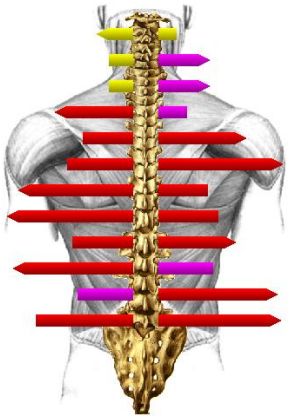
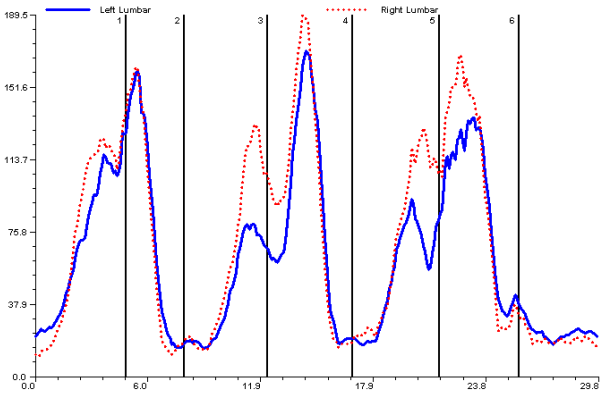
MYOVISION

Utilizing MyoVision in the Medical-Legal Arena to Prove Presence or Absence of Soft Tissue Injury





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The Value of Surface EMG and Range of Motion Studies in Objectively Documenting Soft Tissue Injury

Documentation of Soft Tissue Injury and Patient Progress:
Research, Legal Precedence, & Case Studies

Written by David Marcarian, M.A.
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Expert witness credited with establishing the validity of surface electromyography (sEMG) in the 2006 Superior Court Case in Florida

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This document is the result of evaluating the usage of instrumentation in various clinics around the United States to determine what provides the most cost-effective, valuable data from physiological monitoring equipment. Refer to the American Medical Association (AMA)'s publication *The Practical Guide to Range of Motion Assessment* for information on range of motion testing. Because this topic has been presented in the literature for many years, proof of its value is excluded from this document.

Summary and Conclusions of This Paper

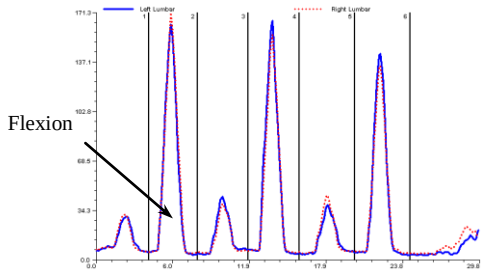
Note: All conclusions are supported by the body of the text in this 29-page document under the appropriate sections.

Four major conclusions establish dynamic surface EMG as clinically valuable in objectively evaluating injury as described below.

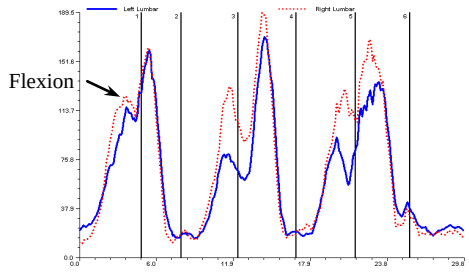
Critical Note: There are two types of surface EMG: static and dynamic. Most of the negative image the medical and scientific community has with regards to surface EMG is based on the utilization of *static* surface EMG. **This paper focuses on dynamic surface EMG, which is well established** within the scientific and medical communities as a valid method of obtaining objective data.

Four Major Conclusions Support the Value of Surface EMG:

1. **Surface EMG can separate those with soft tissue injury from those without through a lumbar flexion test.** Those with excess muscle firing (bracing) are most likely experiencing soft tissue injury, as it is a reflex for the muscle in the lumbar spine to relax in full flexion. Those who are not experiencing injury do not display trademarks of relaxation when tested. The measure of the flexion relaxation response is well accepted by the entire scientific community, making it a valuable tool for documenting injury.



Sample Normal Dynamic Flexion sEMG: Three consecutive flexions shown. Note that readings are very low in flexion (markers 1, 3, 5), as the muscles in normal individuals relax when in full flexion.



Sample Abnormal Dynamic Flexion sEMG: Note the very high readings in flexion, the lack of flexion relaxation, which correlates highly with soft tissue injury.

2. **Surface EMG has established its ability to objectively document soft tissue injury in the medical-legal arena** in a major court case in Florida between the State of Florida (joined by most major insurers) and an industry expert on surface EMG through a review of all the scientific literature on the topic. It went all the way to the Supreme Court of Florida after the Superior Court of Florida upheld a lower court decision that was 47 pages long.

3. **Surface EMG significantly augments range-of-motion testing** and can aid in separating those truly injured from symptom magnifiers. The process is simple: If there is a limited range of motion and muscles fire at a very high level and display signs of irritation, injury is most likely the case. If there is a limited range of motion accompanied

by low muscle firing and low irritability of muscle firing, there is a good chance that symptom magnification may need to be considered.

4. **The AMA has a CPT code for billing dynamic surface EMG**, which the Florida Court determined supported the use of surface EMG. According to the AMA's manual *Applying for Codes: CPT Background and Categories of CPT Codes*, a test must be "generally based upon the procedure being consistent with contemporary medical practice and being performed by many physicians in clinical practice in multiple locations" in order to be eligible for a 5-digit CPT code.

LEGAL PRECEDENCE: Actual detailed legal case documents are summarized in this document.

The validity of surface EMG was established in a decision by the Superior Court of Florida, which evaluated scientific literature and the presentations of expert witnesses, including an established industry expert on surface EMG, representing major insurers and the state of Florida. The Superior Court ruled that surface EMG is a scientific, medically necessary tool for evaluating for soft tissue injury and the resulting appeal to the Supreme Court of Florida was rejected.

SCIENTIFIC LITERATURE: Actual studies are referenced in section on Research in document.

There has been a virtual explosion of literature on the topic of surface EMG and its ability to objectively evaluate soft tissue injury, most importantly showing that the measurements obtained using surface EMG do correlate with soft tissue injury and thus can be relied upon to document injuries.

1. *Recent Meta-Analytic Review of the Literature:* The major University of Michigan study by Geisser et al published in 2005 found that sEMG

   A. has a sensitivity and specificity high enough to be considered equivalent to many tools commonly used in modern medical practice,
   B. provides a superior method of objectively tracking progress when combined with other exams, e.g. range of motion,

   There were numerous studies on flexion-relaxation of the lumbar spine, and the author concluded that "sEMG measures of flexion relaxation appear to distinguish LBP patients from controls with good accuracy, and the sensitivity and specificity of sEMG can be increased by using multiple measures." **It is the recommendation of this paper that the combination of surface EMG, range of motion, and subjective-objective testing provides this increased sensitivity and specificity.**

2. *Whiplash Study:* The Nederhand *et al* study found that surface EMG could clearly delineate those with whiplash from those without with statistical significance. All subjects in the study

were in rear-end motor vehicle accidents (MVAs), making the study directly applicable in clinical practice. In summary, those with whiplash had irritable trapezius muscles which would not relax in comparison to controls, as muscles fire irritably when there is soft tissue injury.

3. *sEMG Sensitivity Study:* The Ambroz *et al* studies (1999, 2005) found that surface EMG could distinguish between those injured and normals in both static and dynamic sEMG for chronic low back pain patients. What is particularly impressive is that surface EMG has the sensitivity to correlate muscle tension with injury, even in those with chronic low back pain. Prior to these studies, it was assumed that surface EMG lacked sufficient sensitivity with chronic patients due to muscle fatigue, but these studies proved this notion false.

Clinical Case Studies: Actual studies shown in detail in this document.

