Clinical Case Report Competition

West Coast College of Massage Therapy
Victoria Part-Time
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Second Place Winner

Kristy Elesko

A multimodal approach for chronic whiplash associated disorder pain
I would like to thank the participant in this case study for his time and effort. I would also like to thank my advisor Dr. Payne for his support and the clinic supervisors in the WCCMT Victoria Intern Clinic for their guidance.

Conflict of Interest

It should be noted that the patient and therapist had a preexisting relationship prior to these treatments commencing. There is no other known conflict of interest.
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Abstract

Symptoms from whiplash injuries often persist long after the initial trauma. Chronic whiplash associated disorder (WAD) symptoms are highly variable, and can have significant impact on a patient’s ability to participate in daily life. This case presentation examines a hyperextension injury, sustained 10 years ago, which presents with regular episodes of pain and muscle spasm. A multimodal massage therapy intervention was applied to the patient over 15 weeks which aimed to decrease muscular hypertonicity, make postural corrections and decrease the patient’s stress levels. The patient experienced a decrease in pain, an increase in active range of motion and reported a significant improvement in physical well being and ability to perform activities of daily living during the course of treatment. The combination of techniques applied may be an effective treatment regimen for improving the daily pain free function of similar patients.

Keywords: Whiplash, WAD, massage therapy,
A Multimodal Intervention to Chronic Whiplash Associated Disorder Pain

Introduction

The colloquial term whiplash refers to a type of injury where the head and trunk of the body experience a sudden and opposing change in velocity. This results in a rapid motion where the cervical spine will either involuntarily hyperflex, and then hyperextend, or the reverse. These injuries are typically associated with motor vehicle accidents, but can be sustained during sports or from any other trauma that involves significant velocity or force. Other terms which describe aspects of this condition include whiplash associated disorder (WAD), cervical acceleration-deceleration injury (CAD) or hyperflexion-extension injury. WAD specifically refers to the highly variable range of symptoms which may not present at the time of trauma. Clinical manifestations seen may include headaches, neck and shoulder pain, Temporomandibular joint (TMJ) dysfunction, paresthesia, dizziness, insomnia and difficulty with memory and concentration. (Harvard Health Letter, 2009)

Whiplash is a disorder defined, not by which structures have been damaged, but by the mechanism of injury, and then refined according to the degree of symptoms experienced over time. The standard classification system, known as the Quebec Task Force Classification (QTF), was developed in 1995 and serves as a grade of severity and treatment protocol (Appendix F, Table 1). The QTF is not without criticism, but has stood as the international standard to which all new research and evidence is applied. Of particular concern is the assertion that WAD is ‘self-limiting’ which does not coincide with other research identifying the tendency for WAD symptoms to become chronic and lead to potential disability (Rattray, 2005). While its conclusions were felt to be based more on consensus of stakeholders rather than quality research, the
QTF classification system and definition of WAD still form the basis of most investigations and guidelines (Foreman & Croft, 2002).

While absolute numbers vary, most investigations into hyperextension-flexion cervical injuries and whiplash associated disorder agree that the condition is both highly variable, and highly disruptive to normal life function. Fifty percent of those who sustain injury will progress to a chronic state and ten percent of all injuries may suffer from persistent disability (Harvard, 2009; Walton, 2013). There is also a body of thought which identifies psychological factors such as stress, fear and emotional trauma as relevant co-morbidities involved in both the initial injury, and its transition to chronicity (Smith, 2013; Harvard, 2009).

WAD injuries have the possibility of creating lesions in most of the structures within the neck. Severe cases are assessed for the potential of fractures in the cervical spine. WAD inducing injuries typically involve the muscle, ligament, joints and nervous tissue of the neck, and the body’s response of guarding and repairing these structures. Which tissues are damaged will depend on the direction of the force, and whether the spine’s initial is to hyperextend (stressing the anterior neck and compressing posteriorly) or to hyperflex (stressing the posterior neck and compressing anteriorly). A rotary force or concussion can also be involved, which may lead to additional injury or longer recovery time (Rattray, 2005; Bacchus, 2011).

Muscles which often experience damage include the sternocleidomastoids, scalenus group, trapezius and longus colli muscles. Strains may also occur in the suboccipitals, intrinsic spinal muscles, cervical erectors, levator scapulae, rectus capitis anterior, longus capitis, platysma and the supra and infrahyoid muscles (Rattray, 2005). Muscular injury may not immediately present with spasm, but
potentially with tenderness or a palpable gap. Hypertonicity and guarding will likely develop over time and be manifestations of a late subacute or chronic injury. These may present with altered posture and function.

