Office of David Marcarian

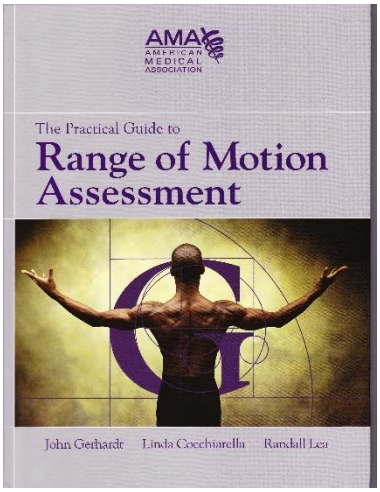
2801 1st Avenue, Unit 1211, Seattle, WA 98121

Phone: 206-357-6501 **email**: david@myovision.com **Patient Name:** JOHN DOE

Test Performed: Lumbar DynaROM Surface EMG Exam
Test Performed by: Precision Biometrics, Inc.

Instrument Utilized: MyoVision Wirefree™ DynaROM Motion sEMG
Electrode Attachments: Lumbar Paraspinals (approx... L1 and L5 bilaterally).

Patient Name: JOHN DOE
Test Date: Nov 08, 2016
Interpretation By: David Marcarian, MA
Interpretation Date: **Nov 16, 2016**



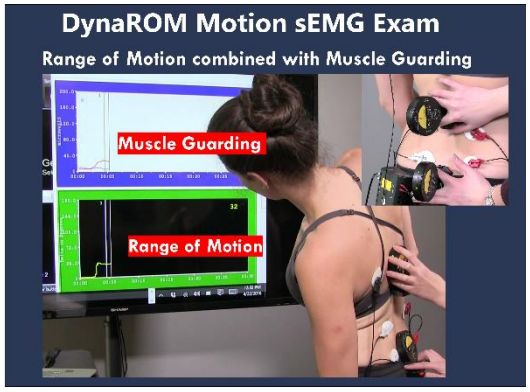
Objective measurement of soft tissue injury utilizing DynaROM Lumbar Motion Evaluation Technology. Performed as demonstrated in the AMA Publication "The Practical Guide to Range of Motion Assessment"

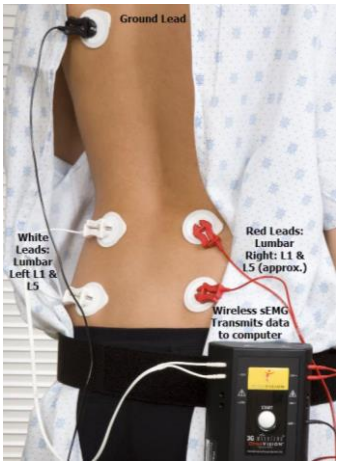
The test was performed as referenced in the American Medical Associations Guides to Evaluation of Permanent Impairment. The test simultaneously measures both range of motion and muscle muscle guarding, utilizing EKG technology which measures the smaller muscles bilaterally about the spine. Pain experienced in motion leads to a muscular response commonly known as spasm or hypertonicity, and studies have found it increases sensitivity and specificity of range of motion measures to include the measurement of muscle guarding.
The system generates color graphs showing muscle activity and range of motion data for each range of motion. Refer to the print out from the MyoVision System when evaluating the interpretation of the data from each exam. Each test typically requires that the patient performs between 2 and 3 trials of each range of motion. The published paper "A meta-analytic review of surface EMG among persons with low back pain and normal, healthy controls (Geisser, et. Al. 2005, Journal of Pain) concluded that the addition of Dynamic Surface Electromyography (sEMG) to Range of Motion increased sensitivity and specificity of Range of Motion Measures.

Electrodes are attached bilaterally at approximately L1 and L5 with a ground attached above the bony prominence of the scapula.
The ranges of motion evaluated in this interpretation include:

- Flexion
- Left Lateral Flexion
- Right Lateral Flexion
- Left Rotation
- Right Rotation

Range of Motion alone is a poor measure of soft tissue injury due to the fact that many patients have normal ROM but muscle guarding and pain.





