

# Interpretation Of Dynamic Surface Electromyography Study: Cervical Spine

Instrument Utilized: MyoVision 8000 Surface EMG

Test performed by: David Marcarian

Interpretation by: David Marcarian, MA

Electrode attachments: CPs: Approximately C4 and T1 left and right sides, SCMS left and right sides  
Precision Biometrics, Inc. 2801 1<sup>st</sup> Avenue, Unit 1212, Seattle, WA 98121 206-448-3464

PATIENT: Kimberlee PATIENT: phone and address of patient

Test performed: November 26<sup>th</sup>, 2006 Interpretation: January 4<sup>th</sup>, 2007

## Test: Cervical Flexion / Re-extension (3 trials per graph):

Muscles measured: Cervical Paraspinals (left is blue, right is red)

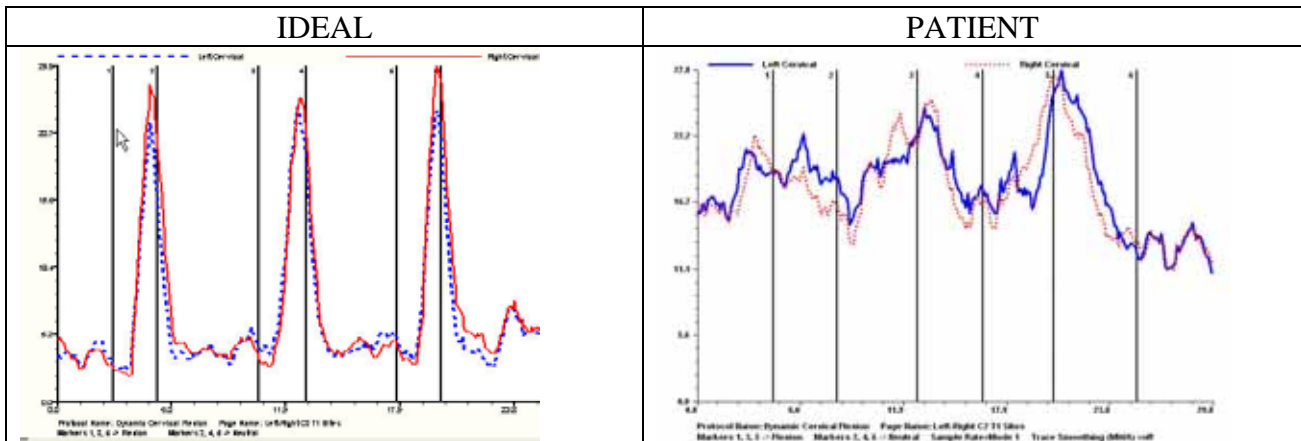
### Graph Title (bottom left of page): Dynamic Cervical Flexion:

#### Overview Of Testing Methodology:

This is a study of the muscle activity of the cervical paraspinal region as the patient performs a series of three flexions in a row. Readings should be relatively low in flexion, and muscles should relax both in flexion (markers 1,3,5), and at the neutral position (markers 2, 4, 6). Ideally the following is true in normal individuals:

#### In summary:

1. IRRITABILITY: Muscles fire in a smooth fashion in normal individuals, with little irritability or fasciculation. Soft tissue injury appears to create a state of abnormal motor functioning which appears as “jitter” in the signal or increased variability in the SEMG signal as the patient moves.
2. SYMMETRY: In general, muscles fire symmetrically when an individual is *not* in pain when comparing left and right sides in motion. Left and right sides fire with approximately the same level of activity throughout the motion.
3. FLEXION RELAXATION: In general, muscles of the cervical paraspinals “relax” when the body is placed in a fully flexed position.
4. CONSISTENCY: In general, those not in pain show a greater consistency in muscle patterns than those injured, with those injured showing a greater increase in variability in the test results when comparing trial to trial on the graph.
5. RATIO OF FLEXION PEAK TO RE-EXTENSION PEAK. In general, in patients *not* experiencing pain, the initial flexion peak (peak preceding markers 1, 3, 5) is significantly lower in amplitude than the re-extension peak (peak preceding markers 2, 4, 6).
6. LEVEL OF ACTIVITY OVER TRIALS: In general, readings across trials decrease in those not severely injured.



