

2.01.35		Paraspinal Surface Electromyography to Evaluate and Monitor Back Pain	
Original Policy Date:	September 12, 2008	Effective Date:	August 1, 2022
Section:	2.0 Medicine	Page:	Page 1 of 10

Policy Statement

- I. Paraspinal surface electromyography (SEMG) is considered **investigational** as a technique to diagnose or monitor back pain.

NOTE: Refer to [Appendix A](#) to see the policy statement changes (if any) from the previous version.

Policy Guidelines

Coding

There is no specific CPT code for surface electromyography (SEMG), other than the following code which is part of the CPT coding for motion analysis:

- **96002:** Dynamic surface electromyography, during walking or other functional activities, 1-12 muscles

Existing codes for electromyography (95860-95872) explicitly describe needle electromyography, in which a needle is inserted into an individual muscle. Therefore, these codes do not describe SEMG.

One of the following nonspecific CPT codes might be used:

- **95999:** Unlisted neurological or neuromuscular diagnostic procedure
- **97799:** Unlisted physical medicine/rehabilitation service or procedure
- **99199:** Unlisted special service, procedure or report

The following HCPCS code is specific to SEMG:

- **S3900:** Surface electromyography (EMG)

Description

A noninvasive procedure that records the summation of muscle electrical activity, paraspinal surface electromyography (SEMG) has been investigated as a technique to evaluate the physiologic functioning of the back. Additionally, this procedure has been studied as a technique to evaluate abnormal patterns of electrical activity in the paraspinal muscles in patients with back pain symptoms, such as spasm, tenderness, limited range of motion, or postural disorders.

Related Policies

- N/A

Benefit Application

Benefit determinations should be based in all cases on the applicable contract language. To the extent there are any conflicts between these guidelines and the contract language, the contract language will control. Please refer to the member's contract benefits in effect at the time of service to determine coverage or non-coverage of these services as it applies to an individual member.

Some state or federal mandates (e.g., Federal Employee Program [FEP]) prohibits plans from denying Food and Drug Administration (FDA)-approved technologies as investigational. In these instances, plans may have to consider the coverage eligibility of FDA-approved technologies on the basis of medical necessity alone.

Regulatory Status

SEMG devices approved by the U.S. Food and Drug Administration (FDA) include those that use a single electrode or a fixed array of multiple surface electrodes. Examples include the CMAP Pro (Medical Technologies) and Model 9200 EMG System (Myotronics-Noromed).

Several FDA approved devices combine SEMG along the spine with other types of monitors. For example, in 2007, the Insight Discovery (Fasstech) was cleared for marketing through the 510(k) process. The device contains 6 sensor types, one of which is for SEMG. The indications include measuring bilateral differences in SEMG along the spine and measuring SEMG along the spine during functional tasks. (Earlier Insight models had fewer sensors.) FDA product code: IKN.

Rationale

Background

Back Pain

Back pain is a common condition that affects most individuals at some point in their lives. Identifying the pathogenesis of back pain is challenging, in part due to the complex anatomy of the back, which includes vertebrae, intervertebral discs, facet joints, spinal nerve roots, and numerous muscles. Back pain may be related to osteoarthritis, disc disease, subluxation, or muscular pathologies, such as muscle strain or spasm. Moreover, due to referred pain patterns, the location of the pain may not be anatomically related to the pathogenesis of the pain. For example, buttock or leg pain may be related to pathology in the spine. In addition to the diagnostic challenges of back pain is the natural history of acute back pain.

Diagnosis

Aside from physical examination, diagnostic testing includes imaging technologies, such as magnetic resonance imaging, designed to identify pathology (e.g., bulging discs), or tests such as discography to localize the abnormality by reproducing the pain syndrome. However, these tests lack specificity and must be carefully interpreted in the context of the clinical picture. For example, magnetic resonance imaging identifies 5% of asymptomatic patients as having bulging discs. However, the presence of a bulging disc may only be clinically significant if correlated with other symptoms. Assessment of the musculature may focus on a range of motion or strength exercises.