1. Clinical Studies: Surface EMG, when combined with range of motion tests, has been shown to augment range of motion by providing an objective measure of effort. Under the section below on Clinical Studies the following were shown:
    - **a.** When there was a limited range of motion with excess muscle firing, this helped document injury.
    - **b.** When a limited range of motion was accompanied by low muscle firing along and lack of irritable muscle firing (increased variability in the sEMG signal) this lead the clinician to examine the possibility of symptom magnification, as there was little or no effort of the muscle in response to the limited range of motion.

Use of Instrumentation

Research

A Meta-Analytic Review of Surface Electromyography Among Persons with Low Back Pain and Normal, Healthy Controls (2005)

M. E. Geisser, M. Ranavaya, A. J. Haig, R. S. Roth, R. Zucker, C. Ambroz, and M. Caruso

Originally published in *The Journal of Pain*, November 2005, pp. 711–726.

This paper examined 44 relevant papers on the clinical value of surface EMG and arrived at the following conclusions:

1. Surface EMG measures of flexion-relaxation appear to distinguish low back pain patients from healthy controls with good accuracy.
2. The sensitivity and specificity of dynamic surface EMG measurements averaged 88.8% and 81.3%, demonstrating that surface EMG provides valuable data.
3. The effect size for flexion relaxation measurements was found to be very high (d—1.71) showing that sEMG able to accurately distinguish between low back pain patients and controls.
4. The MyoVision system was the only one of the two best-selling surface EMG systems with unbiased research of a high enough caliber to be included in this review and which provided data supporting the use of surface EMG, establishing it as the instrument of choice when evaluating patients.

Cervical Muscle Dysfunction in the Chronic Whiplash Associated Disorder Grade II (WAD-II) (2000)

M. J. Nederhand, M. J. IJzerman, H. J. Hermens, C. T. Baten, G. Zilvold.

Originally published in *Spine*, volume 25, number 15, pp. 1938–1943.

1. *Results:* The most pronounced differences between patients with whiplash associated disorder grade II and healthy control subjects were found in situations in which the biomechanical load was low. Patients showed higher coactivation levels during physical exercise and a decreased ability to relax muscles after physical exercise.
2. *Conclusions:* Patients with whiplash associated disorder grade II can be distinguished from healthy control subjects by the presence of cervical muscle dysfunction of the upper trapezius muscles, as assessed by surface electromyography. In particular, the decreased ability to relax the trapezius muscles seems to be a promising feature for identifying patients with whiplash associated disorder grade II. Assessment of the muscle (dys)function by surface electromyography offers a refinement of the whiplash associated disorder classification and indicates suitable therapeutic approaches.
3. What makes this paper particularly practical and useful for court use is that all patients in the study were in motor vehicle collisions, making this applicable directly to soft tissue injury associated with motor vehicle collisions.

Chronic Low Back Pain Assessment Using Surface Electromyography (1999)
C. Ambroz, A. Scott, A. Ambroz, and E. O. Talbott

Originally published in *Journal of Occupational and Environmental Medicine*, volume 42, number 6, pp. 660–669

1. Aim of this study was to investigate the reliability of the sEMG technique in differentiating between chronic low back pain patients and healthy controls. Moreover, this investigation included a matching protocol which was not used in the above-mentioned study. The findings of this report support the use of both static and dynamic sEMG as methods of assessing abnormal paraspinal muscle activity independent of the type of low back pain. The effect of position on the sEMG activity was indirectly addressed by the demonstration that different degrees of trunk flexion produced a significant variation in the readings.
2. This study demonstrated clear, statistically significant differences between healthy controls and those with low back pain in both static and dynamic sEMG testing.

VAS scores correlate with Static Surface EMG Signal Intensity in Chronic Spine Pain (2005)
A. Ambroz, C. Ambroz, R. Zucker, E. Benjamin, M. Caruso

Originally published in the AAPM Annual Meeting Abstracts, *Pain Medicine*, volume 6, number 2, pp. 165–197

This paper demonstrated the following:

1. VAS scores correlated highly with the summation of all readings taken during a static sEMG exam (In total, 24 readings, summed, were presented).
2. Static sEMG values correlated highly with pain intensity changes over a 2-month treatment program with results indicating that a VAS score of 6 at presentation with a mean sum static sEMG value of 542 microvolts. After 2 months of treatment, the mean VAS score was 1 for this group, with a mean value of 180 microvolts of summed static sEMG values.
3. Those that did not respond to treatment showed very little change in both the VAS score and the static sEMG sum, with a mean presentation VAS score of 6.8 with a mean summed static sEMG value of 884 microvolts. Two months post-treatment, with no response to treatment the VAS score remained a mean of 6.8 with a mean summed static sEMG value of 709 microvolts.
4. The conclusion of the authors was that the mean summed static sEMG signal intensity can serve as an objective measurement which correlates highly with pain.

Electric Behavior of Low Back Muscles during Lumbar Pelvic Rhythm in Low Back Pain Patients and Healthy Controls (1991)
T. Sihvonen, J. Partanen, O. Hanninen, S. Soimakallio

Originally published in *Archives of Physical Medicine and Rehabilitation*, volume 72, number 13: 1080–1087.

1. Conclusion: The lumbar myoelectric rhythm measured during normal symmetric movements in the sagittal plane appears to be different in back pain patients when compared to pain-free controls. We believe that it is an invaluable aid in detecting and objectifying disturbed function in paraspinal muscles in back pain patients and in general disability. This agrees with recent research, which indicates that kinetic EMG patterns (in contrast to static levels) may best show the complex biomechanical events in the lumbar region.
2. Test-retest reliability was very high, with $r = 0.91$ to $r = 0.97$ for flexion and re-extension, respectively.
3. Surface EMG seemed to yield more information from activity level than needle EMG when evaluating low back pain.
4. The same phases seen in needle EMG were also seen in surface EMG.
5. Of the 30 patients with low back pain, 26 demonstrated abnormally high readings in flexion, and a ratio of the peak in flexion compared with the peak in re-extension significantly lower than in normal, healthy controls.

The Relation Between Electromyography and Growth Velocity of the Spine in the Evaluation of Curve Progression in Idiopathic Scoliosis (2004)
John Cheung, Albert G. Veldhuizen, Jan P. K. Halbertsma, Natasha M. Maurits, Wim J. Sluiter, Jan C. Cool, Jim R. Van Horn

Originally published in *Spine*, volume 29, number 9, pp. 1011–1016

1. Conclusion: The combined measurement of spinal growth velocity and electromyographic ratio has significant predictive potential and may be valuable in the evaluation and treatment of idiopathic scoliosis.
2. The surface EMG shows promise as a tool in evaluating and tracking progression of scoliosis.

Surface Electromyography in the Identification of Chronic Low Back Pain Patient: the Development of the Flexion Relaxation Ratio (1997)
P. J. Watson, C. K. Booker, C. J. Main, A. C. Chen

Originally published in *Clinical Biomechanics*, volume 12, number 3, pp. 165–171

This paper demonstrated that the surface EMG flexion relaxation ratio could definitively discriminate between normal, healthy controls and chronic low back pain patients, noting the following in particular:

1. Test-retest reliability was very high (0.081–0.098) for dynamic sEMG.
2. Sensitivity and specificity were high enough to recommend use in clinical environments.

The Integration of Surface EMG in the Clinical Decision Making Process: A Case Report (1998)
W. R. Nicholson

Originally published in *The Journal of the Canadian Chiropractic Association*, volume 42, number 1, pp. 21–34.

1. Utilizing a MyoVision surface EMG system, patients were evaluated for injury to track progress with two patients.
2. Results of the surface EMG correlated highly with successful treatment of both patients and lead to their return to work earlier than anticipated.
3. Therapeutic intervention was significantly altered based upon the sEMG findings, as it provided valuable information as to the patient's physiological state.

Interpreting the American Medical Association's Position on Surface EMG

Many research papers have been published since the AAEM review, and most recent conclusions, including that of the American Medical Association (AMA), agree that dynamic surface EMG is an insurance-reimbursable procedure, a stance generally accepted in the medical community.