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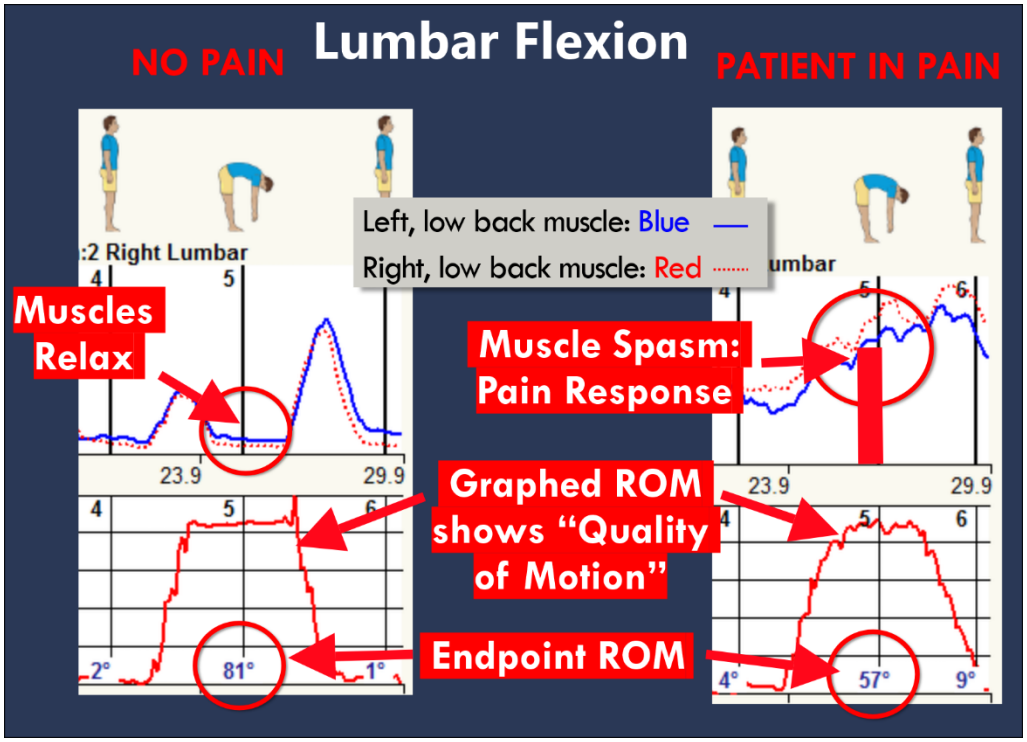
OVERVIEW OF TESTING METHODOLOGY

FLEXION RELAXATION RESPONSE

This is a study of the muscle activity of the Lumbar paraspinal region as the patient performs a series of three consecutive flexions. Muscles of the Lumbar paraspinals "relax" when the body is placed in a fully flexed position. Readings should be relatively low (relax) in flexion (markers 1, 3, 5). Research studies have established this relaxation response in flexion as a reflex, as the body relies upon ligaments in the fully flexed position allowing muscles to relax. Muscles which fire while in the fully flexed position are indicative of a muscle guarding state which is correlates highly with pain and/or injury of the soft tissue.



Correlation of Traces & Irritability: Muscles typically fire in a relatively smooth, fashion with left and right sides traces (red and blue lines) overlaying closely in plane motions (such as flexion and extension). With injury, it is common to see left and right side firing having a low correlation over time, with traces separating. Irritability is also seen as the line graphs demonstrating significant variability (are not smooth during motion). Muscle Irritability is another factor in determining pain and injury state.

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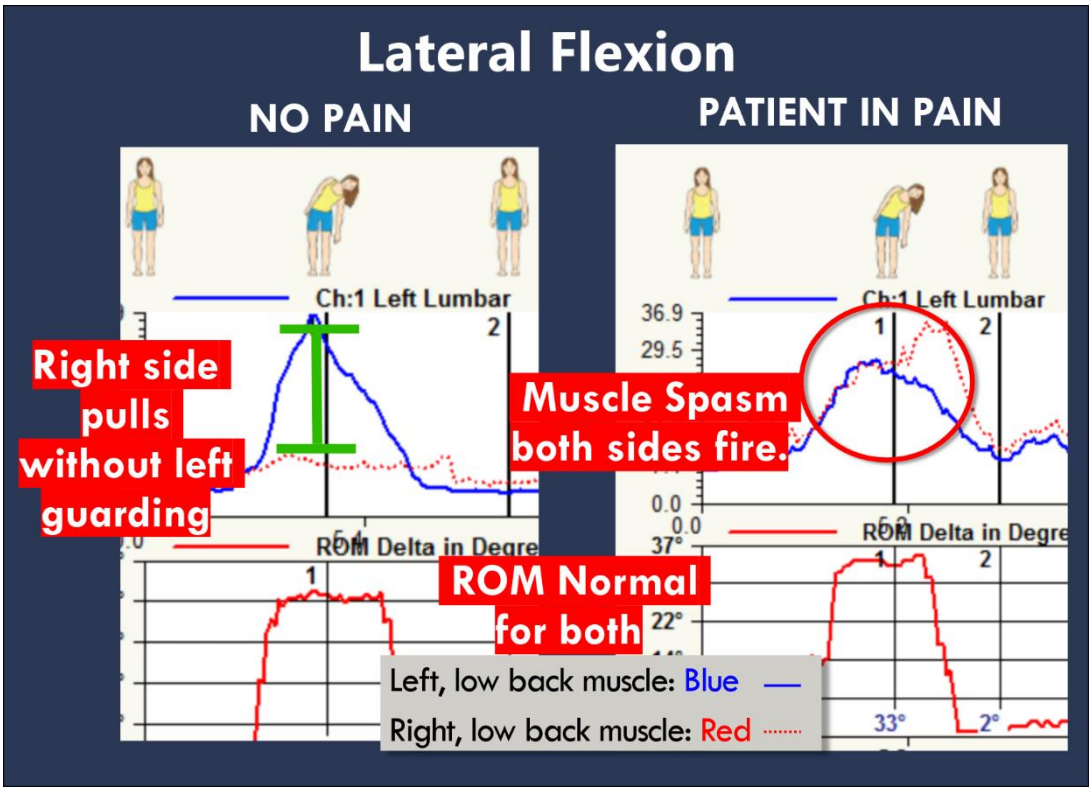
Left/ Right LATERAL FLEXION; Left/Right ROTATION



