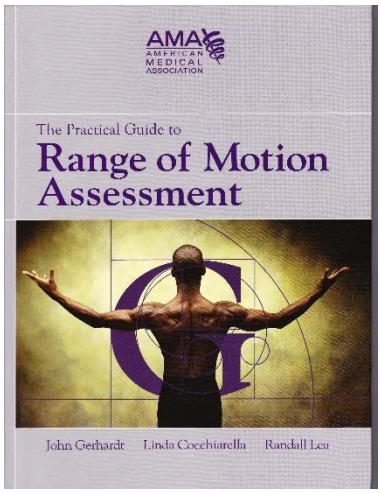
Simplified DynaROM Interpretation Guide For New PCP Report

7.31.2017 Written by David Marcarian, MA



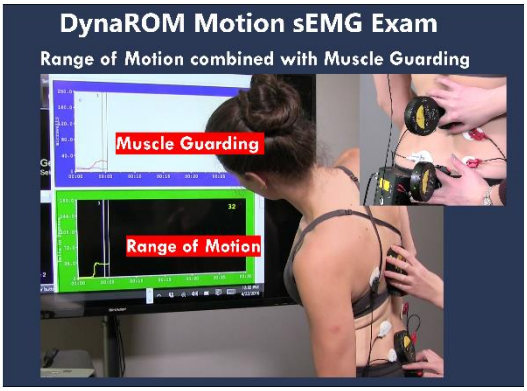
Objective measurement of soft tissue injury utilizing DynaROM Lumbar Motion Evaluation Technology. Performed as demonstrated in the AMA Publication "The Practical Guide to Range of Motion Assessment"

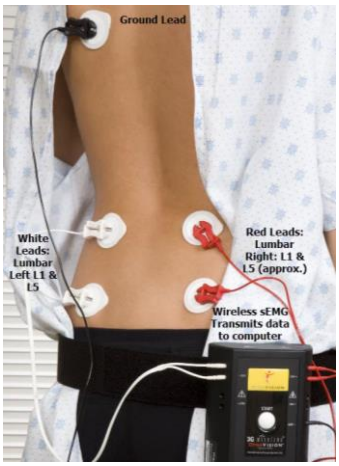
The test was performed as referenced in the American Medical Associations Guides to Evaluation of Permanent Impairment. The test simultaneously measures both range of motion and muscle guarding, utilizing EKG technology which measures the paraspinal muscles bilaterally about the spine. Pain experienced in motion leads to a muscular response commonly known as spasm or hypertonicity, and studies have found that the simultaneous measurement of muscle guarding along with range of motion increases sensitivity and specificity of range of motion to pain (Geisser, et. Al. 2005, Journal of Pain). Range of Motion on its own is a poor indicator of pain, as many patients have normal range of motion with significant muscle guarding and pain, equal to 5-8% impairment in the AMA Permanent Guides to Impairment (5th edition). Muscle guarding is the body's natural defense mechanism in response to pain, and the DynaROM system objectively quantifies this muscular guarding in motion. Unlike needle EMG, used to evaluate for nerve damage by looking at a single motor neuron, the DynaROM measures the region's response to pain by objectively measuring globally the involved regions (e.g. lumbar paraspinals) response to pain. A pubmed search reveals over 9000 published studies on the technology utilized by the DynaROM for evaluating muscle guarding.

The system generates color graphs showing muscle activity and range of motion data for each range of motion. You may refer to the print out from the DynaROM System to review the raw data if needed. Each test typically requires that the patient performs between 2 and 3 trials of each range of motion.

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 & Extension
- Left & Right Lateral Flexion
- Left & Right Rotation





*Office of _DR_NAME_*

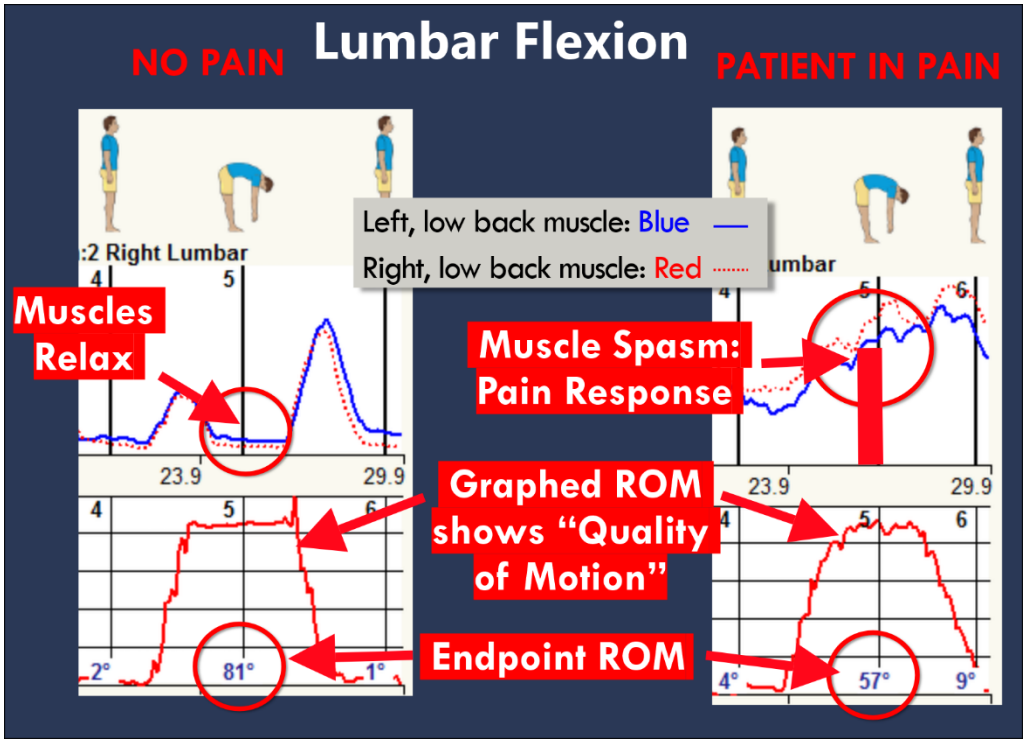
_DR_ADDRESS_

Phone: _DR_PHONE_ **email**: _DR_EMAIL_ **Patient Name:** _PATIENT_FIRST_ _PATIENT_LAST_

OVERVIEW OF TESTING METHODOLOGY

FLEXION RELAXATION RESPONSE EVALUATION

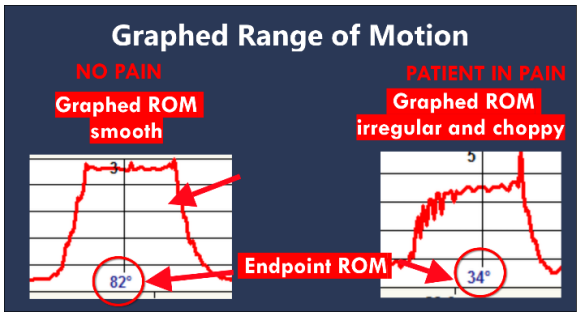
This is a study of the muscle activity of the Lumbar paraspinal region as the patient performs a series of three consecutive flexions. It is a reflex for muscles of the lumbar paraspinals to relax when the body is placed in a fully flexed position, as the body is "hanging" off ligaments (Sihvonen, et. Al. 1991). Readings should be relatively low in flexion (markers 1, 3 & 5).