## INTERPRETATION OF CERVICAL FLEXION:

## OBSERVATIONS &amp; CRITERIA FOR CONCLUSIONS:

1. Consistency between trials is very good.
2. **IRRITABILITY:** Muscles in the cervical spine are extremely irritable as noted by the variability of the SEMG signal (“jitter”) as the patient performs the motion. This correlates with soft tissue injury. Muscles fire in response to pain or joint irritation for the purpose of immobilizing the joint, or “reflexive bracing”.
3. **RELAXATION IN FLEXION:** Muscles do not relax in flexion (markers 1,3,5) on both left and right sides of the cervical paraspinals, which according to the Nederhand, et. al. paper (in the paper attached on Validity of sEMG written by the examiner) correlates with soft tissue injury or mechanical joint restriction.
4. **RATIO OF FLEXION TO RE-EXTENSION PEAK:** In this case, the ratio of flexion peak to re-extension peak appears to be abnormal on the both left and right sides, meaning the muscles go into reflexive bracing and maintain the muscle bracing throughout the motion, which correlates with soft tissue injury.
5. **SYMMETRY OF MUSCLE FIRING:** There is good symmetry in muscle firing when comparing left and right sides in this study. In this case, the irritability is bilateral as muscles from both sides fire in a reflexive bracing pattern. This is again, consistent with muscles firing irritably and randomly in response to pain. Although in most cases symmetry is a negative finding, when accompanied with irritability it again, helps documents soft tissue injury.

**GENERAL CONCLUSION, CERVICAL FLEXION:**

In my opinion, this patient demonstrates classic “reflexive bracing” in the cervical paraspinals in flexion which correlates with soft tissue injury.

**TEST: Cervical Left / Right Lateral Flexion** (two trials per graph moving left first):

**Muscles measured:** Cervical Paraspinals (top half of graph Left is blue, right is red), SCM’s (bottom half of graph – Left is blue, right is red)

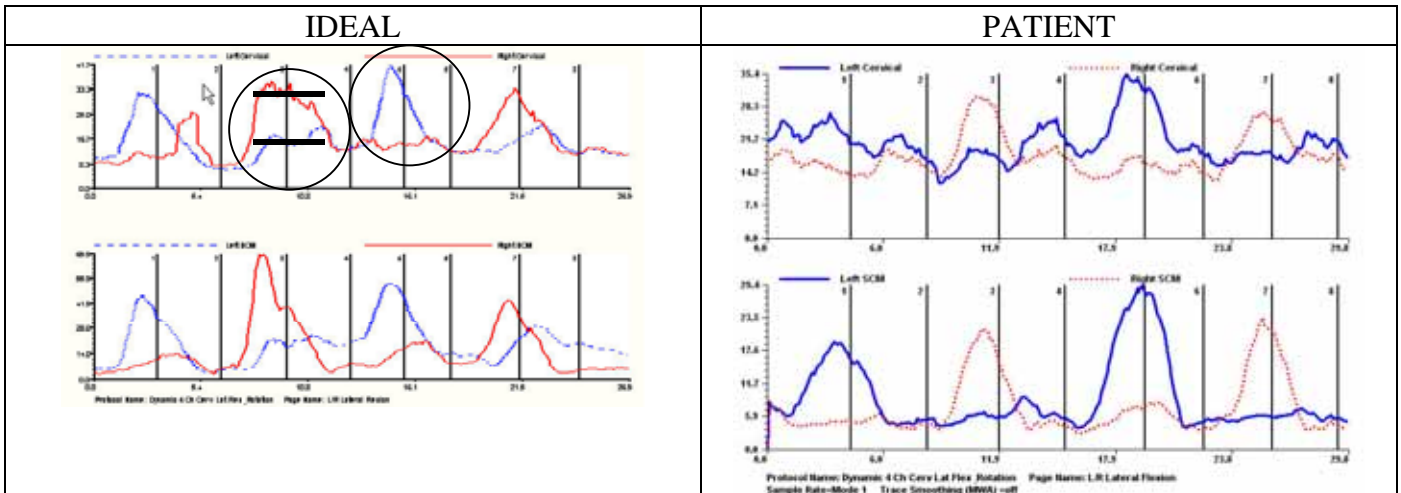
**Graph Title (bottom of page): Protocol name: Dynamic 4 CH CERVICAL LATERAL FLEXION: Page name: L/R Lateral Flexion.**

