Medical Policy Manual

Topic: Paraspinal Surface Electromyography (SEMG) to Evaluate and Monitor Back Pain

Section: Medicine

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IMPORTANT REMINDER

Medical Policies are developed to provide guidance for members and providers regarding coverage in accordance with contract terms. Benefit determinations are based in all cases on the applicable contract language. To the extent there may be any conflict between the Medical Policy and contract language, the contract language takes precedence.

PLEASE NOTE: Contracts exclude from coverage, among other things, services or procedures that are considered investigational or cosmetic. Providers may bill members for services or procedures that are considered investigational or cosmetic. Providers are encouraged to inform members before rendering such services that the members are likely to be financially responsible for the cost of these services.

DESCRIPTION

Paraspinal surface electromyography (SEMG) is an office-based non-invasive procedure that may be most commonly used by physiatrists or chiropractors as a technique to evaluate the physiological functioning of the back, specifically the function of the paraspinal muscles. This technique has been intended for use in patients with back pain symptoms such as spasm, tenderness, limited range of motion, or postural disorders, particularly as it relates to assessing the patient’s capacity to lift heavy objects, or the ability to return to work.

Paraspinal SEMG is performed using one or an array of electrodes placed on the skin surface, with recordings made at rest, in various positions, or after a series of exercises. Recordings can also be made by using a handheld device, which is applied to the skin at different sites. Electrical activity can be assessed by computer analysis of the frequency spectrum (i.e., spectral analysis), amplitude, or root mean square of the electrical action potentials. In particular, spectral analysis focusing on the median frequency has been used to assess paraspinal muscle fatigue during isometric endurance exercises.

The following clinical applications of the paraspinal SEMG have been proposed:

- Clarification of a diagnosis (i.e., muscle, joint, or disc disease)
Selection of a medical therapy course
- Selection of a physical therapy plan
- Pre-operative evaluation
- Post-operative rehabilitation
- Follow-up evaluation of acute low back pain
- Evaluation of exacerbation of chronic low back pain
- Evaluation of pain management treatment techniques

**Regulatory Status**

Paraspinal SEMG devices approved by the US Food and Drug Administration (FDA) include those that use a single electrode or a fixed array of multiple surface electrodes. Several FDA-approved devices combine surface EMG along the spine with other types of monitors.

**MEDICAL POLICY CRITERIA**

Paraspinal surface electromyography is considered *investigational* for all indications, including but not limited to, diagnosing and monitoring back pain.

**SCIENTIFIC EVIDENCE**

Surface electromyography (SEMG) has been proposed as a research tool to evaluate the performance of paraspinal muscles in patients with back pain, and to further understand the etiology of low back pain. However, validation of its use as a clinical diagnostic technique involves a sequential 3-step procedure as follows:

1. **Analytical Validity**- of a device is typically assessed by studies that compare test measurements with a gold standard, and those that compare results taken with the same device on different occasions (“test-retest”).
2. **Clinical Validity**- is evaluated by the ability of a test to accurately diagnose a clinical condition in comparison with the gold standard. The sensitivity of a test is the ability to detect a disease when the condition is present (true positive), while specificity indicates the ability to detect patients who are suspected of disease but who do not have the condition (true negative). Therefore, evaluation of diagnostic performance requires independent assessment by the 2 methods in a population of patients who are suspected of disease but who do not all have the disease.
3. **Clinical utility**- is established when the evidence demonstrates that the diagnostic information obtained from a test can be used to benefit patient management and improve health outcomes. Typically, randomized trials are needed to demonstrate the impact of the test on net health outcomes.

The following discussion focuses on these 3 steps as they apply to paraspinal SEMG.

**Analytical Validity**
Several studies using different SEMG devices have suggested that paraspinal SEMG, in general, is a reliable technique, based on coefficients of variation or test-retest studies,\(^1\)-\(^4\) or ability to differentiate healthy test subjects from those with back pain.\(^5\)-\(^7\) However, no studies were identified that compared the performance of SEMG to a gold standard reference test.

**Clinical Validity**

No articles were identified comparing the results of SEMG (which tests groups of muscles) with needle electromyography (which tests individual muscles) for diagnosing any specific muscle pathology. It is recognized that the pathology of individual muscles (i.e., radiculopathy, neuropathy, etc.) may represent a different process than the pathology of muscle groups (i.e., muscle strain, spasm, etc.); thus, SEMG may be considered by its advocates as a unique test for which there is currently no gold standard. Even if one accepts this premise, there are inadequate data to evaluate the diagnostic performance of SEMG. No articles were identified in the published peer-reviewed literature that established definitions of normal or abnormal SEMG. In some instances, asymmetrical electrical activity may have been used to define abnormality; results may be compared to a “normative data base.” However, there is a lack of published literature defining what degree of asymmetry would constitute abnormality, or how a normative database was established.\(^8\)

In the absence of a gold standard diagnostic test, correlation with the clinical symptoms and physical examination is critical.

