

Is Surface EMG Experimental?

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You may have recently noticed that many insurance carriers, including Medicare, are raising this question. Some are answering it affirmatively. As I ponder this question and their responses, I have to ask whether it is posed on a scientific basis or a societal/professional basis.

From a scientific perspective, an "experimental" procedure is usually a relatively new one, with only a scant amount of evidence describing it. Surface EMG, however, had its birth in the 1840s, coming into clinical use in the 1920s, and has hundreds of scientific studies which examine its use.

In reviewing the scientific evidence on the clinical use of surface EMG, it might be said that this evidence isn't any stronger or weaker than similar evidence for MRI, ROM, strength testing, palpation, or even needle EMG neurodiagnostic studies. Surface EMG has been demonstrated to have tremendous utility in kinesiologic studies, psychophysiologic assessment, chronic pain assessment, and work place studies of task specific muscular load.^{1,2} Surface EMG biofeedback has clearly documented clinical utility in the management of headache, chronic pain, incontinence training, and for some neurologic movement disorders as well as CVA rehabilitation.³

If a general scientific criticism could be leveled at surface EMG, it would be that it may not reflect the energy from only the contracting muscles directly below the sensors. It may pick up some diffuse energy from other possible muscle source generators. Some muscles are clearly not available for surface EMG study. Others require care in electrode placement and subsequent interpretation. These limitations need to be kept in mind when designing and interpreting surface EMG assessment studies. However, one could say that needle EMG suffers conversely from its incredibly small recording area and specificity. The energy at one point in the muscle may not reflect other points in the same muscle, let alone the functional contractile activity of the muscle as a whole. Basmajian and Dulca have clearly defined the respective roles of needle and surface EMG in this regard.¹

So, what is "experimental" about surface EMG? It is my belief that it is the very rapid and widespread use of surface EMG, by a variety of professional groups, which is experimental. Essentially, the real experimental question is: Will we be responsible in the way we use this new technology? There apparently is some debate on this issue. Let me briefly review some of the issues which I have encountered.

Issue #1: Is a static evaluation (muscle scanning) an adequate evaluation of the neuromuscular system?

Having introduced this procedure into clinical practice nearly a decade ago, my answer is: "It's a good start." A static evaluation at multiple muscle sites is an excellent descriptor of a disturbance in the "postural homeostasis" of an individual. This is particularly true when it is used in combination with visual observations of how individuals hold their body up against gravity. A posture disturbance is

frequently associated with pain. The patient may display muscle splinting or a protective guarding (antalgic) posture. These are indirect, yet objective signs of pain, and potential perpetuating factors in the development of chronic pain. Posture is a very important, yet commonly ignored aspect of the neuromuscular system.⁴ It is, however, only one aspect of the neuromuscular system. Other aspects of the neuromuscular function may need to be examined in order to detect or rule out dysfunction in a particular individual.

Issue #2: Is a dynamic EMG evaluation adequate?

Sherrington states, "Posture follows movement like a shadow."⁵ Extending assessment of muscle performance in movement adds dimensions of neuromuscular performance that static assessment may not reveal. The adequacy of a dynamic evaluation depends on how you choose to assess the neuromuscular system. The key word here is "system." All of the muscles work together, in synergies, to create smooth and efficient movement or work. Some muscles are prime movers, while others are stabilizers. The lower back muscles work in concert with the upper back muscles. When it comes to work, the muscles need to work together in an efficient fashion. If the pattern of cooperation is inefficient, the muscles eventually begin to hurt. This is Mother Nature's way of telling us, in no uncertain terms, that we are misusing our muscles. To study only one muscle site (e.g., the L3 paraspinals) means that you miss out on an assessment of these synergies. What one needs to know is which muscle groups work together in "myotatic" units during specific movements.⁶ Next you need to know if they are working in a healthy, cooperative fashion. Multiple muscle sets may need to be monitored simultaneously and examined for co-contractions or excessive inhibition during movement, or for perseverations of activity following the cessation of the movement. Single-site, dynamic evaluations may be misleading since they don't tell the whole story.

Issue #3: Should one consider emotional factors in the evaluation?

Certainly! The third level of organization of the neuromuscular system is the emotions. Emotions do communicative/behavioral physical work. Interestingly enough, this level of analysis is forgotten just as frequently as the postural component. In fact, to proceed as if emotions don't factor into the neuromuscular equation is just as inappropriate as to ignore the contributions of posture and movement. In addition, the emotional features may work in concert with posture and movement.⁷ The person may hold the head forward, with the shoulders slouched, taking on a postural display of sadness or depression. The movement pattern may be smooth and efficient when the emotional tone is normal, but under the emotions associated with anxiety, the dynamic movement pattern may change altogether. Every athlete or performing artist knows this fact all too well. Usually the evaluation of the emotional component is done during quiet sitting using a "stress profile." Here, specific muscle groups, usually the ones associated with complaint, are monitored while the patient recalls pain, the events associated with trauma, or other possible contributors to emotional life. Interestingly enough, these assessments would be even more informative if they were conducted with the postural muscle engaged (i.e., sitting or standing in an unsupported fashion) or in concert with a movement or work pattern.

Issues 1-3 reflect the need to recreate in our assessment procedures the parameters of real and varied life activity. A back-injured millwright seldom has problems in an easy chair, in a darkened room, thinking gentle thoughts. However, muscular dysfunction relevant to pain generation and maintenance may manifest in various combinations of real life postures, movements, and emotional events. It is our

task to recreate these parameters in the clinical setting if we are to be privileged to observe real life patterns of function and dysfunction of the neuromuscular system.

Issue #4: Should surface EMG be used to document soft tissue injury or involvement in pain-related disorders?