## Overview Of Testing Methodology:

This is a study of the muscle activity of the cervical paraspinal region and sternocleidomastoids (scm’s) as the patient performs a series of two series of left and right lateral flexions in a row, beginning with a left lateral flexion. Asymmetrical movements should provide asymmetrical results. Cervical paraspinals and SCMs should fire on the same side simultaneously as lateral flexion is performed. For example, when performing a cervical left lateral flexion, muscles of the left CPs and left SCMs should fire, with muscles on the right CPs and SCMs relatively relaxed. Also, peaks should be of similar magnitude when comparing left to right. There should be a considerable difference between the same muscle groups when comparing left and right sides during lateral flexions. For example, in left lateral flexion, there should be a significant difference in the level of activity of the left and right cervical paraspinals, with the left side firing, and the right side staying relatively relaxed. This is the same of the SCMs.

## In summary:

1. **ACTIVATION PATTERN:** CP’s and SCM’s should fire on the same side as the direction of the motion. In other words, a left lateral flexion should produce muscle activity on the left CP and left SCM.
2. **SYMMETRY:** Muscle firing should be symmetrical when comparing left to right motions for the same muscle group. In other words, the peak value for the left cervical paraspinals in a left motion should be similar to right cervical paraspinals in a right motion.
3. **LEVEL OF ACTIVITY OF OPPOSITE SIDE (CO-CONTRACTION):** there should be little or no muscle activity from the opposite side CP and SCM during a motion. For example, in a left lateral flexion, very little activity from the right CP or SCM should appear in the graphs.
1. **IRRITABILITY:** Muscles fire in a smooth fashion in normal individuals, with little irritability or fasciculation. Soft tissue injury appears to create a state of abnormal motor functioning that appears as “jitter” or increased variability in the SEMG signal as the patient moves. This occurs as the patient “braces” in response to pain or joint restriction. An individual who is experiencing pain or joint restriction typically demonstrates greater amounts of muscle fasciculation (seen as variability or “jitter”) in response to these conditions.



**INTERPRETATION OF CERVICAL LATERAL FLEXION:**

**OBSERVATIONS & CRITERIA FOR CONCLUSIONS:**

1. Consistency between trials is very good.
2. LEVEL OF ACTIVITY OF OPPOSITE SIDE (CO-CONTRACTION): There is a significant co-contraction of the cervical paraspinals mainly in both left and right lateral flexion, indicating that this patient may be experiencing pain or joint restriction in both left and right lateral flexion. Essentially, muscles are firing in the cervical paraspinals to “brace” and “guard” for the purpose of immobilizing the region to reduce pain or irritability. These results correlate very highly with soft tissue injury. The fact that there is NOT tremendous irritability accompanying the co-contraction indicates that the injury is most likely not acute.
3. ACTIVATION PATTERN: There is significant co-contraction, so the activation pattern is not normal in this case, except that there is some firing of the cervical paraspinals along with the SCM’s in right lateral flexion (marker 4). There should be firing of only the CP’s and the SCMS on the same side that is NOT seen. This also correlates with soft tissue injury.
4. SYMMETRY: Symmetry is poor in comparing left to right sides in cervical paraspinals, which correlates with soft tissue injury, with the peaks in left lateral flexion differing significantly from the peaks in right lateral flexion. Symmetry in the SCM’s does not appear abnormal.
5. IRRITABILITY: There is only slight irritability, which combined with the co-contraction indicates that this is not an acute case, but perhaps chronic. When the firing pattern is abnormal, but muscles are not irritable, it is typically seen in chronic patients as the muscles have “learned” to fire in a bracing pattern and maintain this pattern even after the acute phase has passed.

**GENERAL CONCLUSION: CERVICAL LATERAL FLEXION:**

The significant amount of co-contraction demonstrated by this patient in left and right lateral flexions correlates with soft tissue injury. There appears to be equal difficulty in performing both left and right lateral flexions, with the overall test patterns correlating highly with soft tissue injury.