Two of the AMA's requirements for approving a Category I (any 5 digit) CPT code are that

- "that the clinical efficacy of the service/procedure is well established and documented in U.S. peer review literature" and
- "that the suggested procedure/service is a distinct service performed by many physicians/practitioners across the United States."

The fact that the AMA has approved not only one, but two, CPT codes for dynamic sEMG shows the organization's confidence in dynamic sEMG.

▶Motion Analysis◀

▶Codes 96000-96004 describe services performed as part of a major therapeutic or diagnostic decision making process. Motion analysis is performed in a dedicated motion analysis laboratory (ie, a facility capable of performing videotaping from the front, back and both sides, computerized 3-D kinematics, 3-D kinetics, and dynamic electromyography). Code 96000 may include 3-D kinetics and stride characteristics. Codes 96002-96003 describe dynamic electromyography. Do not report codes 95860-95875 in addition to the motion analysis codes.◀

▶Code 96004 should be reported once regardless of the number of study(ies) reviewed/ interpreted.◀

Note: For static surface EMG or postural analysis use 95999.

▶(For performance of needle electromyography procedures, see 95860-95875)◀

▶(For gait training, use 97116)◀

96000●	Comprehensive computer-based motion analysis by video-taping and 3-D kinematics;	2.54
96001●	with dynamic plantar pressure measurements during walking	3.01
96002●	Dynamic surface electromyography, during walking or other functional activities, 1-12 muscles	.54
96003●	Dynamic fine wire electromyography, during walking or other functional activities, 1 muscle	.55
	▶(Do not report codes 95860-95875 in addition to 96002, 96003)◀	
96004●	Physician review and interpretation of comprehensive computer based motion analysis, dynamic plantar pressure measurements, dynamic surface electromyography during walking or other functional activities, and dynamic fine wire electromyography, with written report	2.60

See "Legal Precedence" for the legal interpretation of the claim that a motion analysis lab is required.

Legal Precedence

Please review the 2006 Florida Superior Court Case (# 1D05-729) titled

DEPARTMENT OF HEALTH, THE FLORIDA INSURANCE COUNCIL, INC., THE PROPERTY CASUALTY INSURERS ASSOCIATION OF AMERICA, THE AMERICAN INSURANCE ASSOCIATION, THE NATIONAL ASSOCIATION OF MUTUAL INSURANCECOMPANIES, THE FLORIDA AUTOMOBILE JOINT UNDERWRITING ASSOCIATION, STATE FARM MUTUAL AUTOMOBILE INSURANCE COMPANY, ALLSTATE INSURANCE COMPANY, GOVERNMENT EMPLOYEES INSURANCE COMPANY, THE FLORIDA FARM BUREAU INSURANCE COMPANIES,LIBERTY MUTUAL INSURANCEGROUP, FIRST FLORIDIAN AUTOAND HOME INSURANCE COMPANY, AND UNITED SERVICES AUTOMOBILE ASSOCIATION, Appellants/Cross-Appellees,

v.

RICHARD W. MERRITT, D.C.,
Appellee/Cross-Appellant.

Note: The case files and all information related can be found at www.myovisioninfo.com under "Insurance Help."

The Superior Court decision was unanimous, upholding the lower court decision (Case #04-1149RX) that surface EMG was found to be valid and that a motion analysis laboratory was found unnecessary for billing using the AMA CPT code for dynamic SEMG. Please note that I was the expert witness in this case, testifying on behalf of the validity of surface EMG.

In the lower court decision, with regards to the AMA CPT Codes, Judge Cleavinger, in her 47-page decision, stated:

42. Additionally, the American Medical Association Current Procedural Terminology (CPT) 2004 Manual is a proprietary system of the AMA for reporting medical services and procedures. CPT Codes are the uniform, established system for reporting medical services for reimbursement under government and private insurance programs. CPT coding is mandatory to describe the services a physician renders when submitting that service for payment to an automobile insurance carrier.
43. In order to be assigned a five-digit CPT Code, the procedure must be "consistent with contemporary medical practice and be . . . performed by many practitioners in clinical practice in multiple locations.
44. Code assignment is performed by a CPT Editorial Panel, consisting of 17 physician members, and a larger CPT Advisory Committee of medical and allied health professionals. Among the objectives of the CPT Advisory Committee is to "provide documentation to staff and the CPT Editorial Board regarding the medical appropriateness of various medical and surgical procedures. . . ." (emphasis supplied)
45. Among the considerations for Code assignment are the requirements "that the service/procedure is a distinct service performed by many physicians/practitioners across the United States," and "that the clinical efficacy of the service/procedure is well established and documented in peer review literature."
46. Dynamic SEMG has been assigned a five-digit CPT Code 96002. Similarly, The (sic) review and interpretation of dynamic sEMG has been assigned a five-digit CPT Code 96004.
47. The fact that SEMG has been found to meet the requirements of the AMA for assignment of five-digit CPT Codes provides evidence of the medical value of the test, and strong evidence of the high level of general acceptance of the test by the relevant provider community.

See paragraph 76 of the decision, where the judge concludes (emphasis added) that

76. Additionally, based on a review of the entire record, the Petitioner has demonstrated, by a preponderance of the evidence, that SEMG has a level of general acceptance by the relevant provider community. SEMG is regularly used by chiropractic physicians who are a part of the relevant provider community. The Florida Chiropractic Association and the Florida Chiropractic Society, the leading chiropractic professional groups in Florida, agree that SEMG is generally accepted by the practicing chiropractic community. The basis for the rating of "established" in the CPG, has been accepted and endorsed by the Florida Board of Chiropractic, the chiropractic physician regulatory and licensing arm of the Department of Health. The American Medical Association had determined that SEMG is **a distinct service** performed by many physicians and practitioners across the

> United States. In addition, the clinical efficacy of SEMG has become established and documented as reflected in peer reviewed literature. Therefore, by including SEMG in Florida Administrative Code Rule 64B-3.004(2) the Department has exceeded its grant of rulemaking authority conferred by Section 627.736(5)(b)6., Florida Statutes, and has enlarged, modified, or contravened the specific provisions of Section 627.736(5)(b)6., Florida Statutes. As such, Florida Administrative Code Rule 64B- 3.004(2) is an invalid exercise of delegated legislative authority.

The key phrase is "distinct service," meaning that dynamic sEMG was interpreted by the court as functionally independent of a motion analysis lab, thus concluding that the dynamic sEMG CPT was distinct and separate from the motion analysis section where it resides. The court transcripts show how the court arrived that the conclusion that the AMA CPT code did NOT require a motion analysis laboratory to perform dynamic surface EMG tests.

This is further supported by the explanation under the "Motion Analysis" subheader:

> Codes 96000-96004 describe services performed as part of a major therapeutic or diagnostic decision making process. Motion analysis is performed in a dedicated motion analysis laboratory (ie, a facility capable of performing videotaping from the front, back and both sides, computerized 3-D kinematics, 3-D kinetics, and dynamic electromyography). Code 96000 may include 3-D kinetics and stride characteristics. Codes 96002-96003 describe dynamic electromyography. Do not report codes 95860-95875 in addition to the motion analysis codes.

The fact that CPT codebook distinguishes between codes 96002–96003 for dynamic surface electromyography and the rest of the paragraph – which uses the phrase "motion analysis" extensively – shows the separation between the dynamic sEMG and motion analysis. Otherwise, the description for codes 96002 and 96003 would include the words "motion analysis" in the verbiage. Therefore, offices where MyoVision testing occurs were and are equipped with the proper instrumentation for the utilization of the surface electromyography CPT code.

An Interpretation of the Case from a Legal Perspective

Written by David Marcarian, MA
with aid from an attorney associated with the case

Please note the following important details:

1. MyoVision was the only one of the top two devices with research support of a high enough caliber to be considered admissible in court, making it the most valid tool on the market for the purpose of evaluating patients.

