A critique of:

Physiological aspects of masticatory muscle stimulation: the myomonitor

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The article by *J. DeBoever* and *W. D. McCall* ("Quintessence International", Report 0616, Volume 3, May 1972) is in need of clarification and correction. Essentially it presents the author's evaluation of the general potential of electrical stimulation in dentistry and, specifically, of the Myo-monitor.

A clearer description of the conditions under which some parts of the investigation were done would enable the reader to better judge whether the conditions of the experiment were applicable for drawing the conclusions reached. There is also question regarding some of the data and, particularly, of the validity of the conclusions.

The statement is made that "Recording the EMG from the same masseter muscle which was stimulated revealed that the threshold was approximately 20 volts." Our data, under clinical conditions using live patients, averages significantly lower, showing typical values of 14.7 and 15.5 volts at positive clinical threshold (Fig. 1). Clinical threshold was established as the first palpable contraction of the muscle and the first visible rise of the mandible that could be identified. One would expect the EMG to have identified threshold at even lower levels.

The description given in the paper does not adequately describe the conditions of the clinical investigation on the five patients. It does not make clear why, in an investigation of the Myo-monitor, a Grass Stimulator was used instead of the Myo-monitor itself. Nor does it specify what electrodes were used for the investigation. To draw clinical conclusions about a specific modality would seem to require that stimulation be done through the same

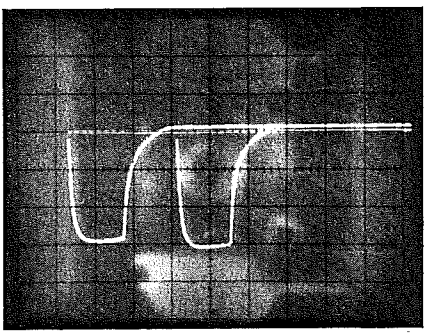

Fig. 1

Sensitivity: 5 volts per cm, 1 msec. per cm, Myo-monitor amp setting 5 (threshold). Balance adjusted for equal response each side. Left signal: 14.7 volts; right signal: 15.5 volts peak

pulse source and the same configuration of electrodes as are being evaluated.

The article states that tests conducted by loading the Myo-monitor with a variable impedance showed it to be a constant voltage source. The oscilloscope display, showing what happens when the Myo-monitor is loaded by the

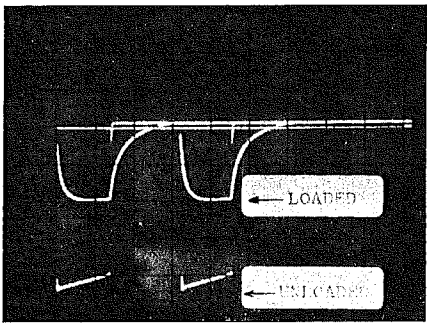

Fig. 2
Sensitivity: 5 volts per cm, 1 msec. per cm, Myo-monitor amp setting 3. Balance control centered. Loaded output 9.8 volts peak. Unloaded output 22 volts peak

impedance of a patient, does not bear this out. An initial pulse output of twenty-two volts amplitude drops to about 9.8 volts upon connection with the patient to the output circuit (Fig. 2).

The article also implies that since most FES devices are constant current, the Myo-monitor should also be a constant current device. Cited as a reason is that with a constant voltage device one is unsure how much current is available for stimulation after losses in the electrode-skin interface and tissue short-circuits. However, the Myo-monitor was designed specifically to perform certain objectives in clinical dentistry and the measuring of constant current available for stimulation is n o t one of those objectives. The objective is to generate a muscle response under the control of the dentist. Suitable manual controls are provided to permit adjustment of the stimulus by the dentist to match individual requirements. The dentist needs only to turn a knob until he gets the desired muscle response.

The Myo-monitor is neither a constant current nor a constant voltage instrument. It operates in a region between constant voltage and constant current. Extensive clinical experience has shown that operating in that region is a satisfactory solution to the clinical problem of obtaining a desired muscle response.

The article further states that the area recommended for application of the electrodes does not coincide with the motor point of one of the masticatory muscles. This statement is unclear. Actually, the input electrode is so designed and so situated that it is over both the motor point of the facial nerve (Fig. 3) and also over the opening of the mandibular notch (Figs. 4 and 5) where there is an open pathway through highly conductive tissue to the motor trunk of the fifth nerve on each side after it emerges from the base of the skull. The dispersing electrode is situated posteriorly at the nape of the neck. Because the current flow through tissues and tissue shunts is extremely complex, the exact pathways of flow are difficult to establish and, at present, can be expressed only in the most general terms. However, one way to get an indication of neural conduction is to reduce the pulse width of the stimulus and observe whether contractions still occur. Pronounced contractions are still evident when pulse width is reduced to as low as .3 msec. In addition to neural stimulation it would be logical to expect some spread of the stimulus through tissue.