Ligament damage often involves the capsular ligaments around the facet joints, as well as the anterior longitudinal ligament (ALL) and posterior longitudinal ligament (PLL). Damage to ligaments visible by MRI have been “correlated with the patient’s self-reported assessments of pain...” (Harvard, 2009, pg. 7). The ligament structures surrounding C0, C1 and C2 can also be stressed with these injuries and need to be assessed to ensure there is a safe amount stability. These include the alar ligaments, the transverse ligament and ligamentum flavum.

The joints commonly affected by whiplash are the facet joints of the cervical spine and the intervertebral joints and discs, possibly resulting in avulsion fractures. Damage may occur along the thoracic spine, or to the shoulder, and these are also common referral patterns for cervical spine lesions. It is important to note that patients with WAD may have multiple injuries stemming from one common traumatic event. As an injury progresses to a chronic state, the combination of damage to muscles and ligaments may contort the patient’s posture, reducing the cervical lordosis. These changes can displace the weight that is usually born by the facet joints on to the intervertebral disc, contributing to greater potential for developing osteoarthritis (Hertlin & Kessler, 2006).

Typically treatment for whiplash involves range of motion exercise, mobilizations, manipulations and short term NSAID use, according to the QTF protocol (Gurumoorthy, 1996). People may associate WAD with the use of a soft cervical collar, but this device is controversial for long term use. The QTF recommends not using a cervical collar more than 72 hours after injury and instead suggests treatment aimed at gently restoring normal motion to the neck (Spitzer, 1995). Treatment for whiplash does remain a subject debate and there is a strong agreement that there is no
This case presentation was conducted to see if a multimodal intervention of general swedish massage (GSM), assisted stretching, diaphragmatic breathing, trigger point therapy and remedial exercise can reduce the frequency and intensity of chronic WAD neck pain. Research conducted regarding the effects of massage therapy on WAD patients, or those with non-WAD neck pain, has generally found insignificant clinical findings to suggest general massage therapy as a comprehensive treatment for chronic pain of this type (Vernon, 2006; Thompson, 2011). These same studies and literature reviews instead present discussion in favour of a more varied approach to treatment, incorporating a variety of active and passive interventions.

The anticipated outcomes from these treatments were to decrease the frequency of spasmodic pain episodes by addressing muscular hypertonicity and increasing circulation to the affected structures. By releasing contracted musculature in the neck and chest, the intent was to help correct the body’s posture and prevent excessive long term strain on the joints of the cervical spine.

Methods

The individual treated in this case study was a thirty year old male ectomorph, 183cm tall and 74 kg in weight. Ten years prior he had sustained a whiplash injury while running down a set of stairs, when his head impacted with a beam. He does not believe his neck was at all rotated at the time of impact. His immediate symptom was head pain, and then neck pain, which developed within twenty four hours.
He was diagnosed with a concussion and whiplash by a physiotherapist and received three sessions of treatment. Stretches along the cardinal ranges of motion were given to the client during these sessions as remedial exercise and over the course of the following ten years, the patient regularly employed them to relieve, or sometimes prevent, aggravated flare ups of pain.

The patient reported regular episodes of muscle spasm and pain, occurring approximately ten times a year. These spasms would last up to three days and be entirely debilitating, leaving the patient unable to work or partake in normal activities. Regular activities of daily living (ADLs) for this patient included seated academic work, often at a laptop, regular walking and hiking and a recent history of practicing martial arts. Aggravating factors included long periods of work (reading or typing at a computer), emotional stress and poor sleep. A history of insomnia and TMJ dysfunction, also triggered by stress, predated the injury. There was no history of balance problems, cognitive dysfunction, paresthesia, dizziness or headache. The patient had no previous experience with massage therapy.

Upon taking a health history, the patient was asked to describe his pain and stress levels according to a Verbal Analogue Scale (VAS) of zero to ten. A response of 10 meant the worst pain or stress the patient had ever experienced and zero marked no pain or stress. The client was also asked to complete the Neck Disability Index (Appendix A) regarding his symptoms prior to treatment and towards the end of the treatment plan (Appendix B)(Magee, 2008). A postural assessment was done and the patient was asked to close his eyes and replicate his work biomechanics (Appendix D, Figure 4).