Level of Activity of Opposite Side (Muscle Guarding and Co-Contraction): There should be little or no muscle activity from the Lumbar paraspinals on the opposite side during motion. For example, in a left lateral flexion, one side produces the motion, and the opposite side should be silent. If there is pain in motion, muscles not normally used are recruited to brace and immobilize. **Irritability:** Muscles fire in a smooth fashion in normal individuals with little irritability or fibrillation. Soft tissue injuries create a state of abnormal motor functioning which appears as "jitter" or increased variability in the traces shown in the upper half of the graph as the patient moves.

Consistency: There are two ways to interpret consistency: In general, if the patient was given a "pre-measurement" training (e.g. performing 1-3 left rotations prior to collecting data, consistency should be good from trial to trial (there are typically three trials in each graph). Consistency between these trials is seen in general in both healthy and unhealthy individuals. In severe pain, individuals will sometimes show a pattern of worsening consistency from trial to trial. The distinction between pain as the source of this lack of consistency vs. the patient attempting to alter the test results is based upon the level of irritability seen from trial to trial. If there is an increase in irritability from first to last trial this decreases consistency but is most likely a result of pain produced by the motion itself.

Symmetry of muscle firing: Left vs. Right Motion: The purpose here is to compare the left motion with the right. They should appear as mirror images. If the left (blue) reading is higher amplitude in the left rotation, the right (red) reading should be higher amplitude in the right rotation. If one muscle group fires consistently higher in both motions, this is most likely a learned guarding response. This is the same for all muscle groups in both rotation and lateral flexion.

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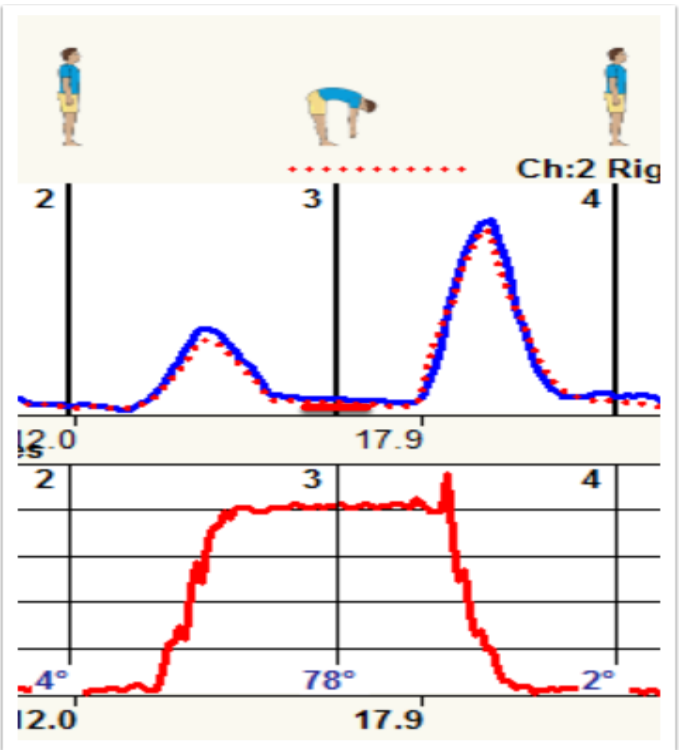
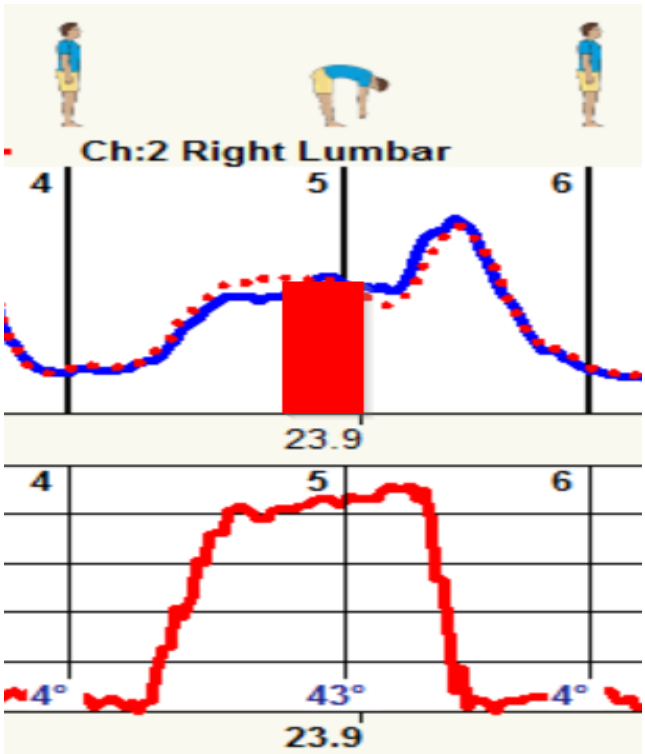
Interpretation of Patient Test Results

