasions as she was unable to cope and keep up with their regular routine, representing a Participation Restriction in her role as primary caregiver.

Potential Mechanisms Influencing Patient Presentation

The two main mechanisms influencing the patient pain presentation were nociceptive pain and neuropathic pain. The nociceptive pain occurred due to both chemical and mechanical transmission. Chemical transmission was due to the release of chemicals as part of the inflammatory process following tissue damage and ischemia. Mechanical transmission was due to a decrease in the threshold for mechanical stimuli that fire A-delta and/or unmyelinated C-fibres.

Neuropathic pain was the most likely reason for the ongoing pain after the first accident and was starting to resolve with IMS prior to the second MVC. Clinical features of neuropathic pain that were present for this patient included pain in the absence of ongoing tissue damage, delay in onset after precipitating injury, mild stimulus causing extreme pain (allodynia), pronounced summation and after reaction with repetitive stimuli and loss of joint range and pain caused by the mechanical effects of muscle shortening.

(1)

Clinically Perceived Level of Irritability

The severity of the injuries for this patient was mild to moderate. There were no neurological symptoms or deficits, fractures, dislocations or injuries that required significant medical intervention.

The patient's clinically perceived level of irritability was high. Small amounts of activity easily provoked and aggravated her neck pain and headache which would often last for two to three days. Her headaches would change sides and vary in intensity and duration. Although she was often able to reduce her symptoms, the response was variable and inconsistent. She was not always able to alleviate the pain on her own and she had to limit her activities significantly (e.g. shoveling, swimming, etc. as noted above).

Patient Specific Flags

There was no indication of Red Flags, Orange Flags or Blue Flags. (2)The Yellow Flags Questionnaire Score of 63 indicates a moderate risk for chronicity.(3)The fact that she did have chronic pain prior to the MVC was another indication that there was the potential for ongoing long-term pain. However, prior to the accident, she had had a positive response to treatment and significant relief of her headaches.

There was an indication of Black Flag signs as the treatment proceeded.(2) She had difficulty with her insurance adjustor approving treatments, which initially created an emotional response of anger and frustration from the patient. Since she was an insurance broker, her understanding of the insurance system was helpful in resolving this issue.

The patient also had a barrier to treatment when her work supervisor started questioning her attendance for weekly treatment and refused to allow the patient to work an extra 30 minutes at the end of her shift to make up for the additional 30 minutes of time off during her lunch break which she used for treatment. Her ability to change her schedule was also limited due to the time commitment of being a single parent with limited external support. The patient ended up taking some days off work and made other arrangements for time off on Fridays during which she attended treatment.

Potential Risk Factors / Prognostic Indicators

One of the initial potential risk factors identified was that the patient had a previous MVC and had headache symptoms prior to the accident. She was already having treatment for mechanical and neuropathic pain at the time of the second MVC.

She had recurrent aggravation of her neck pain and headaches with simple ADLs which would affect her function and ability to tolerate treatment. There was often significant allodynia which required treatment modification and therefore affected the speed of her recovery and progression of the treatment plan. This increased pain affected her ability to work efficiently and effectively due to a lack of concentration. It also affected her ability to take care of her children and remain committed to her personal responsibilities.

Hypothesis/Analysis

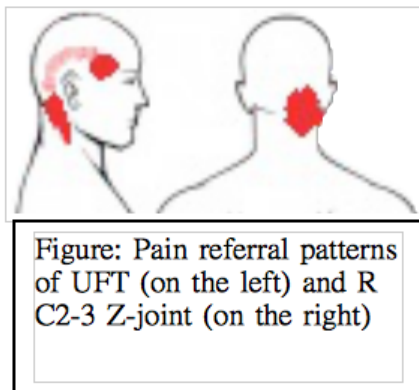
The working hypothesis was that this patient had a combination of inflammatory, mechanical and neuropathic pain of the cervical and thoracic spine. Her headache was hypothesized to be cervicogenic in nature.

It was hypothesized that she had inflammatory pain immediately post-MVC due to tissue damage and the release of chemicals during the inflammatory process after her injury. She had generalized stiffness of the neck and thoracic spine and very little activity aggravated her pain, stiffness and headaches. There was little she was able to do to manage her pain other than medication, which was minimally helpful. Her neck was very sensitive to palpation and light touch, therefore hands on manual treatment was minimized.