In contrast to anatomic imaging, surface electromyography (SEMG), which records the summation of muscle activity from groups of muscles, has been investigated as a technique to evaluate the physiologic functioning of the back. A noninvasive procedure, SEMG differs from needle electromyography, an invasive procedure in which the electrical activity of individual muscles is recorded. Paraspinal SEMG has been explored to evaluate abnormal patterns of electrical activity in the paraspinal muscles in patients with back pain symptoms such as spasm, tenderness, limited range of motion, or postural disorders. The technique is performed using a single 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 is assessed by computer analysis of the frequency spectrum (i.e., spectral analysis), amplitude, or root mean square of the electrical action potentials. In particular, a spectral analysis that focuses on the median frequency has been used to assess paraspinal muscle fatigue during isometric endurance exercises. Paraspinal SEMG has been researched as a technique to establish the

etiology of back pain and has been used to monitor the response to therapy and establish physical activity limits, such as assessing capacity to lift heavy objects or ability to return to work.

Paraspinal SEMG is an office-based procedure. The following clinical applications of the paraspinal SEMG have been proposed:

- clarification of diagnosis (i.e., muscle, joint, or disc disease)
- selection of a course of medical therapy
- selection of a type of physical therapy
- preoperative evaluation
- postoperative rehabilitation
- follow-up of acute low back pain (LBP)
- evaluation of exacerbation of chronic LBP
- evaluation of pain management treatment techniques.

Treatment

Most cases of acute LBP resolve with conservative therapy (e.g., physical therapy) while continuing normal activities within limits permitted by the pain. Therefore, initial imaging or other diagnostic testing is generally not recommended unless "red flag" warning signs are present or the pain persists for more than 4 to 6 weeks. Red flag findings include significant trauma, history of cancer, unrelenting night pain, fevers or chills, and progressive motor or sensory deficits.

Literature Review

Evidence reviews assess whether a medical test is clinically useful. A useful test provides information to make a clinical management decision that improves the net health outcome. That is, the balance of benefits and harms is better when the test is used to manage the condition than when another test or no test is used to manage the condition.

The first step in assessing a medical test is to formulate the clinical context and purpose of the test. The test must be technically reliable, clinically valid, and clinically useful for that purpose. Evidence reviews assess the evidence on whether a test is clinically valid and clinically useful. Technical reliability is outside the scope of these reviews, and credible information on technical reliability is available from other sources.

Surface Electromyography

Paraspinal surface electromyography (SEMG) has been used 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 (LBP).^{1,2,3,4} Preliminary research has also been performed to determine which SEMG parameters best differentiate patients with and without back pain.^{5,6}

Clinical Context and Test Purpose

The purpose of paraspinal SEMG in patients who have back pain is to identify the pathogenesis of the pain (i.e., muscle, joint, or disc disease) to inform a decision on a treatment plan. The question addressed in this evidence review is: Does paraspinal SEMG improve the net health outcome in individuals with back pain?

The following PICO was used to select literature to inform this review.

Populations

The relevant population of interest is individuals with back pain.

Interventions

Paraspinal SEMG is a noninvasive technique that aggregates data on muscle activity from groups of muscles. One or more electrodes are placed on the skin surface, and recordings are taken at rest, in various positions, or during a series of exercises.

Comparators

Other noninvasive techniques to assess back pain include clinical examination and imaging technologies.

Outcomes

The general outcomes of interest are a reduction in back pain and improvement in activities of daily living.

Both false-positive test results and false-negative results can lead to an incorrect recommendation for the type of treatment or no treatment at all. Some treatments are long-term programs, and if individuals are incorrectly referred to the program, more appropriate therapy will be delayed.

Study Selection Criteria

For the evaluation of clinical validity of the paraspinal SEMG test, studies that meet the following eligibility criteria were considered:

- Reported on the accuracy of the marketed version of the technology (including any algorithms used to calculate scores);
- Included a suitable reference standard;
- Patient/sample clinical characteristics were described;
- Patient/sample selection criteria were described.

Clinically Valid

A test must detect the presence or absence of a condition, the risk of developing a condition in the future, or treatment response (beneficial or adverse).