Lumbar Flexion DynaROM Dynamic Surface EMG

1. Flexion Relaxation: ABNORMAL: Patient demonstrates abnormal pattern of muscle firing, correlating highly with pain and/or soft tissue injury.
2. Correlation of Traces; Left vs. Right: NORMAL: Left and right sides fire equally throughout motion, typically a normal finding.
3. Consistency across Trials: Good: Test was performed properly.
4. How quickly muscles relax upon return to neutral: MODERATE: Muscles return to relaxed state, but do so slowly indicating continued bracing upon return to neutral, a moderately abnormal finding.
5. Fibrillation of muscles in motion: MODERATE: some irritabliity indicating patient experiences moderate amount of pain in motion.
6. Flexion Range of Motion in Degrees. AMA: 50° Patient: 44°

Ideal	Patient: John Doe
	

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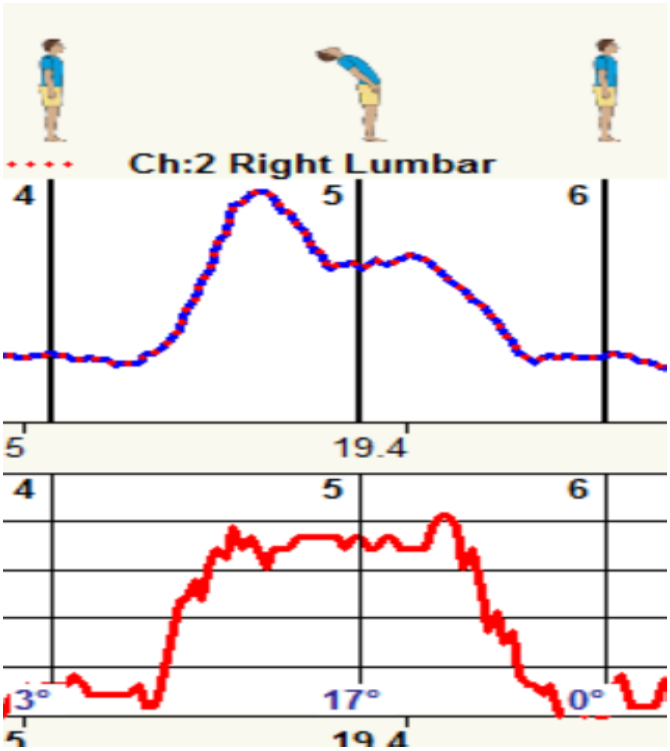
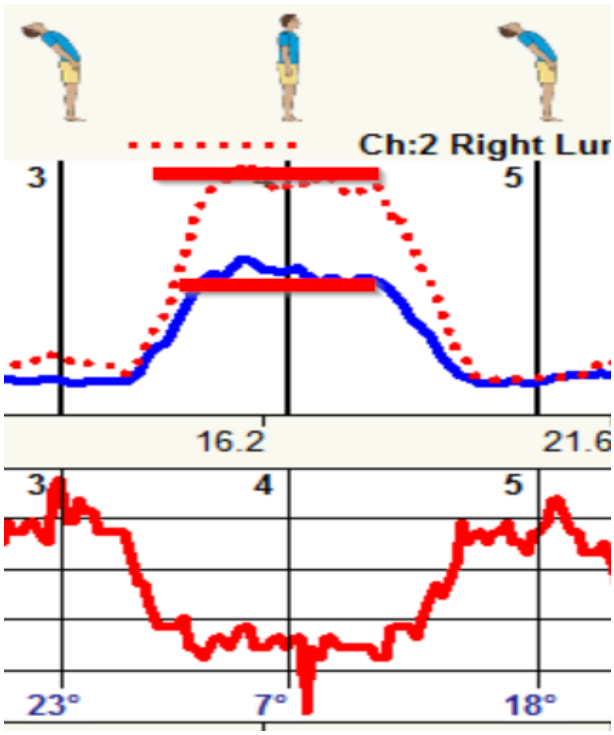
Interpretation of Patient Test Results