The patient's subjective complaints of increased neck and thoracic pain with activities such as shoveling, swimming, exercises, ADLs and yard work suggest that this pain was caused by mechanical factors. In addition, prior to the second MVC, decreased cervical AROM was noted on objective examination and her neck pain could be reproduced during testing. AROM testing was performed using inclinometry. (4)She had segmental hypomobility of the bilateral C2-3 and C3-4 facet joints and generalized hypomobility of the right more than the left T1-T6 facet joints and right 1st rib.(5)There was moderate hypertonus of the cervical and thoracic paraspinals, mild hypertonus of the suboccipitalmuscles and moderate tone of the upper fibers of trapezius (UFT). Subsequent to the second MVC, there was significant segmental hypomobility of the right more than left C2-3 facet joints, bilateral C3-4 facet joints and T2-5 facet joints were particularly hypomobile bilaterally. She had moderate to severe hypertonus of the cervical and thoracic paraspinals and UFT, with increased tenderness and spasm of these muscles.

The pre-existing long standing neck and thoracic pain prior to the second MVC and presence of objective neuropathic signs suggests that there was a neuropathic component to her pain. Objective neuropathic signs included severe enthesopathy and trophedema in the cervical spine and T1-8 area. (1)The paraspinal musculature was thickened and shortened, and there was allodynia in the cervical and thoracic regions. She initially responded well to IMS with reduction of her neck pain and headaches, which is another indication that part of her initial pain presentation was due to neuropathic pain. Subsequent to her second MVC, the neuropathic pain was aggravated and increased. Her tolerance for a small amount of activity was greatly reduced, she had severe allodynia along with pronounced summation and after reaction with repetitive stimuli. These are key clinical features of neuropathic pain as noted above. (1)

Sustained neck positions,ADLs and exercise all aggravated the patient's neck pain and subsequently caused a headache. This temporal relationship supported a diagnosis of cervicogenic headaches. (6,7)The headache distribution was in the referral pattern of the UFT and C2-3 facet joint irritation (shown in Figure). (8,9)The UFT would have been activated and contracting during all the aggravating activities and the C2-3 facet joint could be irritated during such postures and activities as well.



Outcome Measures

The three outcome measures that were used with this patient were: Yellow Flags Questionnaire, Neck Disability Index (NDI) and Headache Disability Index (HDI).

The Yellow Flags Questionnaire was chosen to help determine the likelihood of chronicity of the patient's pain state. (3)A high score indicates that the patient has thoughts and beliefs that correlate with a greater chance that the pain will be chronic and difficult to treat. Improvements in this score or lower scores indicate more appropriate thoughts and beliefs and correlates with a higher level of knowledge regarding their pain state. The score of 63 indicated a moderate risk for chronicity (62-77 = moderate risk for chronicity). (3)

The NDI was chosen as it is a reliable self-report measure of the level of functional disability that the patient encounters as a result of neck pain. (10) A higher percentage correlates with increased disability. This patient's score of 18% indicates a mild disability (9%-28% = mild disability). (10)

The purpose of the HDI scale is to identify difficulties that a patient may be experiencing because of their headache. (11) Since headaches were one of this patient's main complaints, it was implemented. She had a score of 42 which indicates a moderate disability. (11)

Treatment Plan

The treatment plan for this patient consisted of education, inflammatory and pain-relieving modalities, activity modification, therapeutic exercises, manual therapy and IMS.

There is good evidence that a patient understanding pain physiology changes the way people think about pain, reduces its threat value and improves their management of it. (12) The treatment plan was to ensure that this was the foundation of each treatment visit including ongoing education about how to re-integrate daily activities, pacing and self-management with home exercises.

The use of inflammatory and pain-relieving modalities was used sparingly and as needed to help the patient move through the inflammatory phase of her injury. The use of manual therapy was planned to address the segmental hypomobility of the cervical and thoracic facet joints, thereby reducing and improving her mechanical pain. (13) Since she had a good response to IMS prior to the second MVC, IMS was part of the treatment plan to address the neuropathic component of her pain. (14) Finally, therapeutic exercise was planned to help increase her cervical AROM, postural strength and general function in order to help her return to her daily activities.

Response to Initial Treatment and Progression

The initial treatment was focused on education and managing the pain. In addition to education about pain mechanisms and understanding how she could manage the pain at home, ultrasound was initially used on the right C2-4 area to help reduce the inflammatory component of her pain. TENS was applied to the cervical spine to help manage the neck pain.