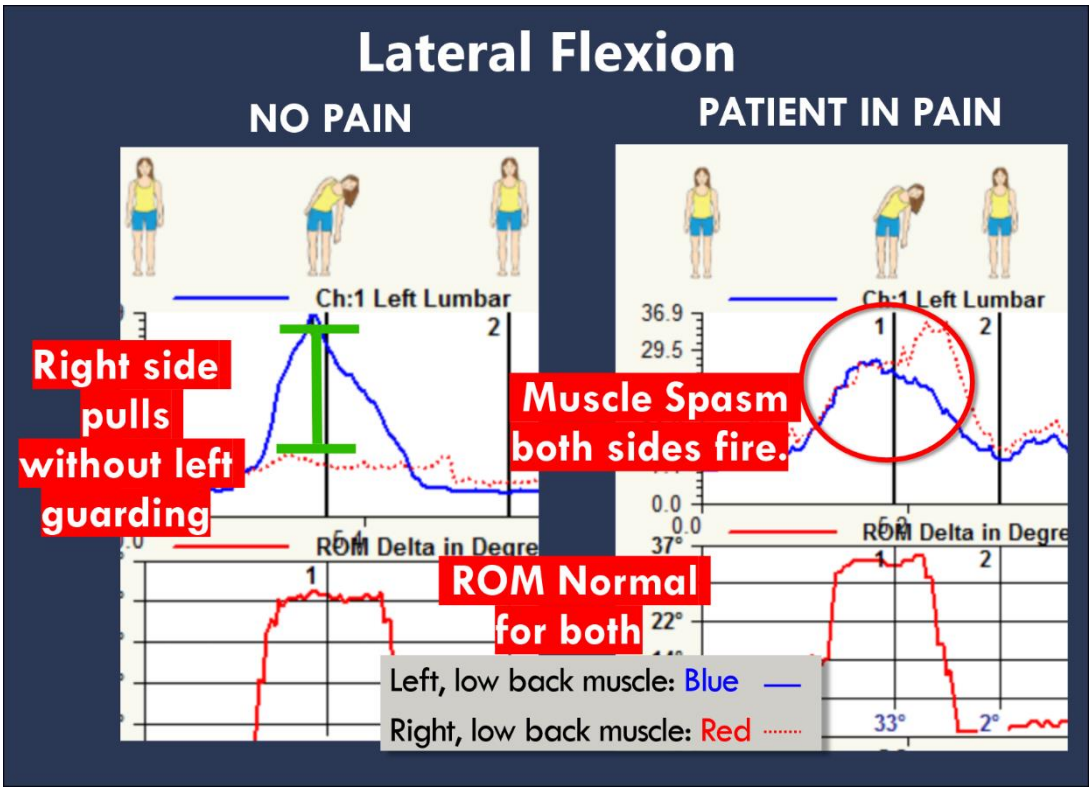
Muscles which fire while in the fully flexed position correlate highly with pain and/or injury of the soft tissue.

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 traces on the graph (left and right muscle activity) separate as one side fires at a higher amplitude to compensate for pain in this motion. Irritability or muscle fibrillation also a indicator of pain in motion. As the patient moves, if pain is induced, muscles are recruited which are not typically used to create this motion, leading to a random firing, or line graphs which lack smoothness. Muscle irritability/fibrillation is one variable taken into account when interpreting the graphs.

Quality of Motion: All motions Endpoint range of motion shows only the degree to which a patient can bend. Just as one would compare a photograph to video, by graphing range of motion, we can see not only how far the patient bends, but how they moved. A patient without pain will move smoothly. Those in pain will display jerky, irregular and choppy motion as seen on the graph. This is a normal response to pain, and is commonly referred to as "ratcheting" in the scientific literature.



Left/ Right LATERAL FLEXION; Left/Right ROTATION



Level of Activity of Opposite Side (Muscle Guarding and Co-Contraction): In performing a left or right lateral flexion or rotation, only one side of the paraspinal muscles should engage, initiate and produce the motion. For example, in a left rotation, it is typical to see a large separation between the blue (left) and red (right) traces on the graph as the patient moves into the end range of motion. It is the body's natural defense mechanism to have muscles fire from the opposite side to brace and immobilize. If there is no pain in motion, there would therefore be no recruitment of muscles from the opposite side, demonstrated as a large separation between blue and red lines in the graphs. There should be significant space between blue and red lines at the point where the patient has reached the full end point of the range of motion. **Irritability/fibrillation:** Muscles fire in a smooth fashion in normal individuals with little irritability or fibrillation. Soft tissue injury creates a state of abnormal motor functioning which appears as "jitter" or increased variability in the traces shown in the portion of the graph where muscle activity is displayed as the patient moves (the upper half of the graph).

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 motions 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. In addition, if the patient test data improves from first to last trial, (there is an increases in the separation of left/right traces), this indicates the patient improves through stretching, decreasing the likelihood that the patient's pain is significant.

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/lateral flexion, the right (red) reading should be higher amplitude in the right rotation/lateral flexion. If one muscle group fires consistently higher in both motions, this is most likely a learned guarding response, and an indication of a chronic condition.

IMPORTANT GUIDELINES:

BASIC PRINCIPLES:

1. Muscle guarding is the body's natural defense mechanism to pain in motion. If there is pain, muscles will guard to brace and immobilize for the purpose of reducing further pain and injury. This is what we are looking for in the graphs. It is that simple.
2. DynaROM is a simultaneous measure of range of motion and muscle guarding (as measured with surface electrode EMG) graphed over time. It allows us to document muscle guarding regardless of range of motion measures.
3. Range of Motion is, on it's own, a poor indicator of soft tissue injury. At least 50 per cent of patients demonstrate normal end point range of motion, but with muscle guarding and pain. The point of simultaneously measuring muscle activity and range of motion is to increase the sensitivity of range of motion by adding the muscle guarding component. If a patient is experiencing muscle guarding and normal range of motion, they are most likely experiencing pain, which is not possible to measure with range of motion itself.
4. Insurers love range of motion and MRI studies. Why? Because there is no relationship between one experiencing an auto accident and positive findings in an MRI, and a huge percentage of patients with pain still have normal range of motion; used against the patient and establishing them as "normal" when they are not. DynaROM proves soft tissue injury even with normal range of motion For a video showing this, visit: https://vimeo.com/216419148

Lumbar spine: The Flexion-Relaxation Response.