Lumbar Extension DynaROM Dynamic Surface EMG

1. Correlation of Traces; Left vs. Right: ABNORMAL:Traces from left and right sides are significantly different in amplitude, indicating a pattern of activity which correlates with soft tissue injury or pain in this motion.
2. Consistency across Trials: Good: Test was performed properly.
3. How quickly muscles relax upon return to neutral: MODERATE: Muscles return to relaxed state, but do so slowly indicating continued bracing upon return to neutral, a moderately abnormal finding.
4. Fibrillation of muscles in motion: SEVERE: Excessive variability in graph indicating patient experience significant pain and/or in acute state.
5. Extension Range of Motion in degrees: AMA: 20° Patient: 21°

Ideal	Patient: John Doe
	

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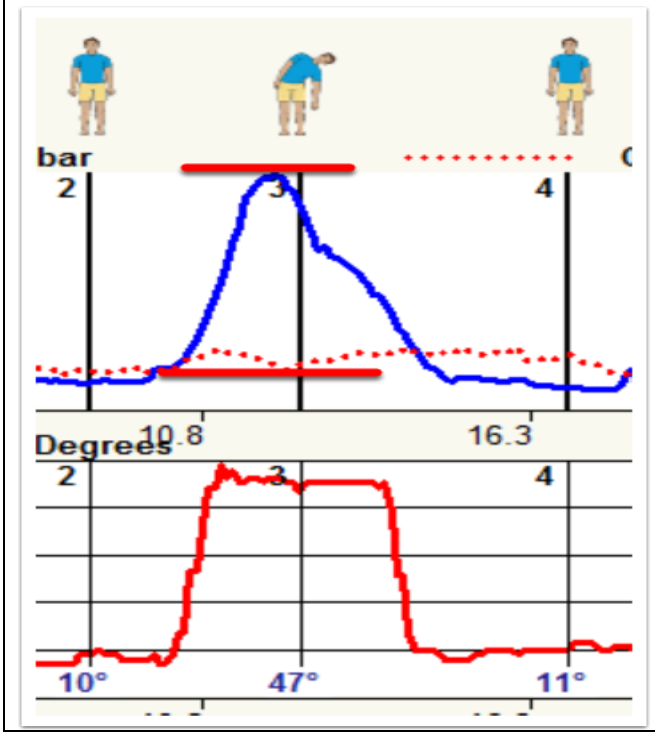
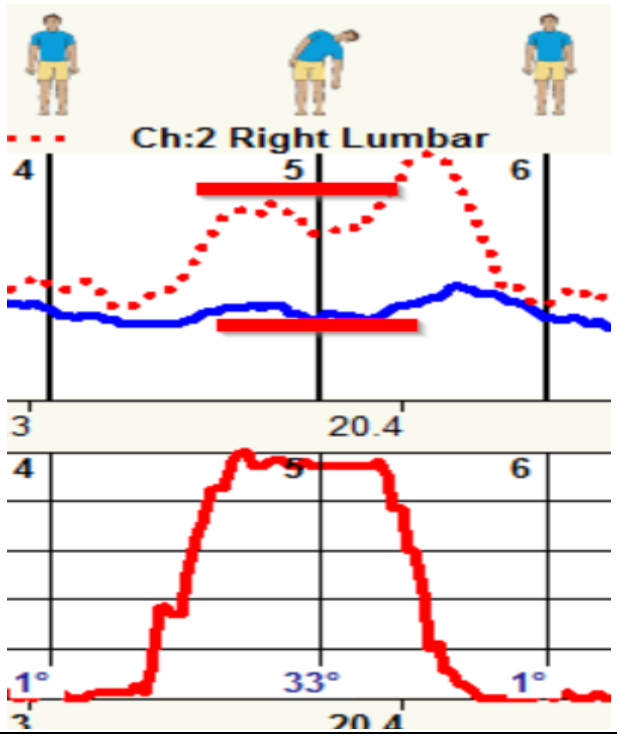
Interpretation of Patient Test Results