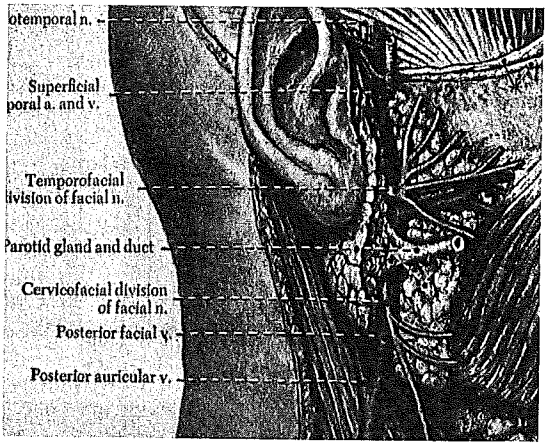

Fig. 3
Facial nerve anterior to soft lower lobe of ear.

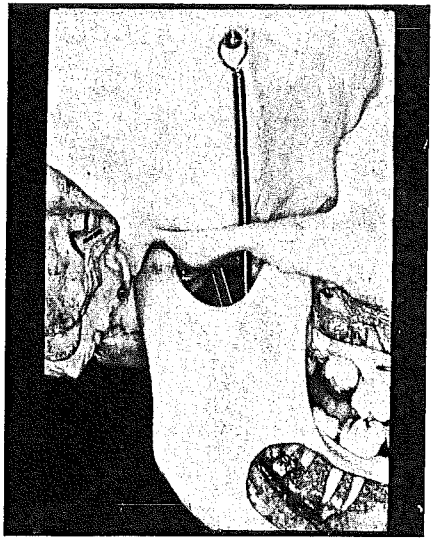

Fig. 4
Mandibular nerve seen through mandibular notch

Fig. 5
Facial motor point and mandibular notch are both covered by the electrodes

The comment that "It is not certain that the Myo-monitor by stimulating the masseter muscles can provide the physiologic position of the mandible in the horizontal, frontal and sagittal planes" is a speculation that might be relevant if it were factual that only the masseters contract. However, multiple muscle contraction is clinically evident and can be readily established visually

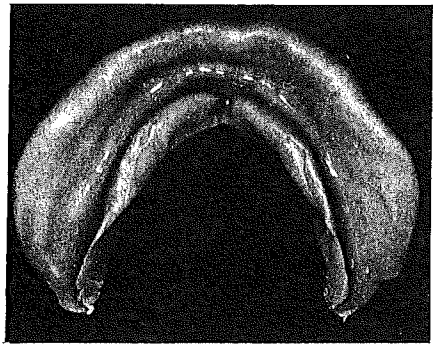

Fig. 6
Mandibular impression molded under the influence of the Myo-monitor; note molding by muscles of the floor of the mouth

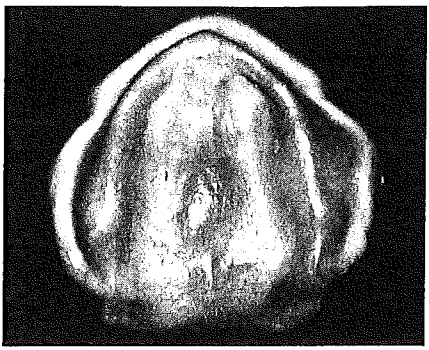

Fig. 7
Impression molded by muscle contraction under the influence of the Myo-monitor

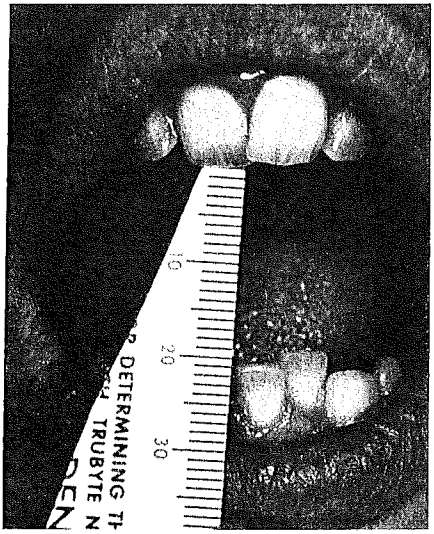

Fig. 8
Maximum opening before treatment

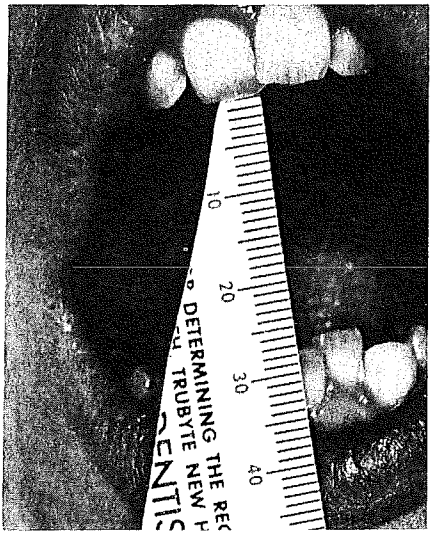

Fig. 9
Increased opening after thirty minutes on the Myo-monitor

and by palpation. Contraction is also evident by the unmistakable molding of denture impression borders by the surrounding musculature (Fig. 6 and 7).