Listen Up. I don't know why this is so difficult, but 99% of those who hear it 500 times don't seem to get it.

IN NORMAL, PAIN FREE INDIVIDUALS, when they bend into flexion (past 40-45 degrees) muscles shut off. Complete silence. NO MUSCLE CONTRACTION AT ALL. Why? What do ligments do in full flexion? They take over at 40-45 degrees, and lumbar paraspinal muscles shut off as the patient is hanging off ligaments. There is NO muscle activity at all in full flexion in normal individuals.

IN PATIENTS IN PAIN: In full flexion, muscles fire with a very high amplitude as a muscle guarding response.

Dynamic sEMG:

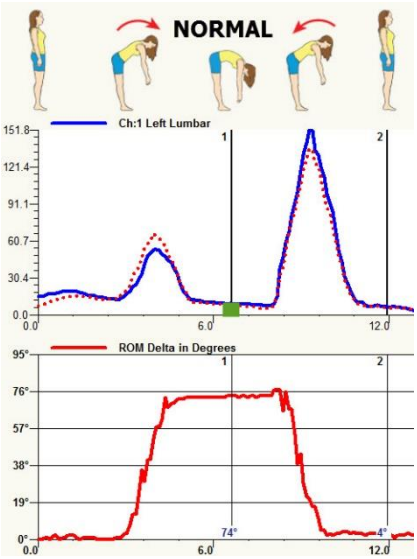
Blue: Left Lumbar

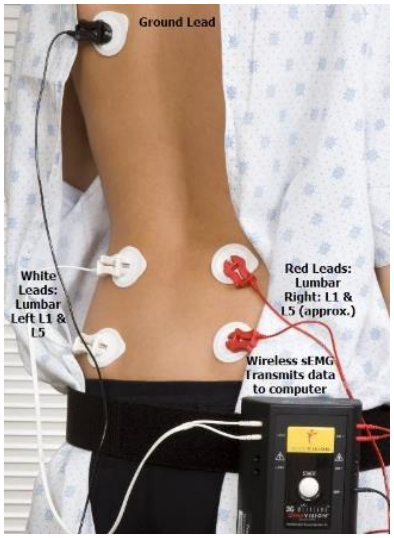
Red: Right Lumbar

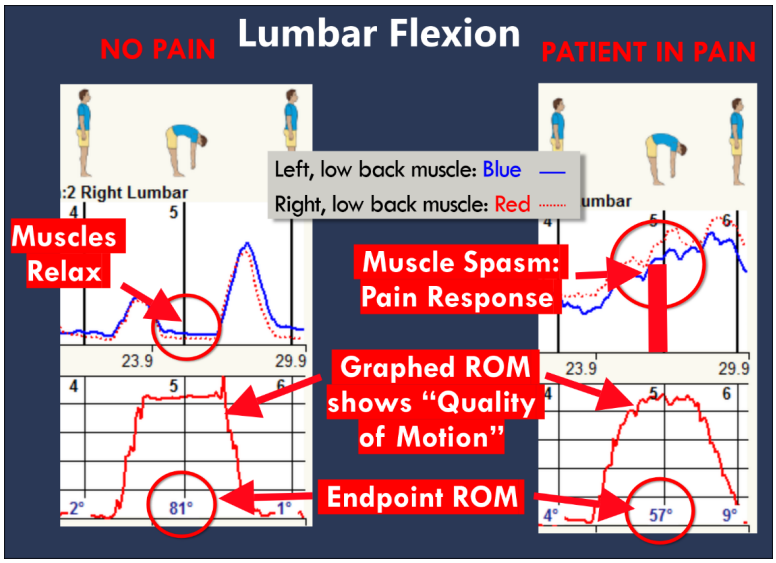
Range of Motion

Endpoint ROM at

Marker 1 (74 degrees)

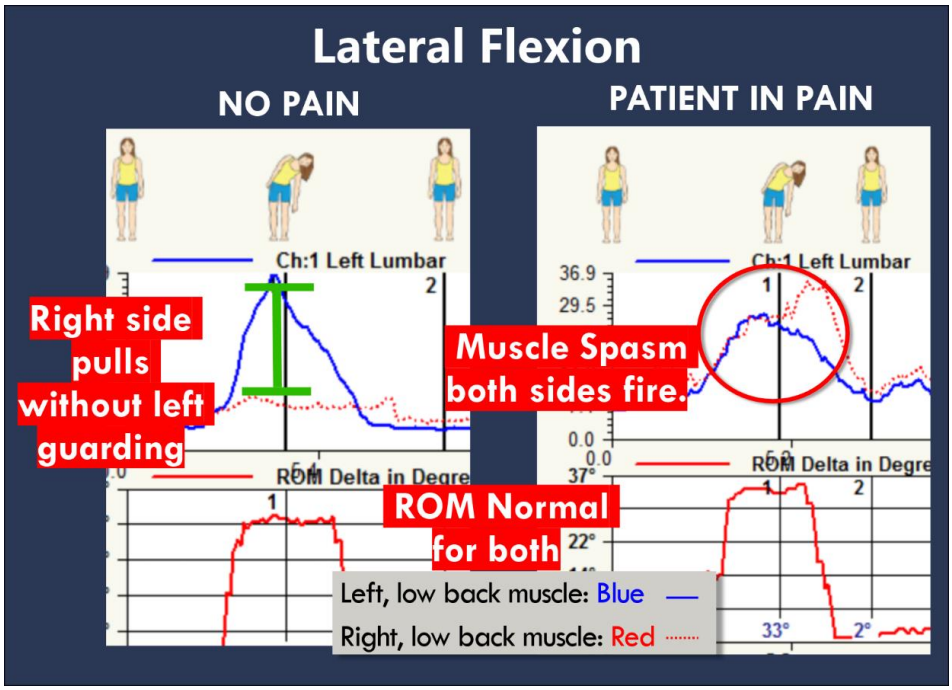






1. Look at the Lumbar flexion first as most important, and then lateral flexions and rotations. Your priorities are on Lumbar Flexion providing the most information, as it is indisputable. At 40 to 45 degrees of flexion, muscles will shut off completely. If they don't? You have solid proof of pain in this motion.
2. Next, look at left and right lateral flexion and rotation. BASIC PRINCIPLE: Again, it is so extremely simple, so don't make it more complex than it is.

   In performing a left or right motion, ONE SIDE (it does not matter which side. Some people perform a left rotation by using muscles on the right side believe it or not), should fire INDEPENDENT from the other. In other words, when performing a left rotation, at the end range of motion, there should be a SIGNIFICANT DIFFERENCE IN THE BLUE AND RED TRACES. The only the blue and red traces would overlay, or fire at the same approximate level, is defined as muscle guarding. In other words, the only reason muscles are recruited from the opposite side is to produce a guarding response, the body's natural defense mechanism to pain in motion. As you can see below: No pain? Muscles on the left and right sides fire independent of each other. Pain? Muscles fire SIMULTANEOUSLY. Look for the SPACE BETWEEN THE BLUE AND RED TRACES. If there is a lot of space? No guarding. If there is a little space? Significant guarding.