Lumbar Left Lateral Flexion

1. Level of Activity of Opposite Side (Muscle Guarding / Co-Contraction): Normal: The patient shows no bracing or guarding: Left and right sides fire independently, with little or no firing from the opposite side.
2. Consistency across Trials: Good: Test was performed properly, as at least 2 of 3 trials were consistent.
3. Fibrillation of muscles in motion: MODERATE: some irritabliity indicating patient experiences moderate amount of pain in motion.
4. Range of Motion in Degrees. AMA: 30° Patient: 31°

Ideal	Patient: John Doe
	

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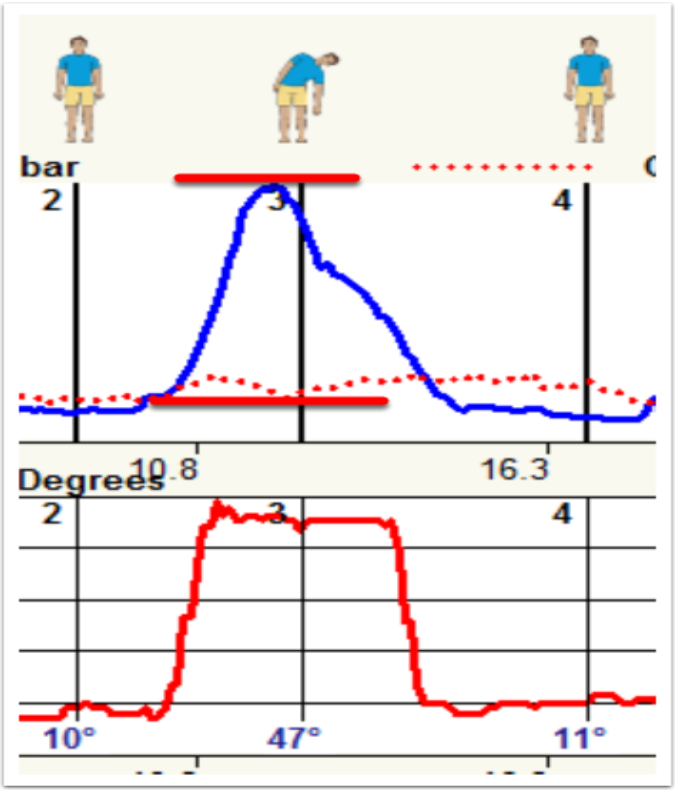
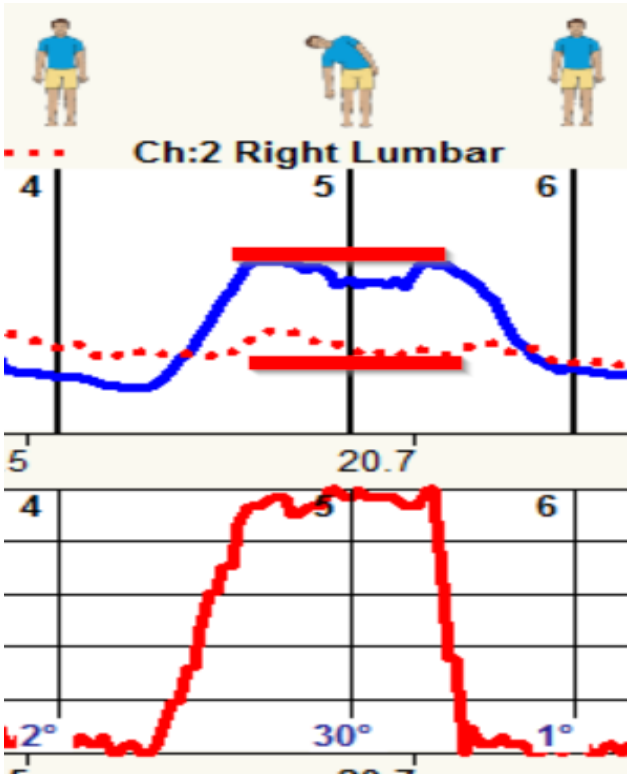
Interpretation of Patient Test Results

Lumbar Right Lateral Flexion

1. Level of Activity of Opposite Side (Muscle Guarding / Co-Contraction): Moderate: Left and right sides fire simultaneously, but with a difference not greater than approximately 60% of the higher side at end range of motion.This correlates with a chronic problem in this motion
2. Consistency across Trials: GOOD: Test was performed properly, as at least 2 of 3 trials were consistent.
3. Fibrillation of muscles in motion: MODERATE: some irritabliity indicating patient experiences moderate amount of pain in motion.
4. Range of Motion in Degrees. AMA: 30° Patient: 27°

Ideal	Patient: John Doe
	

Does left lateral flexion and right lateral flexion show opposite muscle groups firing?

1. Comparison of Left vs. Right Lateral Flexion: GOOD SYMMETRY: When comparing left vs. right motion, the high trace in the left motion is the low trace in the right motion.