Review of Evidence

No articles that directly compare the results of SEMG (which tests groups of muscles) with needle electromyography (which tests individual muscles) for diagnosing any specific muscle pathology were identified in literature searches. However, the pathology of individual muscles (i.e., radiculopathy, neuropathy) may represent a different process than the pathology of muscle groups (i.e., muscle strain, spasm), and thus SEMG may be considered by its advocates as a unique test for which there is currently no criterion standard. Nevertheless, even if one accepts this premise, there are inadequate data to evaluate the diagnostic performance of SEMG. In some instances, the asymmetrical electrical activity may have been used to define abnormality; results may be compared with normative data. However, no published literature was identified defining what degree of asymmetry would constitute abnormality.

A study by du Rose and Breen (2016) looked into the relationship between lumbar intervertebral range of motion and paraspinal muscle activity in healthy adults, as measured by SEMG and quantitative fluoroscopy, to establish "normal" measurements.⁷ Fluoroscopic images and SEMG measurements were taken for 20 men with no history of LBP. What would be considered normal intervertebral ranges of motion were related to a diverse set of muscle activation patterns as measured by SEMG. The authors concluded that larger sample sizes and measurements from patients with LBP would be needed to established standard criterion.

Absent a criterion standard diagnostic test, correlation with the clinical symptoms and physical exam is critical. De Luca (1993) published a series of studies investigating a type of SEMG called the Back Analysis System, consisting of surface electrodes and other components to measure the electrical activity of muscles during isometric exercises designed to produce muscle fatigue.² Using physical exam and clinical history as a criterion standard, De Luca (1993) found that the Back Analysis System accurately identified control and back pain patients 84% and 91% of the time, respectively, with the values increasing to 100% in some populations. Accuracy was defined as the sum of true-positive and true-negative results. However, these studies were not designed as a clinical diagnostic tool per se but were intended to investigate the etiology of back pain and to investigate muscular fatigue patterns in patients with and without back pain.

Hu et al (2010, 2014) published 2 articles on dynamic topography, an approach to analyzing SEMG findings.^{8,9} Both studies included patients with LBP and healthy controls. All participants underwent SEMG at study enrollment and then back pain patients participated in a rehabilitation program. The first study found different dynamic topography at baseline between the healthy people and back pain samples (a more symmetric pattern in healthy controls).⁸ After physical therapy, the dynamic topography images of back pain patients were more similar to the healthy controls on some of the parameters assessed. In the second study, following rehabilitation, back pain patients were classified as responders or nonresponders based on changes in back pain severity.⁹ Some associations were found between baseline SEMG parameters and response to rehabilitation. Surface electromyography was not repeated after the rehabilitation program, and thus it is unclear whether there are any significant associations between continued symptoms and SEMG abnormalities. Moreover, it is unclear how SEMG analysis would affect treatment decisions for patients with LBP.

Clinically Useful

A test is clinically useful if the use of the results informs management decisions that improve the net health outcome of care. The net health outcome can be improved if patients receive correct therapy, more effective therapy, or avoid unnecessary therapy or testing.

Direct Evidence

Direct evidence of clinical utility is provided by studies that have compared health outcomes for patients managed with and without the test. Because these are intervention studies, the preferred evidence would be from randomized controlled trials.

A number of studies have described SEMG as an aid in classifying LBP.^{10,11,12,13,14} Most of this research has focused on the use of SEMG to assess muscle fatigability rather than on how information from test findings could enhance patient management. While SEMG may be used to document muscle spasm or other muscular abnormalities objectively, 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. In part, the difficulty in clinical interpretation is understanding the extent to which the SEMG abnormalities are primary or secondary. Additionally, as noted in the Background section, no specific workup is recommended for acute LBP without warning signs.

The following studies have proposed using SEMG results to inform treatment decisions; however, none provided data to validate whether treatment based on SEMG results in improved outcomes.