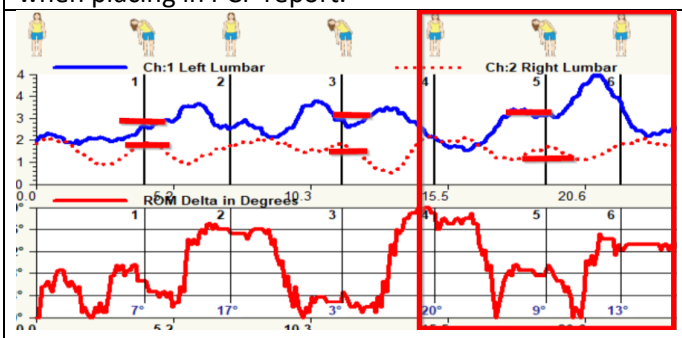
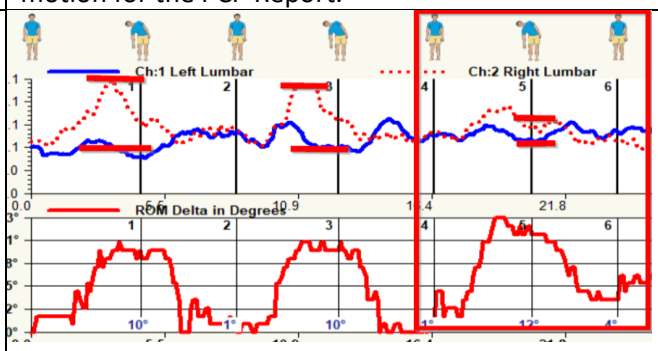
3. The same is true of lateral flexion and rotation. In rotation, there should be a significant difference between left and right sides (blue and red traces) at the end range of motion.

LUMBAR EXTENSION: Muscles traces should overlay and fire in a calm fashion, with little "jitter" in the signal. When there is joint instability or pain in extension, muscles begin firing with a separation of blue and red lines, as one side of the paraspinals fires more than the other to compensate for the instability and/or pain in extension.

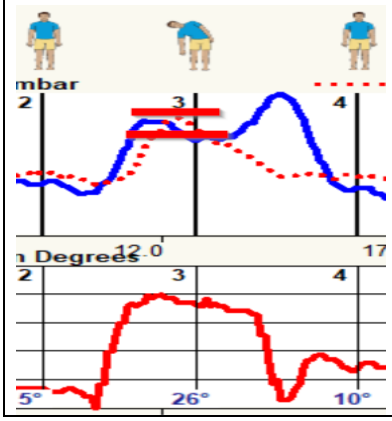
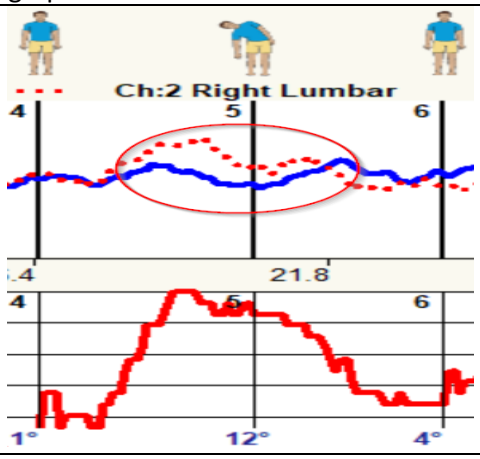
FINE TUNING YOUR INTERPRETATION: WHEN YOU SEECHANGE OVER THREE TRIALS: On occasion, you will find a patient who experiences a significant change in their muscle guarding response over the three trials. Assuming you ran 2 test trials prior to taking data, this is caused by one of two reasons.

IF they get better, stretching helps. If they get worse, pain is severe.

1. IF you see a pattern of muscle firing where the muscle guarding gets worse over the three trials, that means the patient is experiencing exacerbation of symptoms over the three motions: It gets more and more painful.
2. IF you see a pattern of muscle firing where the guarding response is reduced over three trials, it means they are helped by stretching and are not as severe. When doing the screen shots, choose the one which best demonstrates the truth: In the case where they get worse over three trials, show the last one. In the case where they get better over three trials, show the last one as well, as it is more accurate in expressing their actual physiologic state.

Note: Gets better over 3 trials Select the last motion when placing in PCP report.	Note: Guarding increases over 3 trials. Capture the last motion for the PCP Report.
	

What is the difference between muscle guarding with pain and muscle guarding which is a learned guarding response?

Muscle guarding which is chronic, and older is established by a muscle guarding response (left and right sides fire simultaneously) without fibrillation.	Muscle guarding which is acute: has significantly greater fibrillation or "jitter" in the traces on the top half of the graph.
	

COMPLETING THE NEW INTERPRETATION REPORTS:

You can download the screen capture software and review the process by visiting support.myovision.com and searching for "screenshot"

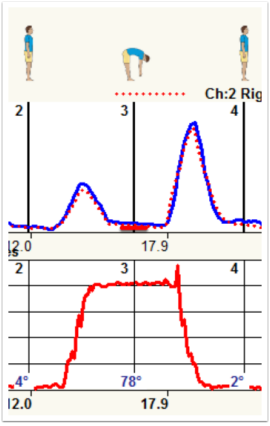
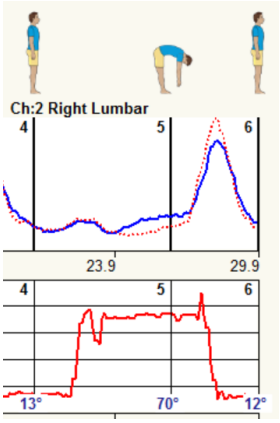
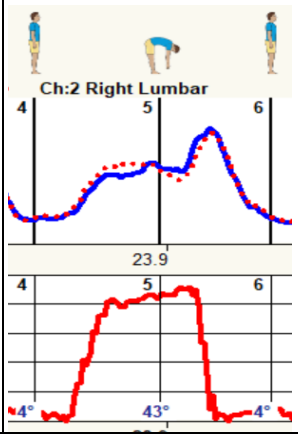
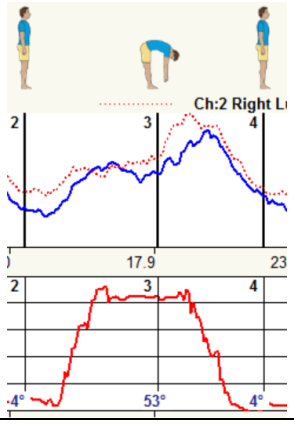
REMINDER: ALWAYS PERFORM 2 TEST MOTIONS PRIOR TO BEGINNING COLLECTING DATA. It eliminates the "training effect" and gives good consistent results across the three trials.