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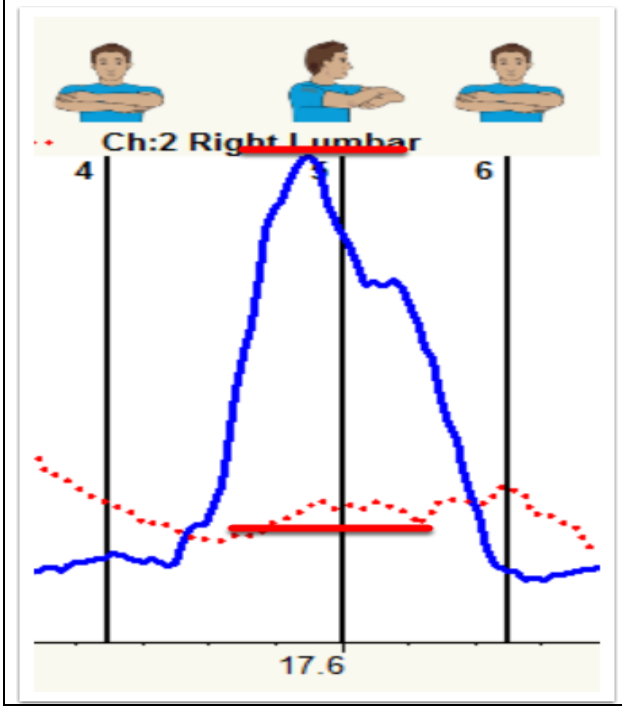
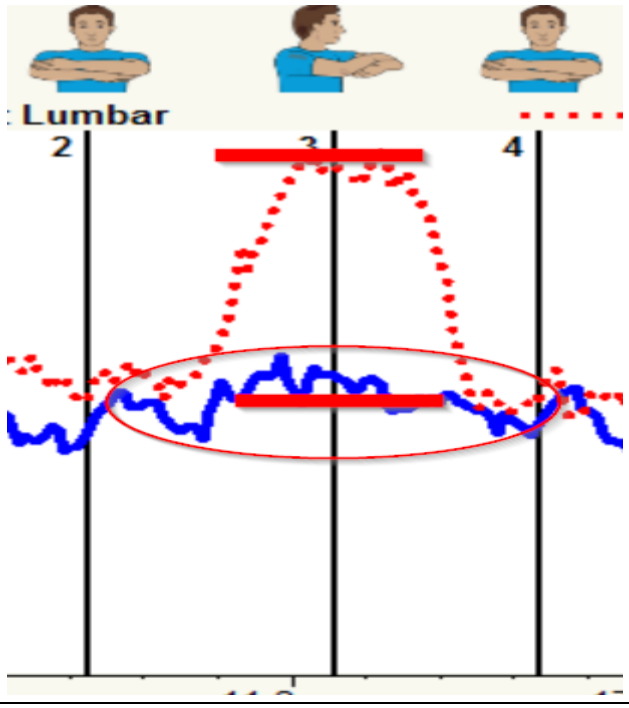
Interpretation of Patient Test Results

Lumbar Left Rotation

1. Level of Activity of Opposite Side (Muscle Guarding / Co-Contraction): Moderate: Left and right sides fire simultaneously, but with a difference not greater than approximately 60% of the higher side at end range of motion.This correlates with a chronic problem in this motion
2. Consistency across Trials: GOOD: Test was performed properly, as at least 2 of 3 trials were consistent.
3. Fibrillation of muscles in motion: SEVERE: Excessive variability in graph indicating patient experience significant pain and/or in acute state.