2. The major research study "A Meta-Analytic Review of Surface Electromyography Among Persons with Low Back Pain and Normal, Healthy Controls," by the University of Michigan's Michael Geisser, further bolsters this case. This study showed that there was definitive value to surface EMG, that it had the sensitivity and specificity expected of a clinical tool, and that it provides a good outcome measure for tracking progress. Furthermore, it again established MyoVision as the only tool that met the extremely high standards required for inclusion in the study, establishing MyoVision as the only well-known instrument utilized in major research studies that is considered acceptable for evaluating patients for injury.

3. The case established that both the MyoVision static and MyoVision dynamic instruments are considered valid tools for evaluating injury.

4. The case details are found on the MyoVision website in the following documents:
    a. The attorney's summary of the lower court case
    b. The court decision (44 pages)
    c. The Superior Court decision (7 pages).
    d. The attorney's additional summary (below), which explains how this case applies in other states and countries
    e. Geisser's "A Meta-Analytic Review of Surface Electromyography Among Persons with Low Back Pain and Normal, Healthy Controls"
    f. The AMA CPT codebook section on surface EMG.
    g. Ambroz's paper on surface EMG results in chronic low back pain patients, which established that there was a statistical difference between normal controls and abnormal patients in both static and dynamic sEMG
    h. Nederhand's paper on whiplash evaluations using dynamic sEMG, which used patients who were in actual motor vehicle collisions and therefore has very practical implications. It showed that there were statistically significant differences between normal subjects and those with soft tissue injury, again establishing surface EMG as a valid measure
    i. Note that the AMA CPT code requirements were essential in establishing the validity of surface EMG, as it states that a requirement for 5-digit codes is that the tool must be commonly used in healthcare professionals' offices

Attorney's Review of Case

In 2003, the Florida legislature enacted a law that authorized the Florida Department of Health to "adopt, by rule, a list of diagnostic tests deemed not to be medically necessary for use in the treatment of persons sustaining bodily injury covered by personal injury protection benefits. . . . based on lack of demonstrated medical value and a level of general acceptance by the relevant provider community and shall not be dependent for results entirely upon subjective patient response."

In early 2004, the Florida Department of Health adopted a rule that included surface electromyography as one of four diagnostic tests "deemed not to be medically necessary for use in the treatment of persons sustaining bodily injury covered by personal injury protection benefits," thus relieving insurance companies of the obligation of reimbursing for the costs of the procedure under PIP. Dr. Richard Merritt, a licensed Florida chiropractor who used SEMG in his practice, challenged the rule.

The case went to a full evidentiary hearing, consisting of two days of testimony and the introduction of thousands of pages of documents. In general, the Department of Health and the insurance industry relied on journal articles, the newest of which was more than ten years old, and the testimony of an expert who admitted the efficacy of SEMG as a treatment technique, but disagreed as to its value in diagnosing injury. Dr. Merritt introduced numerous recent peer reviewed journal articles, including one issued within a month of the hearing, confirming the advances in SEMG, and offered his own expert testimony as a long time chiropractic practitioner and user of SEMG, and that of David Marcarian, who developed and marketed one of the leading brands of SEMG equipment.

The Administrative Law Judge (ALJ) reviewed and weighed all of the evidence presented by the Department of Health, the insurance industry, and Dr. Merritt, and concluded that SEMG should not have been included in the rule. Among her findings of fact were the following:

> Overall, SEMG has advanced as a clinical tool from its earliest, more experimental uses . . . to today, when advances in technology and understanding have resulted in the elimination of problems of electrical interference, bandwidth filtering and electrode placement, and have resulted in a higher threshold of sensitivity.
>
> The evidence in this case demonstrates that SEMG has medical value for use in the treatment of persons sustaining bodily injury covered by personal injury protection benefits. . . . it is clear that SEMG has a degree of demonstrated medical value. Therefore, its inclusion on the list of medically unnecessary tests is arbitrary and capricious; has exceeded the Department's grant of rulemaking authority; and has enlarged, modified, or contravened the specific provisions of law implemented.
>
> The evidence also demonstrated that SEMG is generally accepted in the relevant provider community.

Upon her review and independent assessment of the evidence as a whole, and based on her findings regarding the credibility of the witnesses and the weight of the evidence introduced by all parties, the ALJ concluded that "SEMG has demonstrated medical value . . . [and] that SEMG has achieved a level of medical acceptance as a valuable diagnostic tool for injuries of the spine and upper and lower back."

Unhappy with the outcome of the case, the Department of Health and the insurance industry appealed the decision to the Florida First District Court of Appeal. The parties briefed issues, including the sufficiency and quality of the evidence that supported the ALJ's Final Order. On January 5, 2006, the Court affirmed the Final Order, and held that:

> the final order clearly set forth the finding that surface EMG testing has significant medical value as a diagnostic tool with respect to the treatment of a patient suffering from injuries like those arising out of a motor vehicle accident. This finding is supported by competent substantial evidence and demonstrates that surface EMG diagnostic testing failed to satisfy the statutory requirement, even under the broader reading suggested by the Department, and thus should not have been included on the list.

The Merritt case has answered the question of the validity of SEMG as a valuable tool for diagnosing injury. The Final Order and appellate decision should be viewed as persuasive evidence in other jurisdictions nationwide.

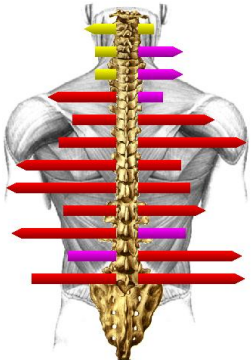
II. BACKGROUND, CLINICAL VALUE AND TESTING REQUIREMENTS
Static sEMG, Dynamic sEMG & Range of Motion Testing

Surface EMG: What is the difference between static and dynamic sEMG?

Surface EMG can be performed with the patient in a neutral posture (static) or while moving through ranges of motion (dynamic).

With static scanning sEMG, two handheld scanners are touched to the skin bilaterally at various points along the spine as the patient stands in a neutral posture. Typically, 12 brief readings of paraspinal muscle tension are performed at levels C2 through L5. The results are presented as a torso graph (see below) with the bar length proportional to the measured muscle activity.

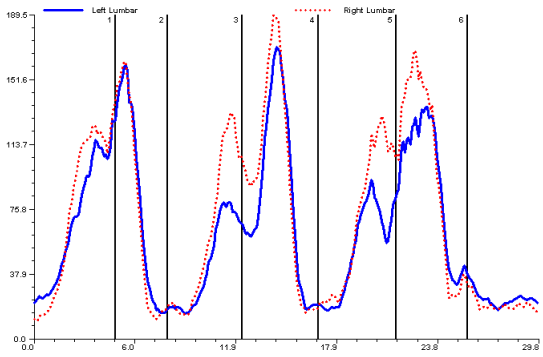
In static sEMG, scanners are held against the body for quick, stethoscope-like measure of muscle tension.



The graphic shows the muscle tension pattern about the spine. The length of each bar is proportional to the level of muscle tension. Readings are given in microvolts (millionths of a volt).

With dynamic (or kinetic) sEMG, electrodes are attached to the skin and muscle activity is measured as the patient moves through various ranges of motion. Comparing static to dynamic sEMG testing is analogous to comparing x-rays to video fluoroscopy in that one is a static measure and the other is functional.

In dynamic sEMG, EKG-style electrodes are attached to the skin and muscle activity is measured as the patient moves.