Prior to the first treatment, the active range of motion of the shoulder was assessed. The patient’s active range of motion at the cervical spine was measured with a goniometer before and after each treatment. These measurements were taken three times, with the median value recorded. The
goniometer was oriented at the patient’s laryngeal prominence while measuring side flexion, and to the most superior point of the head for measuring rotation. Flexion and extension were measured inconsistently, on some occasions by isolating capital range of motion and on others by looking at motion in the lower cervical spine.

Dermatomes and myotomes were tested and an upper limb tension test was done bilaterally. Muscle tests were conducted to assess the relative strength of the neck in flexion, extension, lateral flexion and rotation. Specific muscles, tested for weakness or pain, are noted in Table 2. A series of special tests were conducted as well. (Appendix C)

Over the course of four months, the therapist treated the patient eleven times, with each treatment occurring within twelve days of the previous visit. Treatments were 50 minutes in length and addressed the back, chest, neck and head of the patient. An average of 30 minutes of each treatment was spent addressing the musculature of the cervical spine. The remaining time was spent on areas of secondary concern, such as the back and chest. The seventh treatment was modified due to the patient experiencing low back pain due to physical activity. The tenth treatment was modified to prioritize relaxation as the patient had had a particularly stressful work week.

While the majority of techniques used were consistent through all treatments, the treatment plan did evolve to form three distinct phases. These phases were in response to changes in the patient’s physical activities, improvements in the therapist’s skill and progress made during earlier treatments. The first phase was relatively specific and conservative, spanning the first three treatments. Treatments two through seven were characterized by a greater variety of techniques attempted, as deeper musculature was accessed. The final four
treatments followed the earlier treatment plan, but employed the techniques with greater refinement, specificity and intensity (Appendix E, Table 3).

Diaphragmatic breathing was introduced to the patient during the initial visit and was encouraged during all treatments in order to diminish stress and prevent muscle guarding. Hydrotherapy was also used: a thermophore or hydrocollator was often placed on the client’s posterior neck and chest during treatments for 20 minutes prior to manual work on those areas. When the more assertive techniques of trigger point pressure release or isolytic release were used, the therapist used cold compresses immediately following treatment for a period of 5 minutes.

Passive range of motion of the cervical spine was done two or three times each treatment. This was initially done in the first three treatments by holding the patient’s head in the therapist’s hands and slowly taking the neck to the end range of each cardinal plane. In latter treatments, this technique was performed with the therapist standing and the patient’s head supported in a sling of fabric (Appendix D, Figure 1). Distraction of the cervical spine was used consistently throughout the treatment plan. Short distractions were used after each range of motion technique and a long distraction was held for two minutes at the end of each treatment.

A suboccipital attachment release was performed during most treatments, often as the last technique at the end of the treatment. During the first phase of treatment, this technique was performed by placing the fingers inferior to the occiput and resting the weight of the patient’s head on the therapist’s finger tips.

This position was held for two minutes. During the later treatments, increased pressure was used and the technique was done bilaterally at first, then the patient’s head was rolled to one side and the pressure was maintained unilaterally, allowing for more muscle to be accessed. During these later
treatments, this technique was performed after a series of short, vertical strokes from one mastoid process, along the superior and inferior nuchal lines, to the contralateral mastoid process.

Specific work on the sternocleidomastoid (SCM) muscles occurred during every treatment, although the intensity of the work did vary depending on the presenting condition of the muscle. The muscle was treated with the patient supine, with the neck contralaterally rotated 40 degrees and slightly flexed to bring the muscle to a shortened position. The muscle was treated with deep stroking and stripping, and as the treatments progressed, the therapist was able to use the petrissage technique “picking up” to access deeper tissues. This involved the muscle being lifted by the therapist and kneaded between two fingers. During the second and third phases of treatment the SCM muscle was also treated while the patient was prone, making the sternal head was more accessible.

Anterior scalenes were treated with GSM during every treatment and later treatments included trigger point pressure release therapy. Two trigger points were found and treated in the right anterior scalene, near the origin along the transverse processes. These were identified with palpation and patient feedback regarding referral pain down the medial border of the scapula. Firm pressure was maintained on each trigger point for more than one minute, and until the patient said that the referral symptoms had decreased. This procedure was completed three times for each trigger point and followed with a left lateral flexion stretch.