Ideal	Patient: John Doe
	

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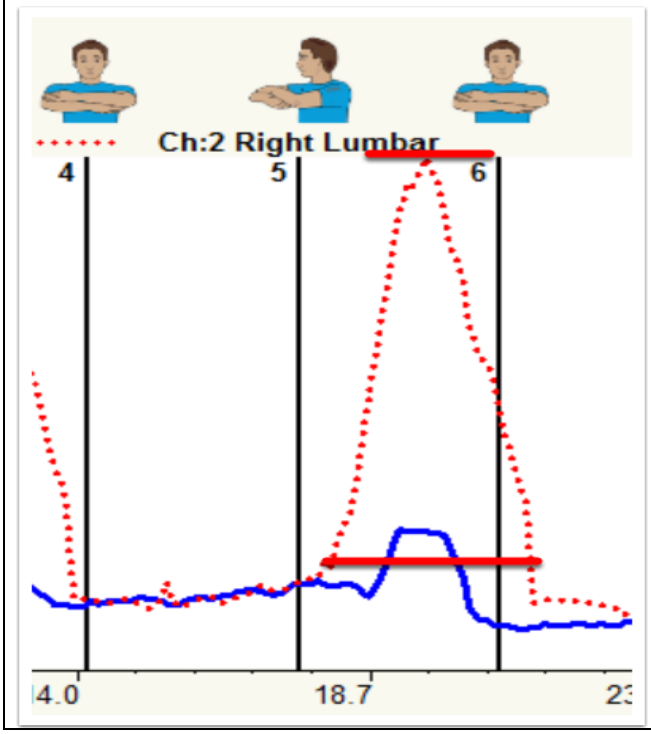
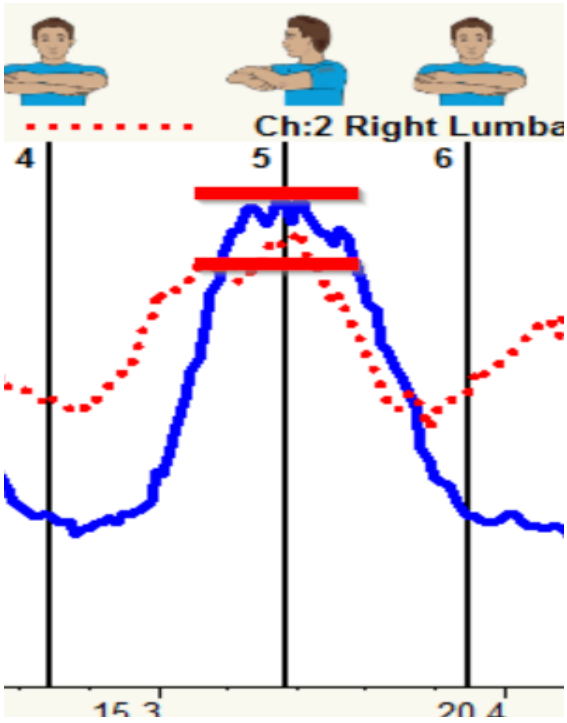
Interpretation of Patient Test Results

Lumbar Right Rotation

1. Level of Activity of Opposite Side (Muscle Guarding / Co-Contraction): Severe: Muscles fire simultaneously at end range of motion, defined as muscle guarding. This correlates highly with soft tissue injury and pain.
2. Consistency across Trials: GOOD: Test was performed properly, as at least 2 of 3 trials were consistent.
3. Fibrillation of muscles in motion: SEVERE: Excessive variability in graph indicating patient experience significant pain and/or in acute state.

Ideal	Patient: John Doe
	

Does left rotation and right rotation show opposite muscle groups firing?

1. Comparison of Left vs. Right Rotation: GOOD SYMMETRY: When comparing left vs. right motion, the high trace in the left motion is the low trace in the right motion.

CONCLUSION:

The purpose of this exam is to provide an objective means of evaluating for soft tissue injury by simultaneously measuring and graphing both range of motion and the muscular guarding response in response to motion. Muscle guarding is the body's natural response to pain in motion and can help establish validity of subjective complaints.

1. The lack of flexion relaxation response in flexion indicates that this patient, although experiencing relatively normal range of motion in flexion, has difficulty and possible pain in forward flexion. The data suggest he may have certain limitations in activities of daily living due to restriction in this motion. This data correlates highly with soft tissue injury. Extension data suggest a moderate level of possible SI joint/ low back ligamentous instability, as the patient data correlate highly with muscular compensation for instability, and quality of motion is poor. Muscle guarding is moderate in this motion.
2. In left rotation, the patient's muscle guarding reduces over three trials to a moderate level, but with significant muscle fibrillation. This fibrillation (jitter in the signal) correlates highly with pain in this motion, and a potential difficulty performing left rotation. The impact would reduce the patient's ability to look over their shoulder to check their blind spot and other activities of daily living.
3. Rotation to the right triggers a severe muscle guarding response with severe muscle fibrillation. This correlates highly with difficulty in producing this motion, and soft tissue injury. The data suggest that this patient would have difficulty looking over their right shoulder to check their blind spot, or other activities of daily living. appears completely normal, with no muscle guarding and only minimal muscle fibrillation, correlating with motion in this direction which is without pain or limitation.

The test data provide objective data establishing that the patient's subjective complaints of pain are well founded, and indisputable. By testing the patient in motion, a "stress test" of sorts is created, which in this patient's case elicits a pattern of muscle guarding which correlate highly with those experiencing soft tissue injury and associated pain syndromes.

Important Information Regarding the Test Results

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 the determination of injury or disability. Muscles often compensate for problems of the spine and do so in a manner that does not always directly reflect the exact location or even the general direction of the source. As an example, Lumbar problems often appear as abnormal muscle activity of the upper thoracic region. It is important to note that no single test can be used to determine injury. The DynaROM Motion ROM-EMG exam provides one piece of evidence used to develop a clinical profile.

Signed,

David Marcarian, MA

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