Use these pictures as comparisons with patient tests: The drop down gives you the choice of one of these pictures.

Basic principles: In lumbar flexion, there is a phenomenon known as the flexion-relaxation phenomenon. In full flexion (past approximately 40-45 degrees) the body shifts to hanging off ligaments. Muscles fire to initiate the motion (the small "blip" in the graph before Marker 1) but once past approximately 40 degrees, muscles shut off completely as we are hanging on our ligaments. This is an established fact with over 30 years of research to back it. If one is in pain, muscles guard and do not experience flexion-relaxation. There are only 3 cases you will see:

1. Muscles shut off in flexion (at marker 1).
2. Muscles fire at a high level in full flexion (at marker 1).
3. Muscles fire at approximately half the level seen in the acute pain stage (number 2 above). These are chronic low back pain patients.
4. The only modifier on this is if they experience pain WITH fibrillation or not. Fibrillation is the "jitter" in the signal, and correlates with pain. Why? When in pain, muscles are recruited in a "fight or flight" manner, meaning there is significant irritability (spasm) in response to motion.

Use the pictures below to choose the appropriate drop down.

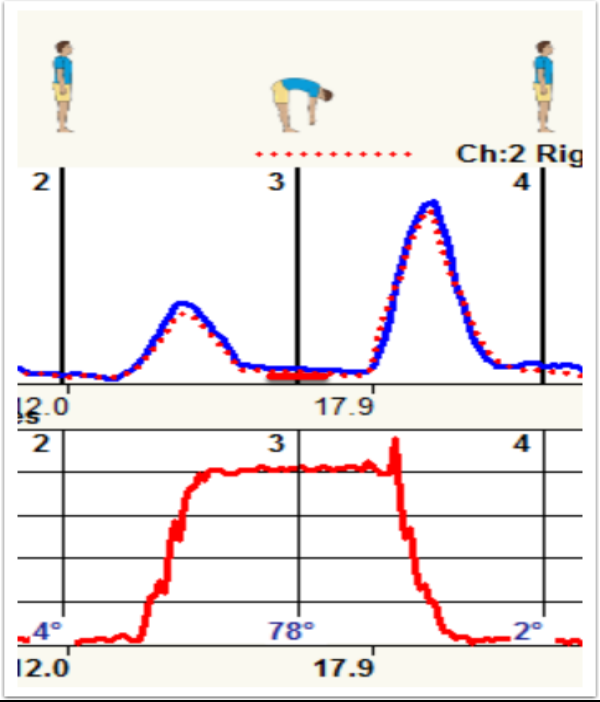
Normal	Moderate	Severe	Severe with fibrillation.
			

The choices below are for your interpretation report: In actual report: Select from drop down and paste patient graphics into right side in table:

SAMPLE BELOW:

Interpretation: Choose an item.

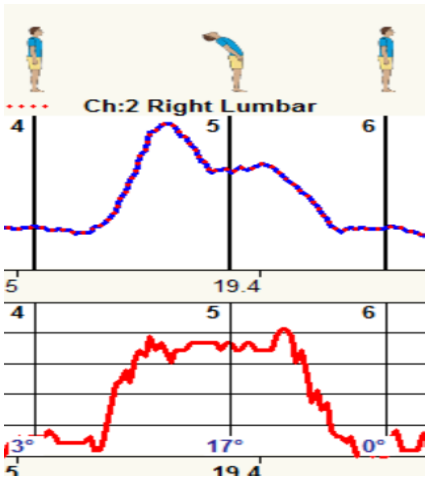
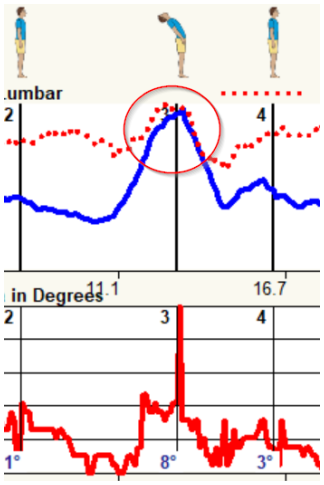
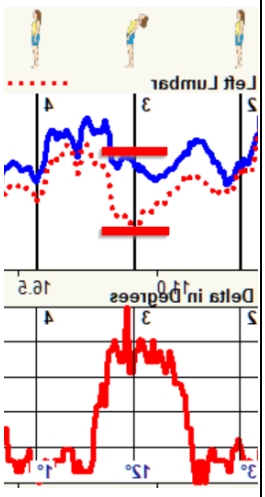
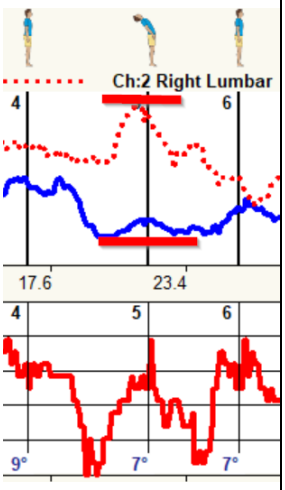
Range of Motion in degrees: AMA: 50° Patient: _RFLEX_AV_

Ideal	_PATIENT_FIRST_ _PATIENT_LAST_
	

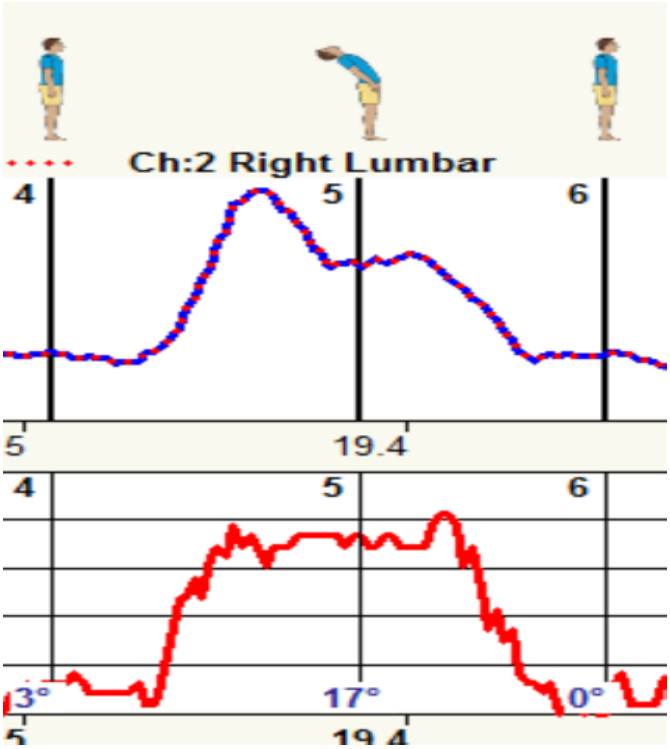
Lumbar Extension DynaROM: Look for separation and fibrillation to tell the story.