Isolytic release of pectoralis major was performed during the first two phases of treatment. After warming the tissues with GSM, the lateral portion of the muscle was gripped by the therapist as the patient’s arm was passively abducted. This technique was performed two or three times bilaterally.

During the final three treatments, an assisted stretch was performed with the client to target their SCM and anterior scalene muscles. The therapist placed an anchor hand to stabilize the ribs and clavicle on one side and the patient was directed to slowly contralaterally rotate their head and hold a
gentle stretch at the end of range. After a hold of 30 seconds the patient was encouraged to return their head to neutral at their own pace, and rotate towards the anchor hand. This stretch was then performed bilaterally (Teschke, personal communication, November 2012).

The longus colli muscle was treated on the fourth, fifth and eighth treatments. The process was demonstrated on the patient by a clinic supervisor. The patient rotated their head to the contralateral side of the muscle that the therapist wished to access. Pillows, or the therapist’s hand, supported the head so that the musculature can relax. The patient was reminded that this procedure may feel intrusive, that diaphragmatic breathing should be used, and that consent for the treatment could be withdrawn at any point. The therapist palpated the SCM muscle and applied pressure medial and posterior to that muscle, locating the posterior triangle of the neck (Muscolino, 2010). The therapist landmarked the vertebrae and the carotid artery and then applied GSM to the longus colli muscle from C2 to C6 with a slow, segmental stroking technique.

A variety of techniques were attempted throughout the treatment plan which were not continued beyond a second attempt. These techniques were removed from the treatment plan on the basis that there was not significant restriction found for them to be indicated.

Reassessment was done at the end of every treatment to evaluate active range of motion, facet irritation and isometric muscle strength in involved musculature. When pain was present, the patient was asked to describe the pain and locate it along the verbal analogue scale. The scalene cramp test was assessed at the end of the treatment plan and the patient completed a second NDI form prior to the final treatment (Appendix B). At the end of the treatment protocol another postural assessment was conducted, this time with a plumb line (Appendix D, Figure 3).
Homecare played a significant role in the treatment plan, having been identified as a major contributor for long term improvement (Sherman, 2009). The patient was initially given a stretch to hold for 30 seconds, twice a day, which targeted his pectoralis major muscle and a bent over row with a low weight to begin increasing back strength. By the second treatment, the patient was instructed to continue stretching both his neck and chest muscles, and to replace the row with straight arm wall pushups to target the rhomboid muscles, middle trapezius fibres and serratus anterior. These push ups were to be done every day in three sets of fifteen repetitions. Corrections to the patient’s form were made to ensure that the appropriate motions of scapular protraction and retraction were occurring. As the treatment plan progressed the patient was encouraged to attempt these pushups on the floor, but return to doing them upright if maintaining form became too difficult.

Following the fifth treatment, the patient was also given a chin tuck exercise to strengthen the deeper muscles of the anterior neck and stretch the suboccipital muscles. These exercises were isometric contractions held for 10 seconds and done 5 times a day. The patient was cautioned to stop if any pain resulted from this action. The patient regularly recorded his homecare activities and was self reported as being 70% compliant.

Results

Changes were seen between assessment and reassessment both within treatments, and over the course of the entire treatment plan. Most ranges of motion were not significantly restricted to begin with, but the patient initially could not right side flex without incorporating a rotational element. After the course of treatment the patient’s right side flexion decreased but the rotational element was eliminated. Left and right rotation of the cervical spine both saw increases after each individual
Running Title: MULTIMODAL INTERVENTION FOR CHRONIC WAD PAIN

treatment, while left rotation saw the greatest improvement. Before the first treatment the patient could rotate 59° to the left and before the last treatment the patient was able to rotate 74° to the left. (Appendix F, Table 4)

The cervical spine quadrant test was usually positive on the right side prior to each individual treatment and negative immediately following. The patient’s right facet joints tested negative for irritation on the 7th and 8th treatments, but returned positive on a pain scale of 1 for the 9th treatment. They then tested negative for the final two treatments. The left facet joints showed irritation on only one occasion.