**TEST: Cervical Left / Right Rotation (two trials, moving left first):**

**Muscles measured:** Cervical Paraspinals (top half of graph: left is blue, right is red), SCMs (bottom half of graph: left is blue, right is red)

**Graph Title (bottom of page): Protocol name: Dynamic 4 CH CERVICAL LATERAL FLEXION: Page name: L/R Rotation. Test date: 9/30/04**

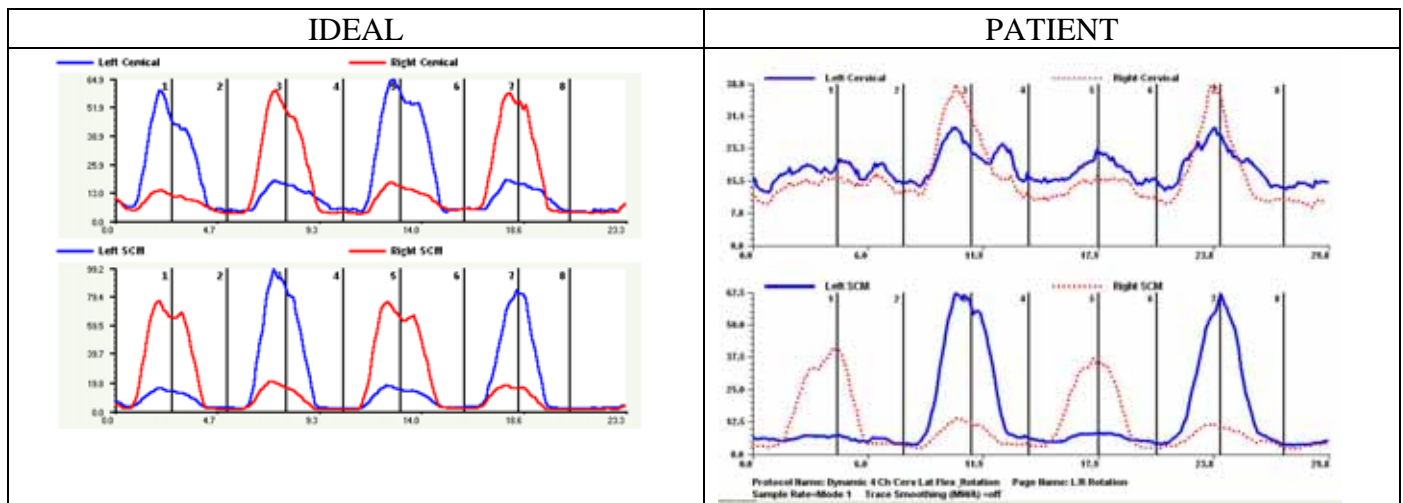
Overview Of Testing Methodology:

This is a study of the muscle activity of the cervical paraspinal region and sternocleidomastoids (scm’s) as the patient performs a series of two left and right rotations in a row, beginning with a left rotation. Asymmetrical movements should provide asymmetrical results. Cervical paraspinals should fire on the side one is turning towards along with and simultaneously with

the opposite side SCM's as rotation is performed, with little or no firing from any other muscle group. For example, in left rotation, the left cervical paraspinals should fire to initiate the motion, with the right (opposite side) SCMs firing to stabilize. Muscles of the right cervical paraspinals and left SCMs should remain relatively relaxed. Also, peak values of the same muscle group should be of similar magnitude when comparing left to right motions (e.g. left cervical paraspinal peaks in left rotation should be similar to right cervical paraspinal peaks in right rotation). There should be a considerable difference between left and right muscles of the same muscle group during rotations, or a lack of co-contraction in motion.