Data is graphed over time and shows muscles response to movement

Important note: Surface EMG is only one of many types of tests which a doctor may use when evaluating a patient. The data from this test is one piece of evidence that, when combined with a subjective report and other tests, is used to create a clinical profile. **In any case where there is a need to document injury or impairment, static sEMG should be augmented with a dynamic sEMG study and with range of motion testing.**

Static sEMG

Appropriate Use

For all patients: Test at initial visit and at each re-exam. Static sEMG testing is popularly used in the chiropractic practice for patient education, marketing, and evaluating both bracing patterns and the balance of the paraspinal muscles. Static sEMG tests also help determine whether muscles are in spasm or have shut down due to fatigue.

Clinical Value and Research

Ambroz et al (2005) found a significant difference in overall levels of muscle activity (summation of activity) between healthy controls and those with chronic low back pain In an earlier study, Ambroz et al (1999) also found a statistically significant difference between healthy controls and those with low back pain in terms of the levels of overall tension.
There are many factors which influence the results of static sEMG tests, but it has a test-retest reliability which is equal to or better than that of measuring blood pressure.

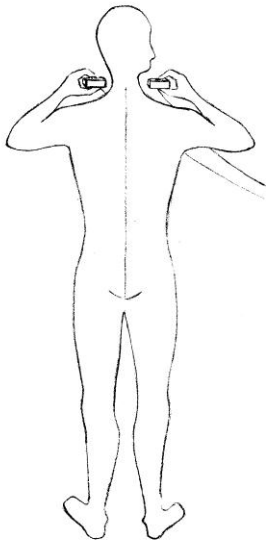
Due to the many factors that can influence the results, (the use of muscle relaxors, rest period after vigorous exercise, etc.) the practitioner would be advised to be cautious about coming to any conclusions based solely on the results of static sEMG exams.

Clinically Practical Uses for Static sEMG

1. **Scoliosis:** Static sEMG can be used to detect an s-shaped pattern of muscle tension. Clinical evidence seems to support the theory that that muscles fire to straighten the curve.
2. **Hypertonicity:** If one palpates and feels what appears to be muscle tension and the static sEMG readings are high, the patient is most likely in a state of hypertonicity. If the static sEMG readings are low, the patient is most likely in a state of contracture, where the muscles have fatigued, shortened, and bulked up as a result of continued hypertonicity. There are many practitioners that feel that the treatments for these two conditions are different and as such, the static sEMG results can aid in differential diagnosis.
3. **Proper Heel Life:** Static sEMG can be used to determine proper heel lift, as the balancing of muscles about the spine occurs as a result of proper heel lift. (Triano, 1989).
4. **Dynamic sEMG Electrode Placement:** Due to the speed of exams, static sEMG can be used to find appropriate areas for electrode placement in dynamic sEMG.
5. **Short Legs:** Muscles compensate for a short leg by firing in an s-shaped pattern.
6. **Cervical Spine Issues:** Static sEMG can help diagnose head-forward position and whether a dynamic sEMG test in whiplash cases is necessary. It is typical to see very high readings in the upper trapezius in response to whiplash.

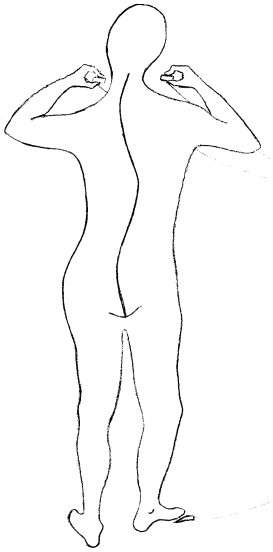
Static sEMG Testing Requirements

1. **All static sEMG tests must be performed while the patient is standing.** Current research (Geisser et. al.) found that there was significantly more valuable information found while standing. Similar to standing x-rays, standing exams elicit abnormal muscle firing, if it exists, as patients must maintain their own posture. In contrast, in the seated or prone positions, the posture is maintained by the chair or table. Newer MRI technology utilizes the standing test for the same reason.
2. **The skin must be gently cleaned with an alcohol wipe and dried with a paper towel prior to testing.** A quick wipe with an alcohol pad will reduce variations in skin resistance due to sweat, makeup, dirt, etc. and provide more consistent results.
3. **A conductive medium must be used on the electrodes at each site measured.** To ensure the same skin resistance characteristics at each level, an electrically conductive gel or liquid should be used, e.g. QuickScan pads™ or Signa Crème™. Be certain that the electrodes have a sufficient quantity of the medium (the electrodes will appear moist) prior to taking each measurement.
4. **Silver/silver chloride electrodes should be used to take measurements.** The combination of silver and silver chloride provides a very stable signal (Basmajian "Muscles Alive", National Institute for Occupational Safety and Health, Geddes and Baker, etc.). The electrical characteristics of this combination provide a form of electrical compensation for the shift in electrical voltage that occurs when only one metal is used. When using a single metal, a voltage can be generated which falsely represents the muscle activity signal.
5. **Patients must be tested without shoes..** Shoes alter the posture of a patient being tested and in turn, change the results. For example, high heels have a tendency to lead to higher levels of muscle activity in the lumbar spine. Therefore, to maintain consistency, it is critical that no shoes be worn by any patient in any tests**.**
6. **The operator must perform static sEMG exams with both feet flat on the floor.** For optimal results, the feet of the operator should be approximately shoulder width apart so that the operator is standing in a neutral posture, which is stable. Any up/down motion of the feet may lead to movement of the electrodes and result in inaccurate readings.



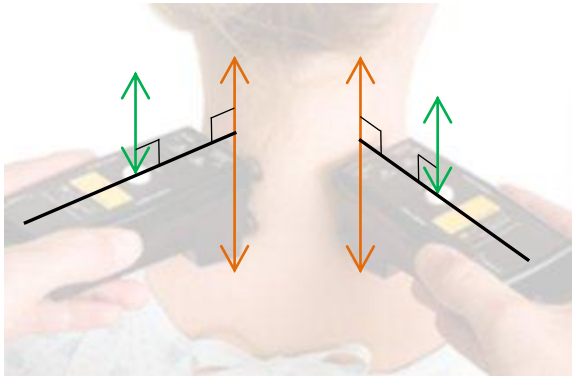
(Left) Standing with feet flat on floor allows the operator to maintain a balanced, natural posture, which in turn helps keep the scanners stable, providing more accurate and reliable static sEMG readings. In addition, this position is significantly more ergonomically sound for the operator and may prevent repetitive motion disorders. The use of low force buttons is crucial to optimizing the process.

(Right) The use of foot pedals makes it difficult to get stable readings, as electrodes respond to the up/down motion of the feet and it is more difficult for the operator to concentrate on holding the probes steady. Ergonomically and biomechanically the up/down motion of the foot is taxing on the body and may lead to repetitive motion disorders.



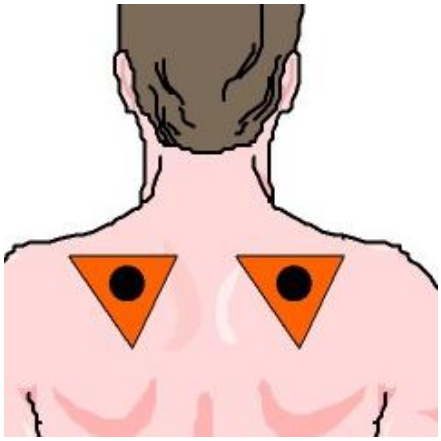
7. **Static sEMG scanners must have buttons that travel parallel to the plane of the skin.** A button travel that is not perpendicular to the patient causes the scanners and electrodes to push against the patient, in turn resulting in patient movement, a change in muscle tension, and in accurate readings.

Ideal: Scanners with buttons that travel perpendicular to the plane of force against the patient and parallel to the plane of the skin



The green arrows show that the direction of button press force is parallel to the patient's skin (orange arrows) and perpendicular to the plane of the scanners and electrodes (black segments), which increases the accuracy of the reading.

Error Prone: Button Press Probe Pressing Against Patient.



UNACCEPTABLE: Button press directly towards back. As the operator presses the button, the patient is "pushed" forward causing an "equal and opposite" force in the opposite direction. This would lead to increased muscle activity.