In a study of patients with chronic LBP (N=216) by Kienbacher et al (2016), SEMG showed potential to discriminate between impaired and unimpaired neuromuscular regulation of back extensors, which would provide useful information for designing individualized exercise programs.¹⁵

In a study of patients with LBP (n=27) and pain-free controls (n=23) by Schabrun et al (2017), SEMG detected a loss of discrete motor cortical organization of the paraspinal muscles among those with LBP.¹⁶ The invasive technique of needle electromyography is usually performed to detect this pathology. Patients with cortical reorganization may benefit from motor skill training. In 2 older studies (1988, 1992), SEMG was shown to differentiate muscle spasm from muscle contracture.^{17,18} Muscle spasm would be treated with relaxation therapy, and contracture would be treated with stretching exercises.

Chain of Evidence

Indirect evidence on clinical utility rests on clinical validity. If the evidence is insufficient to demonstrate test performance, no inferences can be made about clinical utility. Current evidence on clinical validity does not permit construction of a chain of evidence to support the use of SEMG as a diagnostic tool for evaluating and monitoring back pain.

Summary of Evidence

For individuals who have back pain who receive paraspinal SEMG for evaluation and monitoring, the evidence includes several nonrandomized studies on using findings to classify back pain. Relevant outcomes are test accuracy and validity, symptoms, functional outcomes, quality of life, and resource utilization. There have been no studies directly comparing SEMG with other noninvasive techniques for evaluating back pain, and standard criteria for normal and abnormal SEMG measurements have not been determined. Surface electromyography has been proposed as a noninvasive technique providing objective measurements that would inform treatment decisions in patients with back pain. While studies have shown that SEMG results have detected different pathologies in patients with back pain, none of the studies reported health outcomes. There are also no data on the impact of SEMG for managing patients. The evidence is insufficient to determine that the technology results in an improvement in the net health outcome.

Supplemental Information

The purpose of the following information is to provide reference material. Inclusion does not imply endorsement or alignment with the evidence review conclusions.

Practice Guidelines and Position Statements

Guidelines or position statements will be considered for inclusion in 'Supplemental Information' if they were issued by, or jointly by, a US professional society, an international society with US representation, or National Institute for Health and Care Excellence (NICE). Priority will be given to guidelines that are informed by a systematic review, include strength of evidence ratings, and include a description of management of conflict of interest.

American College of Occupational and Environmental Medicine

In 2019, the guideline from the American College of Occupational and Environmental Medicine on diagnostic tests for low back disorders does not recommend surface electromyography as a technique for diagnosing low back disorders, based on insufficient evidence of efficacy.¹⁹

North American Spine Society and American Academy of Pain Medicine

In 2020, the North American Spine Society with input from the American Academy of Pain Medicine issued a guideline on the diagnosis and treatment of low back pain.²⁰ When discussing the diagnostic accuracy of nonimaging tests, the guideline lacks any statement on surface electromyography.

U.S. Preventive Services Task Force Recommendations

Not applicable.

Medicare National Coverage

There is no national coverage determination. In the absence of a national coverage determination, coverage decisions are left to the discretion of local Medicare carriers.

Ongoing and Unpublished Clinical Trials

A search of ClinicalTrials.gov in April 2022 did not identify any ongoing or unpublished trials that would likely influence this review.

References

1. Cram JR, Lloyd J, Cahn TS. The reliability of EMG muscle scanning. *Int J Psychosom.* 1994; 41(1-4): 41-5. PMID 7843866
2. De Luca CJ. Use of the surface EMG signal for performance evaluation of back muscles. *Muscle Nerve.* Feb 1993; 16(2): 210-6. PMID 8429847
3. Jones SL, Hitt JR, DeSarno MJ, et al. Individuals with non-specific low back pain in an active episode demonstrate temporally altered torque responses and direction-specific