- **De Luca** published a series of studies investigating a type of SEMG called the Back Analysis System (BAS), consisting of surface electrodes and other components to measure the electrical activity of muscles during isometric exercises designed to produce muscle fatigue.\(^9\) Using physical examination and clinical history as a gold standard, the author found that BAS was able to accurately identify “control” and “back pain” patients 84% and 91% of the time, respectively, with the values increasing to 100% in some populations of patients. (Accuracy is the sum of true positive and true negative results.) However, these studies were not designed as a clinical diagnostic tool, but were intended to investigate the etiology of back pain and to investigate muscular fatigue patterns in patients with and without back pain.

- A 2010 study used a different type of analysis of SEMG findings called dynamic topography.\(^10\) Using SEMG, the authors evaluated 20 healthy men and 15 men with low-back pain and found different dynamic topography (i.e., a more symmetric pattern) in healthy controls. After physical therapy, the dynamic topography images of back pain patients were more similar to the healthy controls on some of the parameters that were assessed. However, there are no data that analyze how changes in the SEMG correlate to clinical response, whether a clinical response in the face of persisting SEMG abnormalities suggests ongoing pathology, or whether persistent symptoms in the face of a normal SEMG represent malingering.

**Clinical Utility**

Several articles described the use of SEMG as an aid in classifying low back pain.\(^11\)-\(^17\) The articles focused on the use of spectral analysis to assess muscle fatigability. However, it is unclear how this information may be used in the management of the patient. For example, while the innovators of the BAS system indicated that SEMG can suggest potential therapies by distinguishing deconditioning from muscle inhibition secondary to pain-related behavior, no clinical studies described the use of SEMG in suggesting therapy.\(^11\)
In another application of SEMG, Arena and colleagues assessed the amplitude of SEMG recordings as a measure of paraspinal muscle tension in 66 patients and reported that the degree of muscle tension did not correlate with pain levels.[18] These findings raised questions about the role of biofeedback, muscle relaxants, or other therapies designed to reduce muscle tension.

While SEMG may be used to objectively document muscle spasm or other muscular abnormalities, it is unclear how such objective documentation would supplant or enhance clinical evaluation, or how this information would be used to alter the treatment plan. For example, SEMG has been proposed as a technique to differentiate muscle spasm from muscle contracture, with muscle spasm treated with relaxation therapy, and contracture treated with stretching exercises. However, there are no data to validate that such treatment suggested by SEMG resulted in improved outcomes.[19,20] Part of the difficulty in clinical interpretation is understanding, to what extent, the SEMG abnormalities are primary or secondary. In addition, no specific workup is recommended for acute low back pain without warning signs.

A review of spinal muscle evaluation in low-back pain patients indicated that the validity of SEMG remains controversial.[21] The authors noted that although many studies showed increased fatigability of the paraspinal muscles in patients with low back pain, it is not known whether these changes are causes or consequences of the low back pain. Also, “the considerable inter-individual variability and the absence of normative data complicate the description of normal or abnormal profiles, thereby limiting the diagnostic usefulness of SEMG.”

**Clinical Practice Guidelines**

**American College of Physicians and the American Pain Society**

In 2007, the American College of Physicians and the American Pain Society issued a joint evidence-based clinical guideline on the diagnosis and treatment of low back pain. The guideline did not specifically mention paraspinal surface electromyography (SEMG).[22]

**American College of Occupational and Environmental Medicine (ACOEM)**

In 2011, the ACOEM issued guidelines for the evaluation and management of low back pain, which indicated that surface electromyography was not recommended as a diagnostic test due to insufficient evidence.[23]

No other evidence-based guidelines were identified on the use of paraspinal SEMG in the diagnosis of back pain.

**Summary**

There are inadequate data on the technical and diagnostic performance of paraspinal surface electromyography (SEMG) compared to a gold standard reference test. Current evidence is insufficient regarding how findings from paraspinal surface electromyography impact patient management and/or how use of the test improves health outcomes; therefore, the use of this test is considered investigational.

**REFERENCES**


**CROSS REFERENCES**

None

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