RED Arrows above indicate direction of force against patient with non-perpendicular probe buttons. Motion and false sEMG data is created.

Dynamic sEMG

Appropriate Use

For all personal injury/worker's compensation patients and any situations where proving the presence or absence of injury may be of importance. Test to be performed at initial visit and at 8 weeks

Dynamic sEMG provides additional objective information that is particularly valuable in PI/workers' compensation cases, and wherever documentation of objective findings is desired. Evidence of soft tissue injury is revealed in erratic muscle firing patterns during ranges of motion, even when static testing may be appear normal. Adaptation to fixed seated or standing positions may result in apparently normal static SEMG readings even when injury is present. Additionally, the lumbar paraspinals should achieve relative relaxation at maximum flexion, when compared to readings observed during re-extension. If this pattern is not present, it is a well-documented sign of injury (Sihvonen et al, 1991, Geisser, 2005, etc..)

Clinically Practical Uses for Dynamic sEMG

1. **Documentation of Soft Tissue Injury:** A multitude of studies have shown the relationship between dynamic surface EMG and soft tissue injury.
2. **Documentation of Progress:** Recent studies (Geisser et al, 2005) have shown that the dynamic sEMG data correlates with improvement and thus can be used to track progress.
3. **Determination of Need to Refer Patient to New Physician:** The dynamic surface EMG can be helpful in determining the success of the treatment protocol. If results are not achieved when viewed in combination with other subjective and objective tests, the sEMG can be used to help determine when it is appropriate to refer out.
4. **Determining Symptom Magnification:** Since surface EMG is currently the only method for objectively evaluating for low back injury, the use of one such device increases a symptom magnifier's likelihood of admitting exaggeration, as the surface EMG is viewed as a lie detector by patients. In addition, if the data does not support a patient's claims, it is more difficult to justify treatment.
5. **Justification for Pain Medications:** Many doctors are fearful of prescribing opiates, even with patients who are in extreme pain. The surface EMG can help determine whether patients are truly in need of pain medication and whether the pain may have a psychogenic origin.
6. **Documentation of Need and Progress in Rehabilitation Program:** Without objective data, which is provided through the use of dynamic sEMG, range of motion and muscle testing, it is difficult to determine both need and alterations in patient's treatment protocol. Providing an objective measurement of physiological data aids the health care provider in determining the effectiveness and need for rehabilitation.
7. **Documentation of Effectiveness of General Treatment Protocol:** Without objective data, we have no way of determining how effective the treatment protocol has been. Surface EMG,

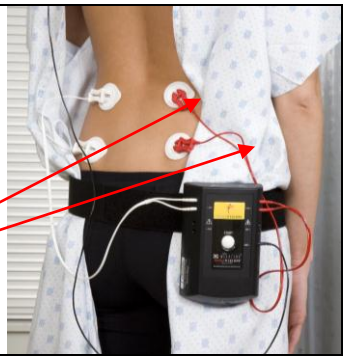
range of motion and muscle testing helps provide a benchmark for determining effectiveness of treatment protocol and additionally provides doctors with valuable feedback used to improve their skills.

DYNAMIC sEMG TESTING REQUIREMENTS

1. **Electrodes must be of the silver/silver chloride type which are independent electrodes (**each electrode is not attached to a group of electrodes but instead is "free floating"). This is necessary to prevent electrodes from falling off when performing motions where the skin is stretched. With electrodes that have a ground, and two measurement electrodes all connected together in a single, inflexible package, it is difficult to keep these electrodes from falling off the body especially when bending for a full forward flexion.

Note: With individual electrodes the body can move in all ranges of motion without restriction caused by the electrode, or issues with electrodes falling off due to being stretched.

Individual electrodes allow unrestricted movement in all ranges of motion.



2. **The skin must be cleaned with an alcohol wipe** and dried with a paper towel (if necessary) at each location of electrode placement.

3. **The body must be put in the position of near the end of the range of motion of interest before attaching electrodes.** By moving the patient in the direction of testing before the electrodes are attached allows the skin to stretch so that electrodes attached adhere more firmly and are less likely to separate from the skin. When electrodes are attached with the skin NOT stretched, there is a high probability that the electrodes will detach during the motion.

4. **For cervical measures, the device must be capable of performing a 4 channel measure.** To properly measure the cervical spine, it is necessary to measure the cervical paraspinals and SCM's making 4 channels a necessity.

Appropriate Use of Range of Motion: Dual Inclinometers Required

Range of Motion provides additional objective information that is particularly valuable in PI/workers' compensation cases, and wherever documentation of objective findings is desired. Evidence of injury is reflected in limited range of motion. Refer to the book published by the AMA, Primary Author: John Gerhardt, MD: "The practical Guide to

Range of Motion Assessment".

Requirement: Dual Inclinometers: MyoVision Is Only Multifunction System with Dual Inclinometers. <u>The use of Single Inclinometer Systems Can Constitute Fraud if Billed.</u>

By using dual inclinometers, the difference in results between the two inclinometers is automatically calculated for the user, thus providing significantly more valid data.
As shown below, proper range of motion testing requires dual inclinometers, as the combination of two provides extremely reliable, reproducible results. Also, it is required by the AMA's book: The Practical Guide To Range Of Motion Assessment".



CLINICALLY PRACTICAL USES FOR RANGE OF MOTION

1. **Documentation of Soft Tissue Injury**. A multitude of studies have shown the relationship between Range of Motion and soft tissue injury.
2. **Documentation of progress**: Range of Motion combined with Dynamic Surface EMG provides a combined measure which shows both range of motion limitations along with effort, so both need to be performed.
3. **Determination of need to refer patient to new physician**. The Dynamic Surface EMG combined with Range of Motion can be helpful in determining the success of the treatment protocol. If results are not achieved when viewed in combination with other subjective and objective tests.

MyoVision sEMG: An Industry Standard

John J. Gerhardt, M.D.

- Fellow, American Academy of Disability Evaluating Physicians
- Fellow, American Academy of Physical Medicine and Rehabilitation
- Clinical Associate Professor in Orthopedics and Rehabilitation Emeritus, Oregon Health & Science University
- Inventor of the SFTR numerical documentation system in the Neutral Zero Measuring Method for Standardized Range of Motion Assessment
- Primary author of the AMA Book *The Practical Guide To Range of Motion Assessment*

"In 12 years of use, I have been impressed with the reproducibility and reliability of the MyoVision system. The software is extremely user-friendly and reliable. It has proven itself in the medical-legal arena without question, making it one of the most desirable instruments for the clinician needing objective data to support their clinical evaluations. It significantly augments ROM data by providing objective assessment of effort. Product support is superb. I highly recommend it without reservation."

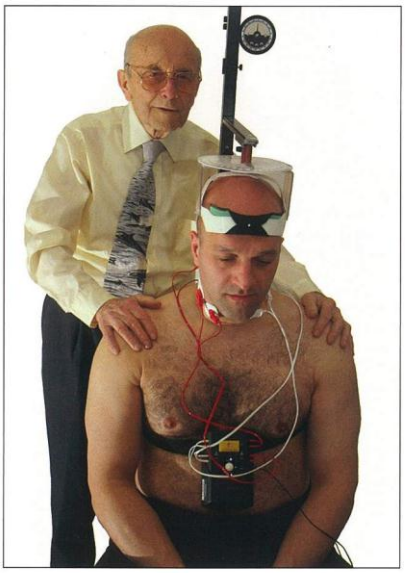


FIGURE 2-26
Measuring rotation of the cervical spine in upright (sitting) position with simultaneous assessment of effort using S-EMG. Examiner stabilizes the shoulders and placement of S-EMG and electrodes is shown.