This is a very difficult question. In most cases of soft tissue injury there is very little in the way of objective findings for the traditional orthopedic and neurological tests. Surface EMG may be the only way to see, let alone quantify, any abnormality associated with the trauma. You, as an expert witness, should know that there are reasonable scientific data on both static and dynamic EMG as to their reliability and validity. Enough, at any rate, to have the surface EMG information admitted into a legal proceeding. It is then up to you, the provider, to have adequate credentials and training, to have done an adequate evaluation, and to be able to represent and defend this data to the judge or jury. As with any other clinical testing procedure, surface EMG data are most useful in this context as one portion of a well-integrated workup involving history, physical examination, functional assessment, and psychometric testing. Objectivity and prudence are the key words here. The medicolegal system is highly dysfunctional and invites dysfunction from counter transference and disability enabling behavior on the part of the clinician. Overinterpretation of inadequate studies, rather than true objective shortcomings of surface EMG technology, presents the major pitfall in this arena.

Issue #5: What training should the operator of the EMG instrument have?

On some levels, this is a very difficult question. On other levels, it is incredibly simple. Was there new information in the four prior issues? If so, then perhaps you should consider some additional training, more than what is found in the EMG manufacturers' manuals, or by what can be obtained in a single weekend workshop. A course of study or consultations might come from an accredited institution of higher education or through a series of workshops is highly recommended. Since surface EMG curricula are just now being assimilated into institutions of higher learning, you may need to seek postgraduate training. SESNA will be one of the forums offering such educational opportunities. The course curriculum should include, but not be limited to, information on the EMG instrument itself, the electrophysiology of the muscles, and the anatomy of the neuromuscular system.

One should clearly appreciate the effects of "noise" on their EMG signal, how to identify when it is present, and how to eliminate it when possible. One should understand the origins, insertions and actions of the muscles being monitored, along with their myotatic units. One should understand where to place the electrodes to pick up specific muscles, and how their EMG signal can become contaminated by "cross talk" from other nearby muscle groups. These are some of the major areas of concern. However, the area is quite rich and inquiry should not be limited to the above examples. Spectral EMG and fatigue are good examples. Because the field is changing so rapidly, you should probably assume that you need more education concerning the neuromuscular system.

Another related issue has to do with credentialing. Should there be EMG credentialing guidelines created for each of the various disciplines who use surface EMG? Should practitioners become "board certified" in surface electromyography? Should guidelines be created for an EMG technician-training program similar to those for EEG and ECG technicians? As the field evolves, these issues will need to be addressed.

Issue #6: Is surface EMG a reimbursable procedure?

On one level, the answer is: Yes, absolutely! On another level, however, I can clearly see that this is where the "experiment" begins. By dubbing the surface EMG procedure experimental, the insurance industry allows the provider to continue the service, but disallows reimbursement. I believe what is needed here is an experimental attitude towards solving some of the problems inherent to this issue.

One major problem is the lack of appropriate CPT codes for the provider to use. Many providers have used the 95869 code (EMG limited study of specific muscles). However, this code is easily confused with a needle EMG procedure since it is literally found on the page with all the needle EMG codes. But what other options do we have? The 90900 code (EMG biofeedback) has also been suggested. While this might be an appropriate code for treatment, it doesn't adequately describe all of the things that go along with an assessment procedure.

Part of what is needed is a willingness on the part of the professional community system to "experiment" with a new set of CPT codes for surface EMG. I would recommend a code be established for static evaluation; one for dynamic evaluation; one for psychophysiologic evaluation; one for spectral analysis (fatigue monitoring); and one for ambulatory EMG monitoring. Each of these codes should have more than one level to allow for the evaluation of more than one region. Perhaps a parallel set of codes for each group of providers is needed to allow for the level of service appropriate to the given specialty.

We also need better codes for EMG treatments. Perhaps 90900 (EMG biofeedback) could be reserved for relaxation therapies, with new codes being developed for "up training," "movement therapies," "work retraining," "rehabilitation," etc.

In addition to restructuring the CPT codes, some consideration needs to be given to the level of reimbursement. Obviously, a 15-minute muscle-scanning procedure is not equivalent to a 45-minute dynamic evaluation. Insurance carriers need to be educated about the durations of the various procedures. As in radiology, should there be a separate fee for the technical component and the interpretive component, or should the report be built into the fee structure? The level of reimbursement needs to reflect not only the time factor, but the cost of the initial expense of the EMG instrument (\$3,000-\$10,000).

Who should be reimbursed? Should the insurance carrier pay any professional who has acquired an EMG instrument? This is another part of the grand experiment. It is reasonable that there be some expectations of specific training in application and interpretation. Initially, we will need to rely on postgraduate education (as described in issue #5). The education issue is a very important one, both for the provider, as well as for the consultants to the insurance industry.

The inadequate understanding of this emerging technology can be clearly seen on both sides. Some insurance reviewers confuse surface EMG procedures with needle EMG procedures and refuse reimbursement because of a mistaken belief that surface EMG is an inferior variant of a needle EMG procedure. Some of the reports these reviewers are asked to read are genuinely "awful." Typically, the bad ones are very narrow, limited static evaluations, presented in the form of a computer generated report which neglects to incorporate the EMG findings into the overall view of the patient, let alone the treatment planning. Others are grossly overinterpreted, often contaminated by provider counter transference. It is no wonder that the insurance reviewers are denying claims. Some of the claims, as for any intervention or procedure, may deserve to be rejected. But, certainly not all of them.

Conclusion

Is surface EMG an experimental procedure? On a scientific basis, of course not! On a professional/societal basis, yes! Just as for the stethoscope, a revolution needs to take place before the technology can find its way into the professional community. We need to use this opportunity to educate others, as well as ourselves, as to what this technology can and cannot do.

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