Isometric muscle testing initially revealed some weakness with left lateral flexion of the cervical spine as well as in the middle and lower trapezius muscle fibres. When these muscles were tested again 16 weeks later there was no notable weakness with left lateral flexion of the neck and the muscle grading of the middle and lower trapezius had risen from a 3, to a 4 on a scale of 5. Weakness was seen in the right levator scapulae and rhomboids, but not in the left. Pain was self identified at 2 on the VAS when testing the right posterior scalene and both pain and weakness were identified in the anterior scalene and longus colli muscles. The final assessment indicated that these muscles were at a healthy strength and pain free during contraction. (Appendix F, Table 2)

Throughout the treatments, the patient noted being more aware of his posture, both in daily life and while working. Postural assessment initially noted a head forward position and a loss of cervical lordosis (Appendix D, Figure 2). Palpation revealed hypertoned SCMs, with the right muscle being notably more hypertoned than the left. Pectoralis major was hypertoned and the patient’s line of gravity was anterior to his leg, resulting in a forward leaning position. Mild scapular winging was noted. When subsequent postural assessments were done,
the patient’s head was notably less forward and his shoulders were less internally rotated in the final assessment.

Tissue quality changed notably over the course of the treatments, with reduced hypertonicity through all of the cervical and suboccipital muscles. This is particularly relevant as the anterior scalenes were only adequately accessible to trigger point therapy by the eighth treatment, when surrounding tissues were pliable enough to access the cervical transverse processes. Ultimately the overall muscle and connective tissue of the head, chest and neck appears to have received increased circulation and nutrition, as evidenced by the frequent hyperemia evident after each treatment and in Figure 1 along the patient’s chest.

Finally, patient feedback regarding their well being appeared to change over the course of the treatment. The patient was notably more relaxed following treatments. Cervical traction and suboccipital release holds maintained between two and five minutes resulted in slower breathing rate, closed eyes and patient confirmation of a more peaceful mental state (Hertling & Kessler, 2006, pg. 265).

The patient was also reporting less stiffness and more postural awareness by the third treatment. While the patient did report periods of muscle pain or stiffness, which he attributed to work or exercise, these symptoms were reported as being transitory and not the symptomatic pain he associated with his chronic injury. No symptomatic pain or spasm was reported through the course of this treatment. The NDI saw an improvement of 11 points, where a decrease of 5 points is considered statistical improvement (Sherman, 2009). (Appendix A; Appendix B)
Over the fifteen weeks of treatment the patient did not experience any significant pain or disability from his injury, which is in clear contrast to his health history. The patient identified stressful emotion, poor sleep and long work hours as the identifiable aggravating factors to his symptoms, which is supported by literature regarding chronic WAD. During the course of treatment the patient experienced several significant life events, completed a major work assignment and suffered regular bouts of poor sleep due to stress induced insomnia and external factors. It is possible that regular massage intervention helped shepherd the patient through a stressful time period, without experiencing pain.

The patient reported improved physical well being and body awareness following treatments and responded well to remedial exercise homecare. While the treatment plan was being implemented, the patient returned to a martial arts practice he had previously ceased. This was not directly connected to the massage therapy, however the therapist’s assessments and prescribed homecare were identified by the patient as a motivating factor to return to activity. While there is no evidence that the results achieved will have a long term effect on the patient, the postural awareness and exercise education may have an ongoing role to play in preventing painful symptoms and supporting proper alignment of the cervical spine.

In retrospect there are a few points which, had they been kept in mind earlier on, would have permitted more specific assessment and treatments. Ambiguity on the part of the therapist in terms of what constituted full range of motion at the neck created inconsistencies while measuring flexion and extension. Further to this, it became clearer as treatments progressed that the patient’s initial range of motion was not greatly restricted, but it was rather the compensatory motions that kept him from moving in a pure cardinal plane that were indicative of pathology. Other than making written note of the rotational element in
side flexion during the second treatment, there was insufficient recording of how the patient actually moved before and after treatment.

It was only as treatments progressed that the therapist realized the relevance of muscle imbalances which were disrupting the patient’s posture. To what extent these imbalances were caused by the initial injury, chronic pain, muscle guarding or poor work posture is impossible to say, however, they were likely all contributing factors to the patient’s pain. It was only after several treatments that it became clear that postural correction was actually the most appropriate area of intervention and therefore, the primary treatment goal. This late realization resulted in insufficient initial assessment and this research would be greatly improved with more postural assessment, including full body plumb line photography of the patient, before any treatment had commenced.

Similarly the Neck Disability Index was only introduced to the client later in the treatment, and he was asked to complete it using hindsight. Later that same day, he completed the NDI again to reflect his current condition. The answers provided may therefore be skewed, and future patients should be given the NDI to complete during their initial consultation.