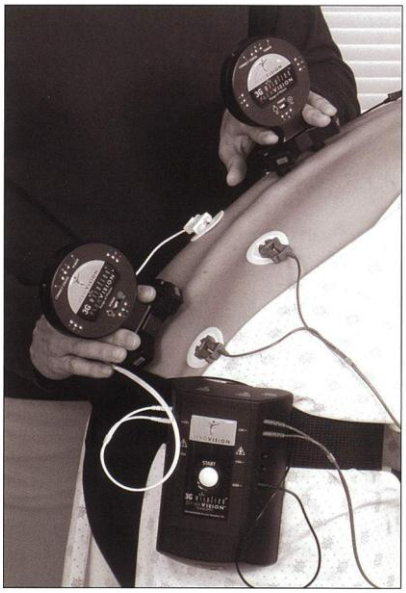


FIGURE 2-27
Measuring lumbar spine flexion. Position and stabilization of the electronic wireless dual inclinometers and placement of the S-EMG with electrodes are shown.

Excerpts from *The Practical Guide to Range of Motion Assessment*, 6th ed., p. 45

How Can Dynamic Surface EMG Augment Range of Motion to Prove Injury or Symptom Magnification?

Two Clinical Case Studies Prove Value of Combined Measures

All tests performed by David Marcarian, M.A. for legal purposes

Clinical Case Study #1: Patient Injured, Surface EMG Supports Abnormal ROM Findings

Clinical Case Study #2: Patient a "Symptom Magnifier". Although ROM Data appears abnormal, sEMG data helps confirm symptom magnification with this patient.

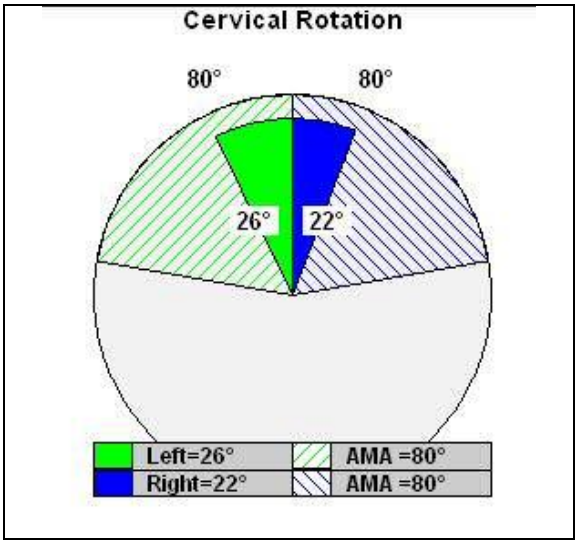
Instrument Utilized: MyoVision 8000 Surface EMG
Test performed by: David Marcarian, MA
Interpretation by: David Marcarian, MA

Electrode attachments: CPs: Approximately C4 and T1 left and right sides, SCMS left and right sides

According to the AMA Guides, 5th Edition page 400-405, under 15.8b ***"Since spinal motion is compound, it is essential to measure simultaneously motion of both the upper and lower extremes of the spine region being examined".***

Clinical Case Study #1: sEMG Supports/Augments ROM Results

Patient: 26 YO Female, Assaulted in bar fight, beaten over head with bottle. Case went to court in 2002.
Range of Motion Results: Three (3) trials, Left 26 Degrees, Right 22 Degrees.



CONCLUSION: Limited Range of Motion Data Correlates With Injury

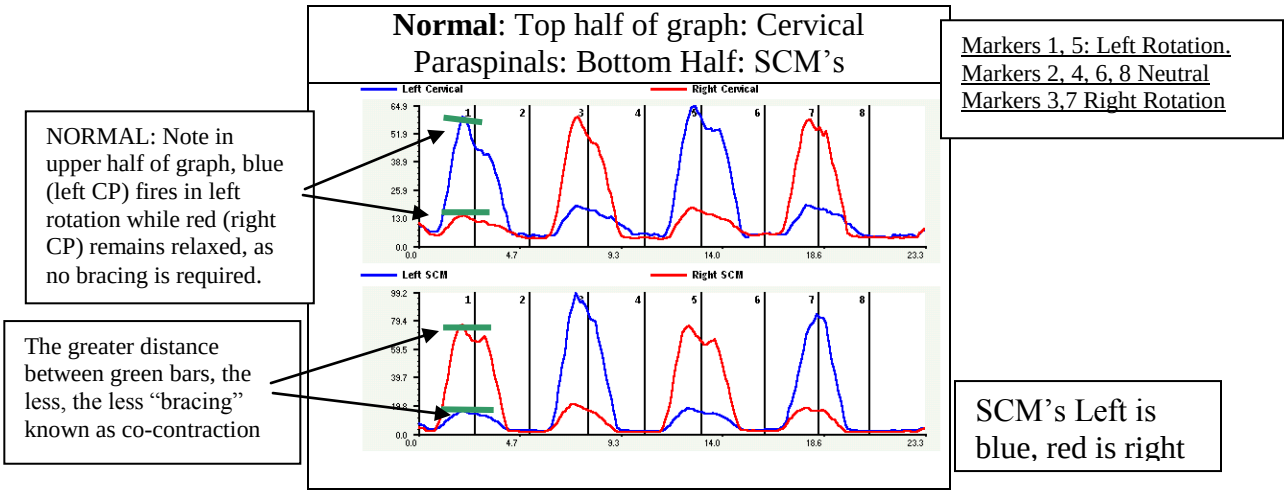
Dynamic Surface EMG Evaluation: Data Below Support ROM Results & Soft Tissue Injury

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)

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.

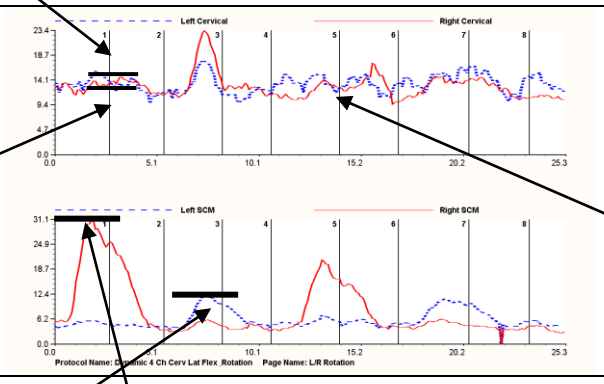
Cervical Dynamic Surface EMG Exam: L/R Rotation
2 sets of Left then Right Rotations



In the bottom half of graph, the RIGHT SCM (RED) fires along with the LEFT CP (blue in top graph) to stabilize the rotation, but no firing found in the LEFT SCM (blue) as there is no injury requiring. Without injury, there is a lack of co-contraction or "bracing".

ABNORMAL: Note in upper half of graph, blue (left CP) fires ALONG with red (right CP) indicating bracing. There is no distinct left right pattern.

Injured Patient: 4 weeks after injury: Top graph: Cervical Paraspinals: Bottom Graph: SCM's



CP's SCM's: Left is blue, red is right

Markers 1, 5: Left Rotation.
Markers 2, 4, 6, 8 Neutral
Markers 3,7 Right Rotation

The lack of distance between "green bars" indicates amount of co-contraction or bracing. In this case, bracing occurs through all motions.

Note excessive variability in sEMG signal throughout entire test indicative of muscle irritability and fasciculation which correlates highly with soft tissue injury.

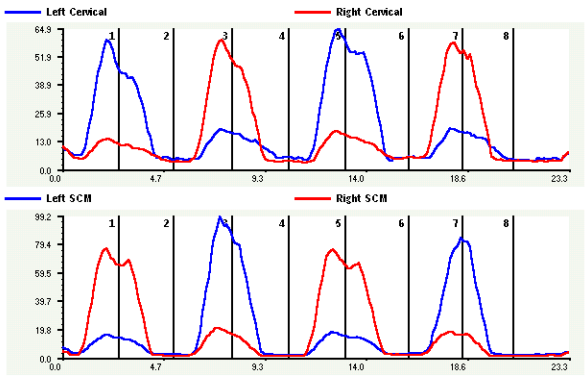
In the bottom half of graph, the pattern of firing is asymmetrical with the RIGHT SCM (RED) generating a higher level of muscle activity when compared with the left SCM (blue). The two peaks should be similar in amplitude (see green bars).