- enhanced muscle activity following unexpected balance perturbations. *Exp Brain Res*. Sep 2012; 221(4): 413-26. PMID 22875027
4. Sheeran L, Sparkes V, Caterson B, et al. Spinal position sense and trunk muscle activity during sitting and standing in nonspecific chronic low back pain: classification analysis. *Spine (Phila Pa 1976)*. Apr 15 2012; 37(8): E486-95. PMID 22024899
 5. Hanada EY, Johnson M, Hubley-Kozey C. A comparison of trunk muscle activation amplitudes during gait in older adults with and without chronic low back pain. *PM R*. Oct 2011; 3(10): 920-8. PMID 22024323
 6. Neblett R, Brede E, Mayer TG, et al. What is the best surface EMG measure of lumbar flexion-relaxation for distinguishing chronic low back pain patients from pain-free controls?. *Clin J Pain*. Apr 2013; 29(4): 334-40. PMID 23328325
 7. du Rose A, Breen A. Relationships between Paraspinal Muscle Activity and Lumbar Inter-Vertebral Range of Motion. *Healthcare (Basel)*. Jan 05 2016; 4(1). PMID 27417592
 8. Hu Y, Siu SH, Mak JN, et al. Lumbar muscle electromyographic dynamic topography during flexion-extension. *J Electromyogr Kinesiol*. Apr 2010; 20(2): 246-55. PMID 19540776
 9. Hu Y, Kwok JW, Tse JY, et al. Time-varying surface electromyography topography as a prognostic tool for chronic low back pain rehabilitation. *Spine J*. Jun 01 2014; 14(6): 1049-56. PMID 24530438
 10. Hung CC, Shen TW, Liang CC, et al. Using surface electromyography (SEMG) to classify low back pain based on lifting capacity evaluation with principal component analysis neural network method. *Annu Int Conf IEEE Eng Med Biol Soc*. 2014; 2014: 18-21. PMID 25569886
 11. Humphrey AR, Nargol AV, Jones AP, et al. The value of electromyography of the lumbar paraspinal muscles in discriminating between chronic-low-back-pain sufferers and normal subjects. *Eur Spine J*. Mar 2005; 14(2): 175-84. PMID 15549487
 12. Peach JP, McGill SM. Classification of low back pain with the use of spectral electromyogram parameters. *Spine (Phila Pa 1976)*. May 15 1998; 23(10): 1117-23. PMID 9615362
 13. Roy SH, Oddsson LI. Classification of paraspinal muscle impairments by surface electromyography. *Phys Ther*. Aug 1998; 78(8): 838-51. PMID 9711209
 14. Van Damme B, Stevens V, Perneel C, et al. A surface electromyography based objective method to identify patients with nonspecific chronic low back pain, presenting a flexion related movement control impairment. *J Electromyogr Kinesiol*. Dec 2014; 24(6): 954-64. PMID 25304196
 15. Kienbacher T, Fehrmann E, Habenicht R, et al. Age and gender related neuromuscular pattern during trunk flexion-extension in chronic low back pain patients. *J Neuroeng Rehabil*. Feb 19 2016; 13: 16. PMID 26896325
 16. Schabrun SM, Elgueta-Cancino EL, Hodges PW. Smudging of the Motor Cortex Is Related to the Severity of Low Back Pain. *Spine (Phila Pa 1976)*. Aug 01 2017; 42(15): 1172-1178. PMID 25893342
 17. Ellestad SM, Nagle RV, Boesler DR, et al. Electromyographic and skin resistance responses to osteopathic manipulative treatment for low-back pain. *J Am Osteopath Assoc*. Aug 1988; 88(8): 991-7. PMID 2975645
 18. Bittman B, Cram JR. Surface electromyography: an electrophysiological alternative in pain management. Paper presented at: Presented at the American Pain Society; Oct 22-25 1992; San Diego, CA.
 19. Hegmann KT, Travis R, Belcourt RM, et al. Diagnostic Tests for Low Back Disorders. *J Occup Environ Med*. Apr 2019; 61(4): e155-e168. PMID 30694882
 20. Kreiner DS, Matz P, Bono CM, et al. Guideline summary review: an evidence-based clinical guideline for the diagnosis and treatment of low back pain. *Spine J*. Jul 2020; 20(7): 998-1024. PMID 32333996

Documentation for Clinical Review

- No records required

Coding

This Policy relates only to the services or supplies described herein. Benefits may vary according to product design; therefore, contract language should be reviewed before applying the terms of the Policy.

The following codes are included below for informational purposes. Inclusion or exclusion of a code(s) does not constitute or imply member coverage or provider reimbursement policy. Policy Statements are intended to provide member coverage information and may include the use of some codes for clarity. The Policy Guidelines section may also provide additional information for how to interpret the Policy Statements and to provide coding guidance in some cases.