Future treatment plans for similar patients should include a more specific plan for addressing the muscles of cervical rotation. Improved results may have been seen if patient education regarding trigger points and referral patterns had been address earlier in the treatment plan. A greater variety of specific home care could have been provided to address the patient’s loss of cervical lordosis. Finally, most of the results achieved were seen within the first five treatments. Similar patients seeking treatment may require fewer treatments, or longer periods between later treatments.

The benefit achieved by the patient was in keeping with anticipated outcomes. Short term benefit was evident, and it remains possible that this intervention may have long term benefit for the
patient as well. The variety of modalities used in these treatments allowed for a creative approach in addressing the patient’s changing circumstances and the broad range of factors which influence his pain. A multimodal approach to treating WAD appears to have notably decreased this patient’s symptoms, and would be an effective plan for treating similar cases.
References


Appendix C
Special Tests

**Scalene Cramp Test**
This test assesses for trigger points in the scalene muscles. With the patient seated, they are instructed to rotate and flex their neck, directing their chin towards their clavicle. Pain in the contracted muscle is a positive result.

**Alar Ligament Rotational Stress Test**
Excessive motion beyond $30^\circ$ found with this test indicates possible damage to the alar ligament and may make a variety of treatments contraindicated. The patient's lamina and spinous process of C2 is grasped by the therapist when the patient is seated or supine and the head is passively rotated.

**Alar Ligament Lateral Flexion Stress Test**
This is a test for the fibers of the alar ligaments which limit lateral flexion between C2 and the occiput. With the patient supine, the therapist holds C2 and attempts to passively side flex the patient's head. A firm end feel is quickly felt. Excessive motion indicates a positive result and will contraindicate most cervical spine interventions.

**Upper Limb Tension Test #1**
This test is designed to apply tension to the brachial plexus and assess for nerve pathology. The patient lies supine, while the patient firmly depresses the shoulder and moves the arm passively into abduction to $110^\circ$. The wrist and then the elbow are passively supinated and extended. If no symptoms arise, the patient is directed to contralaterally rotate their neck to further sensitize the test. Pain or aggravation of symptoms indicate a positive result.

**Cervical Spine Quadrant Test**
This purpose of this test is to compress the facet joints of the cervical spine. If this joint compression causes pain, then the facet joints are experiencing some irritation or are misaligned. The patient side flexes and extends their head before rotating towards the affected side. If no symptoms result, the therapist provides pressure on the patient's head to further narrow the joint space. Pain or irritation is a positive result. This test is similar to Spurling’s Compression Test and the Vertebral Artery test. Positive results may also indicate a herniated disc, vertebral fracture, osteophytes or cervical stenosis or spondylosis. Pain felt on the contralateral side indicates muscle spasm.

(Magee D.J., Orthopedic Physical Assessment fifth addition, 2008)
Appendix D

Figure 1. Passive Range of Motion in Sling

Figure 2. Postural Assessment Pre Treatment

Figure 3. Postural Assessment Post Treatment
Figure 4. Work Biomechanics Pre Treatment
Appendix E

Table 1.0  Quebec Task Force Classification (QTF)

<table>
<thead>
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<th>Grade 0</th>
<th>No complaint about the neck. No musculoskeletal or neurological signs.</th>
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<td>Stiffness, Tenderness or Pain at the neck only. No musculoskeletal or neurological signs.</td>
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<tr>
<td>Grade 2</td>
<td>Stiffness, Tenderness or Pain at the Neck. Decreased Range of Motion. Injury to muscles, tendons, ligaments and joint capsule of significant damage to cause spasm. No neurological signs.</td>
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<td>Grade 4</td>
<td>Fracture or Dislocation</td>
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Table 2.0  Muscle Testing

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| Posterior Scalenes and SCM | 5 – 2 | 5 | 5 | 5 | 5 | 4 | 5 | 4.5 | 5 | 4 | 5 |
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|                          | R     | 4 | 4 | 4 | 4 | 4 | 4 | 5   | 5 | 5 | 5 |
| Anterior Scalenes and Longus Colli | 4 – 2 | 4 | 4 | 4 | 5 | 5 | 5 | 5   | 5 | 5 | 5 |

Numbers indicate muscle strength on a scale of 0 – 5
The second value represents pain levels on the VAS
Table 4.0  Active Range of Motion

<table>
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