Conclusion: Case Study 1: Patient's injury <u>verified</u> by use of Dynamic Surface EMG: Jury Awards $650,000.00

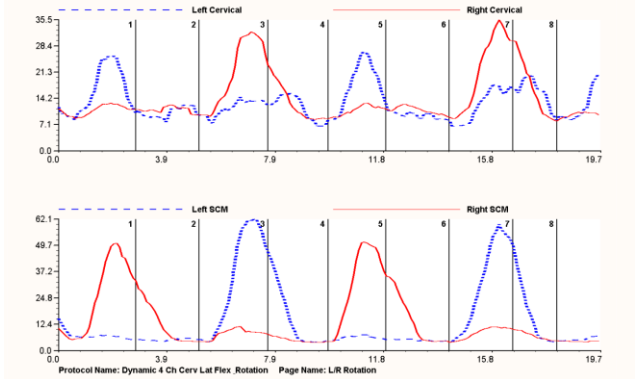
The combination of Range of Motion and Dynamic Surface EMG Provided Better Overall Sensitivity and Specificity when determining soft tissue injury. Surface EMG effectively augments Range of Motion Measures by documenting the physiological response that occurs muscularly when range of motion is limited.

Four Months Post Treatment Results: Surface EMG Functions As "Objective Marker" Showing Patient Has Reached Maximal Medical Improvement.

NORMAL



Patient 4 months post-care appears healthy-MMI

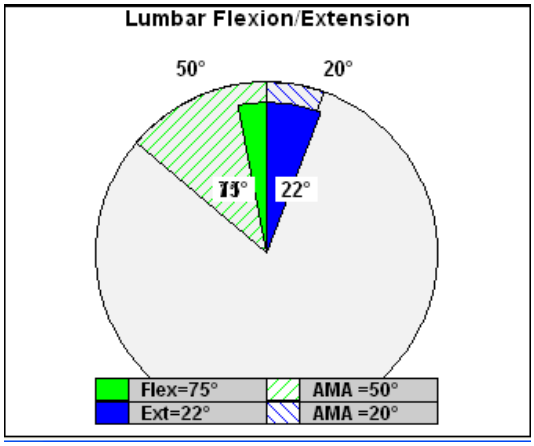


Note in final test results, patient appears similar to the "normal" presented above. Symmetry is good, there are distinct, clear muscle responses to left/right rotations, and irritability and fasciculation no longer present. This provides objective data to support release of patient

<u>Clinical Case Study #2:</u> Patient presents as a "Symptom Magnifier". Although ROM Data appears <u>abnormal</u>, sEMG data helps <u>confirm</u> symptom magnification through documenting normal muscular response to limited range of motion.

Patient: 37 YO Male, Workers Compensation Injury Three (3) trials, Flexion: 15 Degrees, Extension 22 Degrees.

Limited Range of Motion Data Correlates With Injury



Dynamic Surface EMG Evaluation: sEMG Data <u>CONTRADICTS</u> ROM Results Altering Soft Tissue Diagnosis and Case Significantly

Test: Protocol Name: Dynamic Lumbar Flexion / Re-extension (3 trials per graph): Muscles measured: Lumbar Paraspinals (left is blue, right is red)

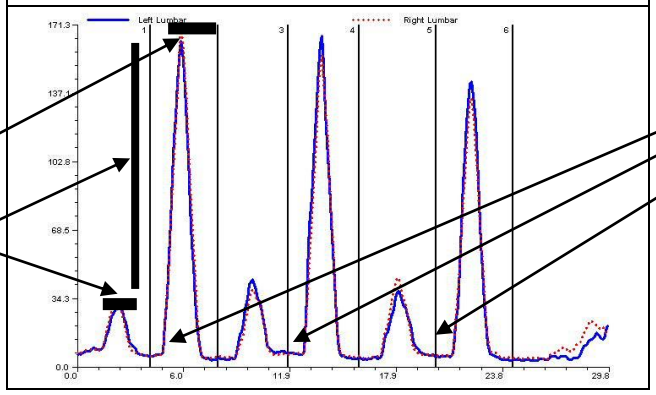
Overview Of Testing Methodology:

This is a study of the muscle activity of the lumbar 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:

Lumbar Dynamic Surface EMG Exam:
3 Flexions In A Row, Stopping at Neutral and Full Flexion

Markers 1,3, 5 Flexion

Normal: Lumbar Flexion: left is blue, right is red. Three Flexions in a row.



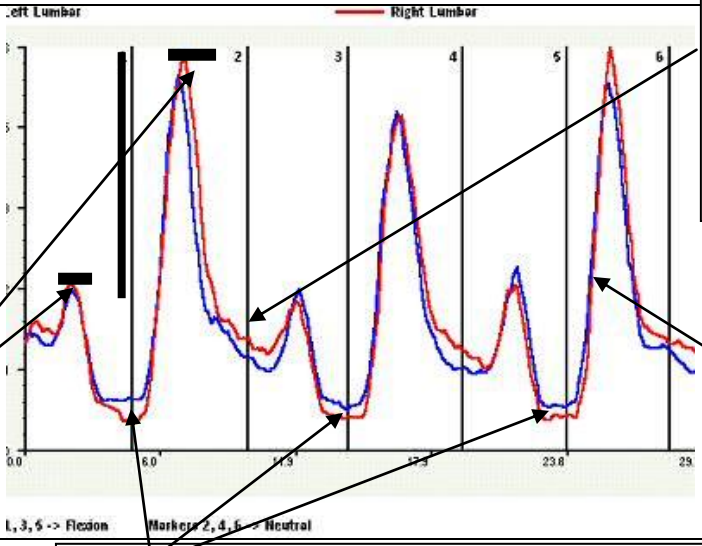
It is typical for normal tests to demonstrate a ratio of the peak in flexion
To the peak in re-extension of

Approximately 1:4.

Note, in normal flexion studies, muscles relax in full flexion (markers 1, 3, and 5) as is shown in the sample test.

Also notice lack of irritability indicated by smoothness in line graph.

Claiming Injury: Dynamic sEMG Lumbar Flexion Study Appears Normal



EXCEPTION:
Readings do not drop as quickly as expected when returning to neutral
Indicates issue may be chronic

It is typical for normal tests to demonstrate a ratio of the peak in flexion
To the peak in re-extension of

Approximately 1:4.

Also notice lack of irritability indicated by smoothness in line graph. This correlates with LACK of injury, as there is no fasciculation.

Note, in normal flexion studies, muscles relax in full flexion (markers 1, 3, and 5) as is shown in the sample test.

Conclusion: Case Study 2: Symptom Magnifier

Dynamic Surface EMG Augments Range Of Motion And Establishes Objective Reason For Reasonable Doubt With Regard To Injury

Result: Attorney Dropped $600,000.00 Case Against Insurer

Based purely on Range of Motion Data, this patient would be considered to have perhaps a serious problem. By augmenting Range of Motion with Surface EMG we were able see quite clearly that the patient was a "symptom magnifier" and the patient agreed to drop a $600,000.00 lawsuit and settled for $25,000.00 to cover.

Surface EMG Combined With Range of Motion Helps Assure Injured Patients Are Cared For, And Symptom Magnifiers Are Handled Appropriately.

Adding Surface EMG as an additional measure to range of motion makes it significantly more effective, efficient and offers more accurate diagnosis and treatment protocols. With the goal in mind to ensure those who are injured are cared for, and those who are not are better handled. The combination of Surface EMG and Range of Motion is not only easy to perform, but results in better patient care and reduced overall healthcare costs.

For further inquiry please contact:

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