After the initial two treatments, gentle retraction exercises (25% ROM) were started to improve cervical paraspinal muscle length and increase AROM. Grade 3 manual mobilizations of the right T3-4, T4-5 were commenced to start improving the segmental hypomobility of this area and decrease the mechanical pain she was experiencing.

IMS was introduced on the fourth treatment post-MVC. IMS is performed by inserting a fine, flexible needle (like an acupuncture needle) into a tight, shortened muscle band. The specific muscle band is chosen by the therapist using careful palpation to determine the area of the muscle that is thickened, shortened and/or tender. The needle is then inserted into the muscle band which induces a twitch response and subsequent release of the muscle band. Multiple muscle bands are often released at one time during the subcutaneous penetration of the needle, thus enhancing the full release of the muscle and decreasing pain caused by the muscle shortening.

Initially, IMS treatment was provided to the superficial cervical and thoracic paraspinals from T1-6 using a .25x30 needle (a smaller gauge needle than would have otherwise been used due to the increased tissue sensitivity and allodynia). As the tissue hypersensitivity reduced and the allodynia improved, a .30x30 needle was used and additional muscles were treated including the bilateral levator scapulae, rhomboids and UFT.

Subsequent treatments included the addition of Grade 3 and 4 manual mobilizations of the bilateral C2-3, C3-4 and T1-6 facet joints. The patient's overall cervical AROM increased, her neck and thoracic pain decreased, her headaches improved (decreased severity and frequency) and she was able to return to her daily activities. She had a few set-backs and increased headaches with the re-introduction of daily activities and with the introduction of more therapeutic exercises. In particular, the addition of cervical and scapular stabilization exercises had to be modified by decreasing the resistance, frequency and repetitions. The return to her daily activities (swimming, exercise, housework, gardening) was done over a period of time during which graded exposure was used to help her return to activity. (12) She did require the use of heat and medication at times to help manage the neck pain and headaches as her activity level increased. The use of a pressure point hook was also helpful in controlling and managing her neck pain and headaches. A pressure point hook is a metal "hook" with a round point at the end which is about 1cm in diameter. Due to the shape of the hook, the patient can use the hook to release trigger points on their own in almost any part of the body and it is particularly useful in the neck, shoulder and back areas. aggravation. Imagery work was done daily.

The following is a summary of the changes in the subjective and objective outcome measures that occurred over the course of treatment.

Outcome Measure	Initial	Discharge
Yellow Flags Questionnaire	63 (moderate risk for chronicity)	35 (mild risk for chronicity)
Neck Disability Index	18% (mild disability)	18% (mild disability)
Headache Disability Index	42 (moderate disability)	22 (mild disability)
Cervical AROM	Flexion 51° Extension 45° Right Side Bend 42° Left Side Bend 32° Right Rotation 90% Left Rotation 90%	Flexion 74° Extension 65° Right Side Bend 56° Left Side Bend 54° Right Rotation 100% Left Rotation 100%
Cervical and Thoracic PIVM's and PAVMs	Significant hypomobility C2-3 bilaterally, C3-4 bilaterally and T2-5 bilaterally	Minimal hypomobility C2-3 bilaterally, C3-4 bilaterally and T2-5 bilaterally
Muscle Tone	Hypertonus T1-6 paraspinals – moderate-severe Hypertonus cervical paraspinals – moderate-severe Hypertonus bilateral levator scapulae and UFT – moderate-severe	Hypertonus T1-6 paraspinals - mild Hypertonus cervical paraspinals – mild-moderate Hypertonus bilateral levator scapulae and UFT – moderate
Neuropathic Signs	Enthesopathy – severe Trophedema – severe Allodynia – significant	Enthesopathy – mild-moderate Trophedema – mild-moderate Allodynia – minimal
Activity Limitations	Talk with head turned for 20 minutes Shoveling sidewalks Swimming Other exercise Vacuuming and sweeping Gardening	No limitations
Participation Restrictions	Assistance required with usual caregiving tasks	No restrictions

At the time of writing, this patient is coming for treatment approximately one time every two to three weeks. Treatment frequency will be further reduced over the next one to two months and it is expected she will be discharged at the end of the two-month period.

Since there are still mild underlying neuropathic signs, this patient may require periodic treatment if she does a new activity or increases her activity significantly. She has several strategies to manage any flare ups on her own and hopefully she will continue to live a comfortable day to day life with minimal to no neck pain, thoracic pain and headaches.

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