Type	Code	Description
CPT®	95999	Unlisted neurological or neuromuscular diagnostic procedure
	96002	Dynamic surface electromyography, during walking or other functional activities, 1-12 muscles
	97799	Unlisted physical medicine/rehabilitation service or procedure
	99199	Unlisted special service, procedure or report
HCPCS	S3900	Surface electromyography (EMG)

Policy History

This section provides a chronological history of the activities, updates and changes that have occurred with this Medical Policy.

Effective Date	Action
09/12/2008	Adopted BCBSA policy MPP 2.01.35 on Paraspinal Surface EMG. Title and Scope broadened to include all Surface EMG's. Policy Statement, literature search, coding update, and rationale added.
10/07/2011	Policy revision without position change
10/31/2014	Policy title change from Surface Electromyography Policy revision with position change
01/01/2017	Policy revision without position change
08/01/2017	Policy revision without position change
08/01/2018	Policy revision without position change
08/01/2019	Policy revision without position change
08/01/2020	Annual review. No change to policy statement.
12/01/2020	No change to policy statement. Literature review updated.
08/01/2021	Annual review. No change to policy statement. Literature review updated.
08/01/2022	Annual review. No change to policy statement. Literature review updated.

Definitions of Decision Determinations

Medically Necessary: Services that are Medically Necessary include only those which have been established as safe and effective, are furnished under generally accepted professional standards to treat illness, injury or medical condition, and which, as determined by Blue Shield, are: (a) consistent with Blue Shield medical policy; (b) consistent with the symptoms or diagnosis; (c) not furnished primarily for the convenience of the patient, the attending Physician or other provider; (d) furnished at the most appropriate level which can be provided safely and effectively to the patient; and (e) not more costly than an alternative service or sequence of services at least as likely to produce equivalent therapeutic or diagnostic results as to the diagnosis or treatment of the Member's illness, injury, or disease.

Investigational/Experimental: A treatment, procedure, or drug is investigational when it has not been recognized as safe and effective for use in treating the particular condition in accordance with generally accepted professional medical standards. This includes services where approval by the federal or state governmental is required prior to use, but has not yet been granted.

Split Evaluation: Blue Shield of California/Blue Shield of California Life & Health Insurance Company (Blue Shield) policy review can result in a split evaluation, where a treatment, procedure, or drug will be considered to be investigational for certain indications or conditions, but will be deemed safe and effective for other indications or conditions, and therefore potentially medically necessary in those instances.

Prior Authorization Requirements (as applicable to your plan)

Within five days before the actual date of service, the provider must confirm with Blue Shield that the member's health plan coverage is still in effect. Blue Shield reserves the right to revoke an authorization prior to services being rendered based on cancellation of the member's eligibility. Final determination of benefits will be made after review of the claim for limitations or exclusions.

Questions regarding the applicability of this policy should be directed to the Prior Authorization Department at (800) 541-6652, or the Transplant Case Management Department at (800) 637-2066 ext. 3507708 or visit the provider portal at www.blueshieldca.com/provider.

Disclaimer: This medical policy is a guide in evaluating the medical necessity of a particular service or treatment. Blue Shield of California may consider published peer-reviewed scientific literature, national guidelines, and local standards of practice in developing its medical policy. Federal and state law, as well as contract language, including definitions and specific contract provisions/exclusions, take precedence over medical policy and must be considered first in determining covered services. Member contracts may differ in their benefits. Blue Shield reserves the right to review and update policies as appropriate.

Appendix A

POLICY STATEMENT (No changes)	
BEFORE	AFTER
<p>Paraspinal Surface Electromyography to Evaluate and Monitor Back Pain 2.01.35</p> <p>Policy Statement: Paraspinal surface electromyography (SEMG) is considered investigational as a technique to diagnose or monitor back pain.</p>	<p>Paraspinal Surface Electromyography to Evaluate and Monitor Back Pain 2.01.35</p> <p>Policy Statement: I. Paraspinal surface electromyography (SEMG) is considered investigational as a technique to diagnose or monitor back pain.</p>