NOTE: ALWAYS PERFORM 2 TEST MOTIONS PRIOR TO BEGINNING COLLECTING DATA. It eliminates the "training effect" and gives good consistent results across the three trials.

1. Left and right traces should fire together in lumbar extension. In other words, the traces should overlay quite well. If they don't it is a muscular compensation for biomechanical lumbar instability (SI joint issues , ligamentous issues etc.).
2. Fibrillation: If there is severe fibrillation, that indicates the patient is most likely experiencing pain with the instability, although instability itself will create this fibrillation response. Remember the muscles job is to guard and protect. If they feel unstable while moving into extension, fibrillation will occur. This leads to an abnormal interpretation choice.
3. Consistency: You should see consistency across all tests.

Normal	This appears abnormal but is normal, as the readings come together at full extension.	Moderate:	Severe: see how left and right sides separate out dramatically? Correlates with SI Joint issues and instability.
			

Interpretation: Choose an item.
Range of Motion in degrees: AMA: 20° Patient: _REXT_AV_

Ideal	_PATIENT_FIRST_ _PATIENT_LAST_
	

*Office of _DR_NAME_*

_DR_ADDRESS_

Phone: _DR_PHONE_ **email**: _DR_EMAIL_ **Patient Name:** _PATIENT_FIRST_ _PATIENT_LAST_

Interpretation of Patient Test Results: ***Lumbar Left Lateral Flexion DynaROM***

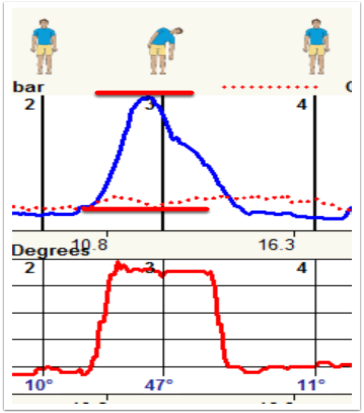
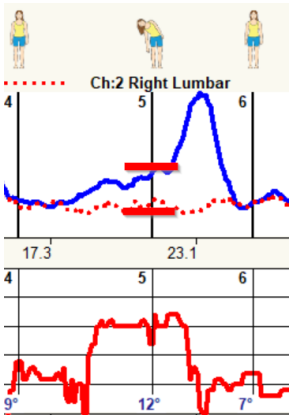
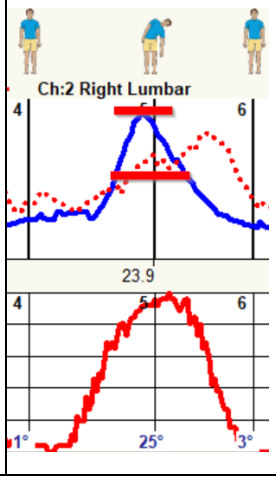
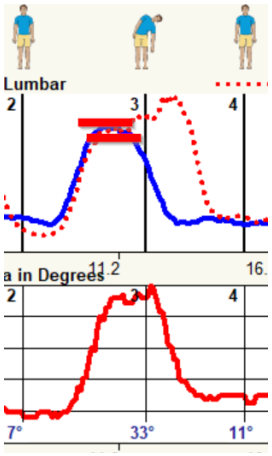
Left lateral flexion and Rotation: Rotation and Lateral Flexion demonstrate the same muscular response::

NOTE: ALWAYS PERFORM 2 TEST MOTIONS PRIOR TO BEGINNING COLLECTING DATA. It eliminates the "training effect" and gives good consistent results across the three trials.

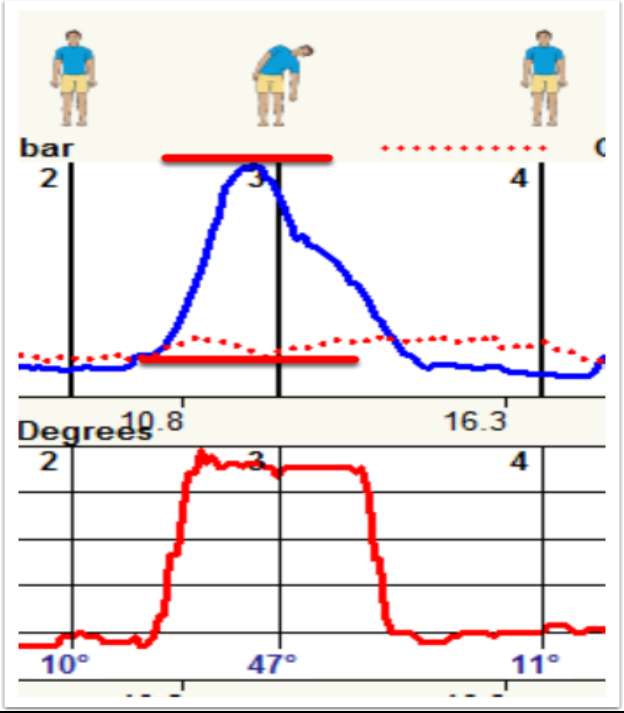
In lateral flexion and rotation, the same principle applies: Left (blue) and right (red) muscles should fire independent of each other. If there is no pain, why would the opposite side be recruited? It would not, as the opposite side firing is literally the body's natural defense mechanism to pain in motion. Muscles are recruited to "guard" to brace and immobilize to prevent further pain or injury.

1. In full left or right lateral flexion or rotation, **ONE SIDE** (it does not matter if left or right. Some individuals for reasons unknown produce the motion by firing on the left side (pulling) themselves over, the other group hang off ligaments, and stabilize with the right side**. It does not matter which side is firing to produce the motion, simply that only ONE SIDE engage at the end range of motion).**

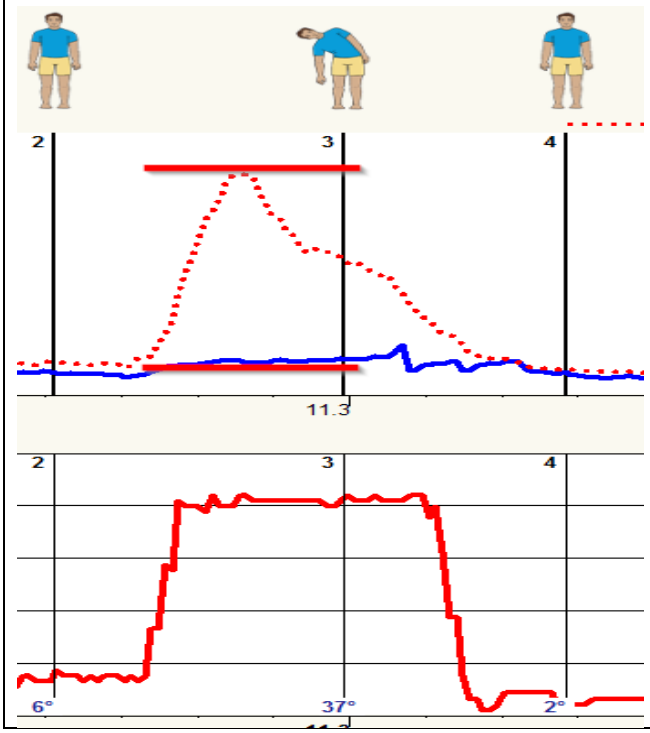
Returning to neutral, some will "spring" back using their ligaments. Others will use muscles to pull themselves back. It does not matter if the opposite side pulls them back. Ignore the small "blip" in firing from the opposite side returning. It is completely normal to see.
Left Lateral Flexion and Rotation: The principle is the same.