In summary:

1. Consistency is good, indicating that the test was performed properly.
2. ACTIVATION PATTERN: Cervical paraspinals and SCMs should fire on the opposite side as the direction of the motion. In other words, a left rotation should produce muscle activity on the left CP and right SCM. The left cp initiates the motion, and the right SCM stabilizes the motion.
3. SYMMETRY: Muscle firing should be symmetrical when comparing left to right motions for the same muscle group. In other words, the peak value for the left cps in a left motion should be similar to right cps in a right motion.
4. LEVEL OF ACTIVITY OF OPPOSITE SIDE (CO-CONTRACTION): There should be little or no muscle activity from the opposite side CP and SCM during a motion. For example, in a left rotation, very little activity from the right CP or left SCM should appear in the graphs.
5. IRRITABILITY: Muscles fire in a smooth fashion in normal individuals, with little irritability or fasciculation. Soft tissue injury appears to create a state of abnormal motor functioning which appears as "jitter" or increased variability in the SEMG signal as the patient moves. This occurs as the patient "braces" in response to pain or joint restriction. An individual who is experiencing pain or joint restriction typically demonstrates greater amounts of muscle fasciculation (seen as variability or "jitter") in response to these conditions.



## INTERPRETATION OF CERVICAL ROTATION:

### OBSERVATIONS & CRITERIA FOR CONCLUSIONS:

1. Consistency between trials is very good indicating that the test was performed properly.
2. LEVEL OF ACTIVITY OF OPPOSITE SIDE (CO-CONTRACTION): There is a significant co-contraction of the cervical paraspinals mainly in LEFT ROTATION, indicating that she has more difficulty or has a restriction in left rotation, indicating that this patient may be experiencing pain or joint restriction in ROTATION. Essentially, muscles are firing in the cervical paraspinals to "brace" and "guard" for the purpose of immobilizing the region to reduce pain or irritability. These results correlate very highly with soft tissue injury. The fact that there is NOT tremendous irritability accompanying the co-contraction indicates that the injury is most likely not acute.
3. ACTIVATION PATTERN: There is significant co-contraction, so the activation pattern is not normal in this case, except that there is some firing of the opposite cervical paraspinals along with the SCM's in right rotation. There should be firing of only the CP's and the SCMS on the same side that is NOT seen. This also correlates with soft tissue injury.

4. SYMMETRY: Symmetry is poor in comparing left to ride sides in cervical paraspinals, which correlates with soft tissue injury, with the peaks in left rotation differing significantly from the peaks in right rotation. Symmetry in the SCM's does not appear abnormal.
5. IRRITABILITY: There is only slight irritability, which combined with the co-contraction indicates that this is not an acute case, but perhaps chronic. When the firing pattern is abnormal, but muscles are not irritable, it is typically seen in chronic patients as the muscles have "learned" to fire in a bracing pattern and maintain this pattern even after the acute phase has passed.

**GENERAL CONCLUSION: CERVICAL ROTATION:**

The significant amount of co-contraction demonstrated by this patient in left and right lateral flexions correlates with soft tissue injury. There appears to be a greater difficulty in performing a left lateral flexion, than right, with the overall test patterns correlating highly with soft tissue injury.

**OVERALL CONCLUSION: Cervical Spine**

The information gathered from the SEMG is one of the many pieces of data used in determining a clinical profile, and should not be used alone in determination of injury or disability. Muscles often compensate for problems of the spine, and do so in a manner that does not always reflect directly the side of pain, or the exact region which is the root of the problem directly. As an example, cervical problems often appear as abnormal muscle activity of the upper thoracic region.

In my opinion, the results of this study of the cervical spine show abnormalities in flexion, lateral flexion and rotation, with the results correlating highly with soft tissue injury. The moderate level of irritability in rotations combined with significant abnormal pattern of firing, and co-contraction of SCMs demonstrates that the patient may not have still been in the acute phase of injury at the time of testing. The overall level of muscle activity throughout the various ranges of motion was higher than would be expected from a normal individual.

Please refer to the PDF titled "M Marcarian's comprehensive guide to Surface EMG for attorneys" which, if you do not have, is available by emailing my assistant [leslie@myovision.com](mailto:leslie@myovision.com).

**Important note: I, David Marcarian, did not in any way question the patient as to the problem, injury, past injuries or other physical problems prior to testing to avoid bias in test results. In addition I did not evaluate any medical records of hers prior to testing again to avoid bias.**

**NOTE: This is a preliminary report only, and has not been thoroughly reviewed for errors. The graphs are accurate, but wording etc. has not been completely reviewed for errors.**

If you have any questions, you can reach me at [david@myovision.com](mailto:david@myovision.com) or 206-448-3464



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Date January 4<sup>th</sup>, 2007