

SEMG EDITORIALS

A Rose Is but a Rose...

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It is important for a scientific term to be understood the same way by fellow scientists from different fields. Surface electromyography (SEMG) is an electrophysiological modality. Therefore, its users from the academic or clinical fields should strive to use quantitative terms appropriate for the context of the modality. In this editorial, the author proposes that the quantitative term "resting tonus," referring to the amplitude potentials of a muscle at rest, should be used in preference to the qualitative term "baseline." Where the term baseline may be used in the SEMG context, it should be defined and qualified appropriately.

Science is generally known to strive for precision. Scientific wording must be used carefully in order to convey a precise meaning and, conversely, to avoid confusion. Colloquialism may be employed during the course of casual conversation between peers equally knowledgeable of a particular scientific subject; however, it should be avoided in scientific writing and discourse.

In this instance, the expression I am referring to is "baseline" as it applies to surface electromyography (SEMG). SEMG is an electrophysiological technique that deals on one hand with the investigation of the electric potentials created by skeletal muscles, and on the other hand with the voluntary control of the individual over the amplitude of those electric potentials in various conditions. The subject of SEMG is *muscle*, and any variation from that subject involves simple electrochemical volume conduction and not with muscle itself.

Muscle has two general states: motion and rest. The motion state reflects the contractile activity generally leading to a joint motion in space. It is the state of energy consumption. The resting state is the state in which muscle is not moving for the purpose of joint contraction. It is not a passive state. It is the condition in which the muscle receives most nutrition and oxygen, the state in which it gets rid of most catabolic products, and the state of energy regeneration.

Although a muscle may not contract for the purpose of joint motion, it has a resting tonus that is an active participant in the maintenance of the volume of the pertinent body part; the maintenance of the body part and viscera in space with or against gravity; and the maintenance of the structural integrity of the blood vessels, lymphatic channels, nerves, tendons, capsules, adipose tissue, subcutaneous and cutaneous tissues, and appendages.

The resting tonus of skeletal muscles is at all times under the influences of sympathetic and hormonal outflow. It is an integral part of the "fight or flight" phenomenon of the stress response. The resting tonus is different for the muscles of facial expression than for other muscles.

SEMG clinicians or biofeedback practitioners have observed that any person can learn to control (decrease) the amplitude of the resting tonus of the muscles under study within a matter of minutes and retain that muscle memory over time. The resting tonus of most muscles is usually less than 3 μV RMS. (microvolt root mean square). Each muscle tested by the author has shown its own resting tonus pattern.

Why would some SEMG practitioners utilize a confusing expression such as baseline to refer to the physiologic reality of the resting tonus? I researched the word baseline. Of several sources, the most pertinent and authoritative meanings I found were in *Merriam-Webster's Medical Desk Dictionary* (2002):

baseline: *n* **1:** an imaginary line or standard by which things are measured or compared: "the established baseline for the budget"; **2:** the back line bounding each end of a tennis or handball court; **3:** the lines a baseball player must follow while running the bases.

Needless to say, the definitions referred to budgets or sports verbiage, but they had nothing to do with muscular physiology. I also searched for the word baseline in my *Dorland's Illustrated Medical Dictionary* (2003) and physiology texts, Guyton (2001) and Ganong (2005). The word is not found anywhere in relation to muscle physiology or pathology.

Does the utilization of the expression baseline convey any scientific information with regard to the resting tonus? None that I could find so far. Hence, I would like to extend a warm invitation to my colleagues who utilize it in the realm of SEMG to consider the benefits of useful scientific vocabulary in place of quaint colloquialisms that are confusing at best and meaningless in fact. *A rose is but a rose...*

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A Rose by Any Other Name: The Case for Baselines in Psychophysiological Research

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In the editorial immediately preceding this one, Dr. Sella advocates eliminating the use of the word "baseline" in surface electromyography (SEMG) research and clinical practice. The author disagrees with that assertion for two reasons: (a) baseline is a well-established term that has been used for over a century in both behavioral and psychophysiological research; and (b) the concept of baseline refers to a measurement, whereas "resting tonus" is the phenomenon that we are measuring.

I read with great interest the accompanying editorial by Dr. Sella where he advocates using the term "resting tonus" instead of the term "baseline" in surface electromyography (SEMG) research and clinical practice. I agree with many of the points that Dr. Sella outlines. However, I disagree with his general assertion that there is no use for the term baseline in SEMG research and clinical practice. My concerns are twofold: (a) baseline is a well-established term that has been used for over a century in both behavioral and psychophysiological research; and, (2) the concept of baseline refers to a

measurement, whereas "resting tonus" is the phenomenon that we are measuring.

The term baseline is not a "quaint colloquialism," as Dr. Sella asserts. Rather, baseline is a well-established methodological concept in psychophysiological research, especially in behavior therapy and the behavioral sciences. It refers to a specific phase of experimental design methodology. It is universal scientific shorthand for a condition or period that occurs prior to the onset of the experimental condition or clinical treatment. In psychophysiological research, a baseline condition is generally defined as, "the period following adaptation, where psychophysiological response measures have stabilized (prior to the onset of any experimental or clinical manipulation, such as a stressor condition or biofeedback). The purpose of this condition is to observe and measure resting basal physiological activity" (Arena & Schwartz, 2003, p. 139). A baseline condition is essential in psychophysiological research and applied psychophysiology when one is working with relative measures (such as raw change scores from baseline condition

or percent change from baseline condition), as relative measures are dependent on the baseline condition.

The psychophysiological research literature is replete with experiments that include a baseline condition or period. Indeed, nearly all psychophysiological studies and specifically SEMG experiments that I am aware of include a condition called baseline. The reason why Dr. Sella could not find this term used in relation to muscle physiology or pathology in standard psychophysiology or SEMG texts—or in a medical dictionary—is because baseline is not a physiological or medical term. Rather, it is an experimental design expression that has universality among both clinicians and researchers. Universal methodological language allows us to communicate across scientific fields. For example, I could peruse an article in an occupational psychology or chemistry journal (both areas that I have no expertise in), and with minimal effort I would be able to understand what the baseline condition was referring to.

I agree with my good friend Dr. Sella when he states that the use of the expression baseline does not, in and of itself, convey any scientific information with regard to the resting tonus. However, knowledge that the experiment or biofeedback modality involves SEMG immediately and implicitly imparts that knowledge to the reader. I further agree wholeheartedly with Dr. Sella when he notes that there is confusion among psychophysiological researchers and applied psychophysiology practitioners as to how the term baseline is applied. I have heard many

individuals in SEMG practice refer to baseline as if they were measuring an event called baseline, rather than the phenomenon of resting tonus. The improper use of the term irritates me, as I am sure it does Dr. Sella. This is not, however, the fault of the expression baseline; rather, it is the fault of the individual who has applied the term incorrectly. To paraphrase Shakespeare, when it comes to confusion regarding the expression baseline in SEMG research and practice, the fault lies not in the stars but in ourselves.

Reference

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