Normal	Mild	Moderate	Severe
			

Interpretation: Choose an item.
Range of Motion in degrees: AMA: 30º Patient: _RLLAT_AV_

Ideal	_PATIENT_FIRST_ _PATIENT_LAST_
	

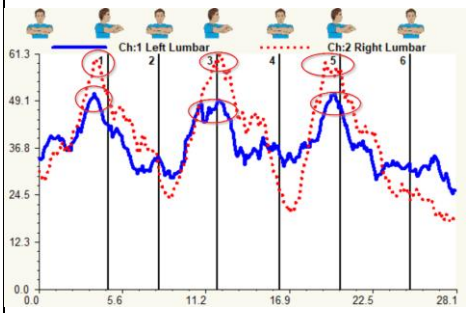
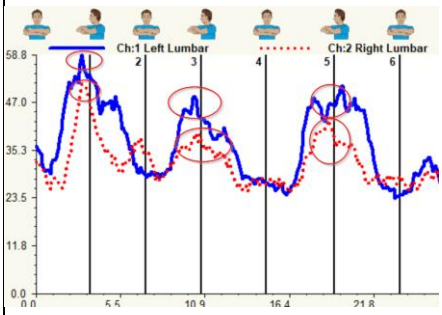
Interpretation: Choose an item.
Range of Motion in degrees: AMA: 30º Patient: _RRLAT_AV_

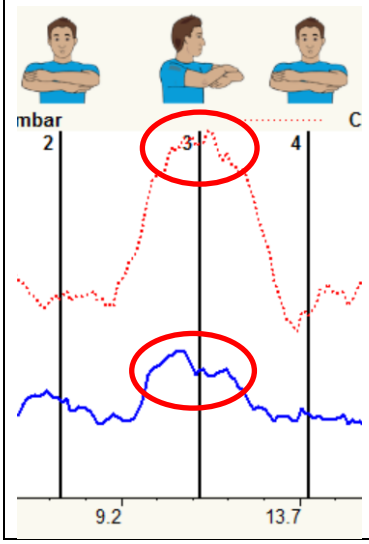
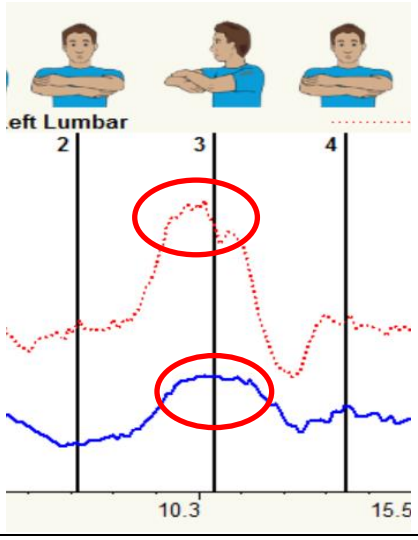
Ideal	_PATIENT_FIRST_ _PATIENT_LAST_
	

Does left lateral flexion and right lateral flexion show opposite muscle groups firing?
Whichever line is higher in the left motion should be lower in the opposite motion (e.g if the left (blue) trace is higher in movement to the left, the right (red) trace should be higher in the motion to the right, and visa versa).

Comparison of Left vs. Right Lateral Flexion: Choose an item.

For this question, it is important to look at the left and right motion. If the red trace is higher in the left motion, it should be higher in the right motion as shown below.

Left: If red is high, then in the motion to the right, the blue should be higher.	Right: You can see, the blue line is higher in the opposite motion.
	

ABNORMAL: Motion to the left, leads to higher red trace. Motion to the right is produced by same side as left..	Right: You can see this patient uses the right side for both left and right motions, proof they have learned to use the same side for all motions An abnormal response.
	

Interpretation of Patient Test Results: ***Lumbar Left Rotation***

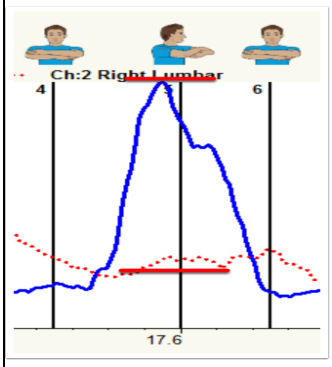
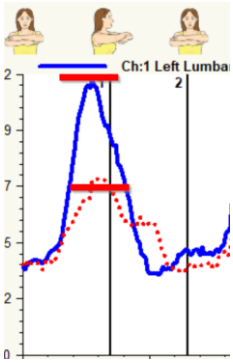
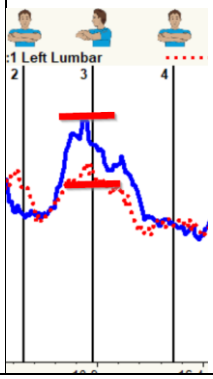
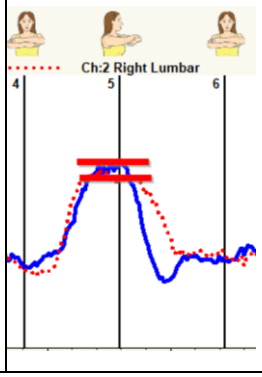
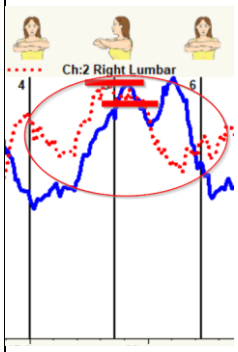
Left lateral flexion and Rotation: The Principle is the same:

NOTE: ALWAYS PERFORM 2 TEST MOTIONS PRIOR TO BEGINNING COLLECTING DATA. It eliminates the "training effect" and gives good consistent results across the three trials.

In lateral flexion and rotation, the same principle applies: Left (blue) and right (red) muscles should fire independent of each other. If there is no pain, why would the opposite side be recruited? It would not, as the opposite side firing is literally the body's natural defense mechanism to pain in motion. Muscles are recruited to "guard" to brace and immobilize to prevent further pain or injury.