The paper concludes that "It is doubtful that, in patients with TMJ dysfunctions, the Myo-monitor can lead to relaxation of the masticatory muscles other than the masseter muscles, and the muscle tensor veli palatini." Even limited clinical experience would have rendered such speculation

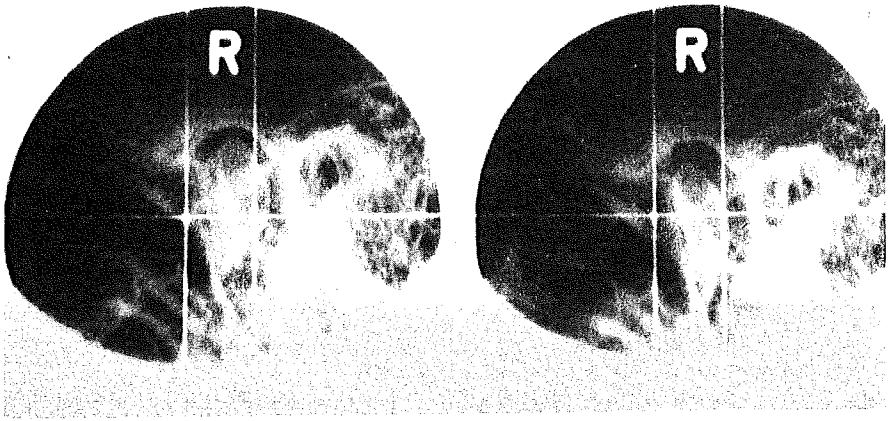

Fig. 10
View of right TMJ with mouth closed and mouth open as far as possible; note limited movement

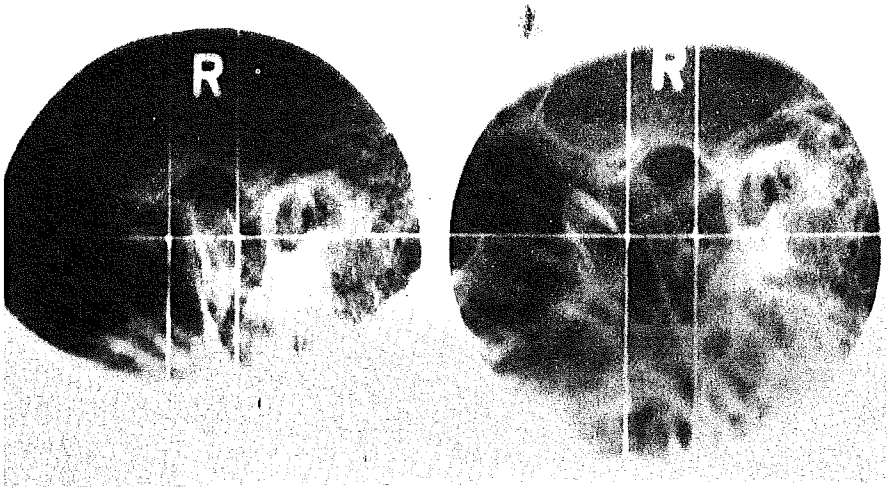

Fig. 11
After thirty minutes on Myo-monitor. Note increased mobility of the right condyle on wide opening

unnecessary. A phenomenon can be established as a scientific fact if it can be measured. In TMJ Syndrome, the occurrence of relaxation can be measured as an increase in maximum opening from incisal edge to incisal edge after application of the Myo-monitor (Figs. 8 and 9). Muscle relaxation is also measurable by increased translation of the condyle after treatment with the Myo-monitor (Figs. 10 and 11).

Several questions arise—whether the Myo-monitor was indeed used in the investigation; whether it was properly used; why the EMG did not record group contraction which can be felt and seen?

The necessity of relating theoretical speculation to reality was emphasized by Albert Einstein "all knowledge of reality starts in experience and ends in it... Conclusions must be consonant with experience." The conclusions propounded in the article by *DeBoever* and *McCall* do not meet that requirement. □

John Abernethy (1764—1831)

Student of John Hunter; in 1797 he carried out the first ligature of the external iliac artery.

Abernethy was famous for his laconicism: he avoided all superfluous talk. A woman, who knew of this idiosyncrasy, wanted to have a dog bite treated. She came in and bared her wound for the doctor's eyes.

"A scratch wound?" he asked.

"A bite," answered the patient.

"A cat?"

"A dog."

"Today?"

"Yesterday."

The doctor was enchanted, and he almost embraced the woman. Eventually, he treated her with the greatest of care, healed her and did not charge her a fee.

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Second World Congress on Ultrasonics in Medicine, Rotterdam, the Netherlands.

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