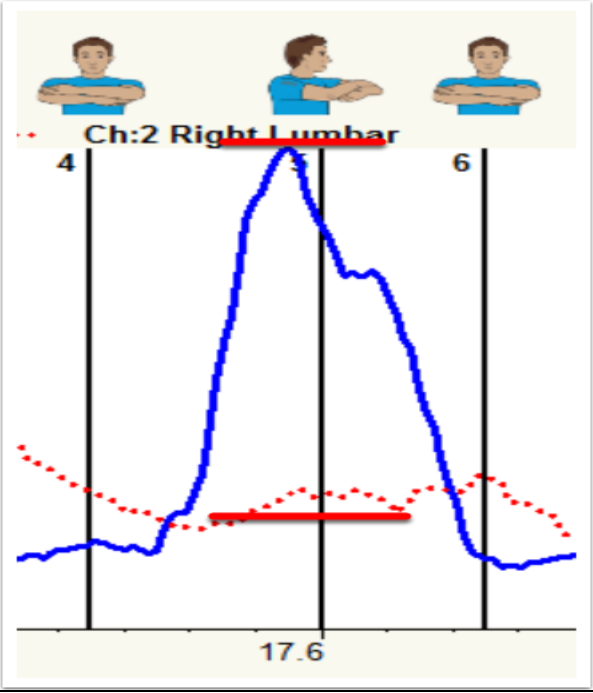
1. In full left or right lateral flexion or rotation, **ONE SIDE** (it does not matter if left or right. Some individuals for reasons unknown produce the motion by firing on the left side (pulling) themselves over, the other group hang off ligaments, and stabilize with the right side**. It does not matter which side is firing to produce the motion, simply that only ONE SIDE engage at the end range of motion).**

Returning to neutral, some will "spring" back using their ligaments. Others will use muscles to pull themselves back. It does not matter if the opposite side pulls them back. Ignore the small "blip" in firing from the opposite side returning. It is completely normal to see.
Left Lateral Flexion and Rotation: The principle is the same.

Normal	Mild	Moderate	Severe	Severe with Fibrillation
				

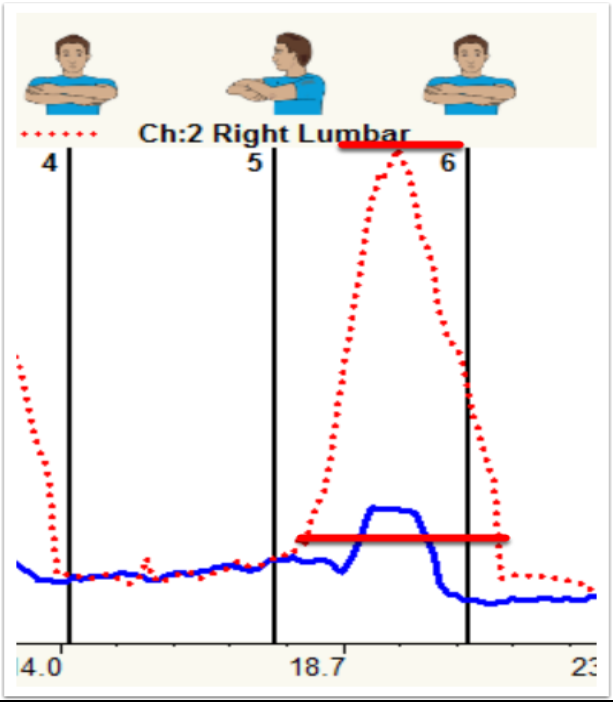
Interpretation: Choose an item.

Ideal	**_PATIENT_FIRST_ _PATIENT_LAST_**

 Ch:2 Right Lumbar 4 6 17.6	

Interpretation of Patient Test Results: ***Lumbar Right Rotation***

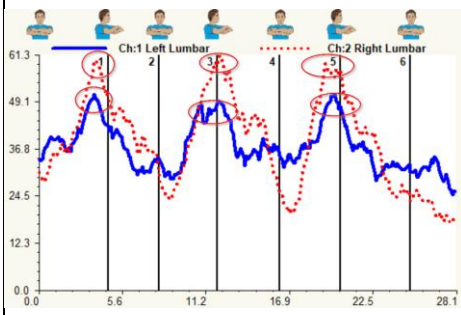
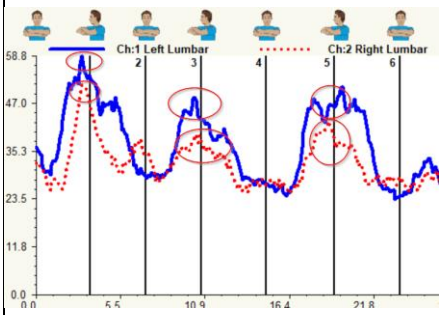
Interpretation: Choose an item.

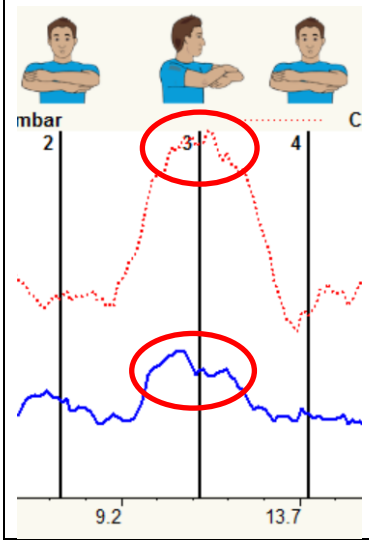
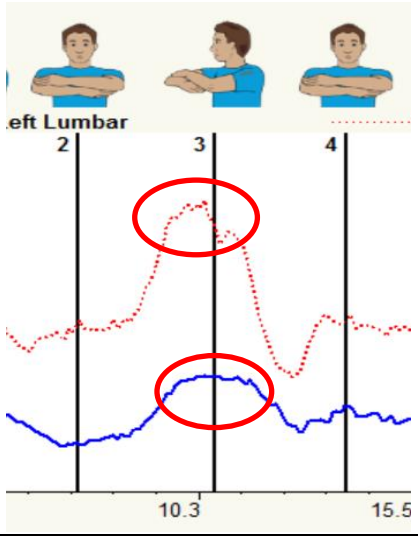
Ideal	_PATIENT_FIRST_ _PATIENT_LAST_
	

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

Whichever line is higher in the left motion should be lower in the opposite motion (e.g if the left (blue) trace is higher in movement to the left, the right (red) trace should be higher in the motion to the right, and visa versa).

For this question, it is important to look at the left and right motion. If the red trace is higher in the left motion, it should be higher in the right motion as shown below.

Left: If red is high, then in the motion to the right, the blue should be higher.	Right: You can see, the blue line is higher in the opposite motion.
	

ABNORMAL: Motion to the left, leads to higher red trace. Motion to the right is produced by same side as left..	Right: You can see this patient uses the right side for both left and right motions, proof they have learned to use the same side for all motions An abnormal response.
	

Comparison of Left vs. Right Rotation: Choose an item.

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. By testing the patient in motion, a "stress test" of sort is created, which allows us to objectively evaluate levels of pain in motion.

Clinical Impression: Choose an item.

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,

Doctor Name, Specialty

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