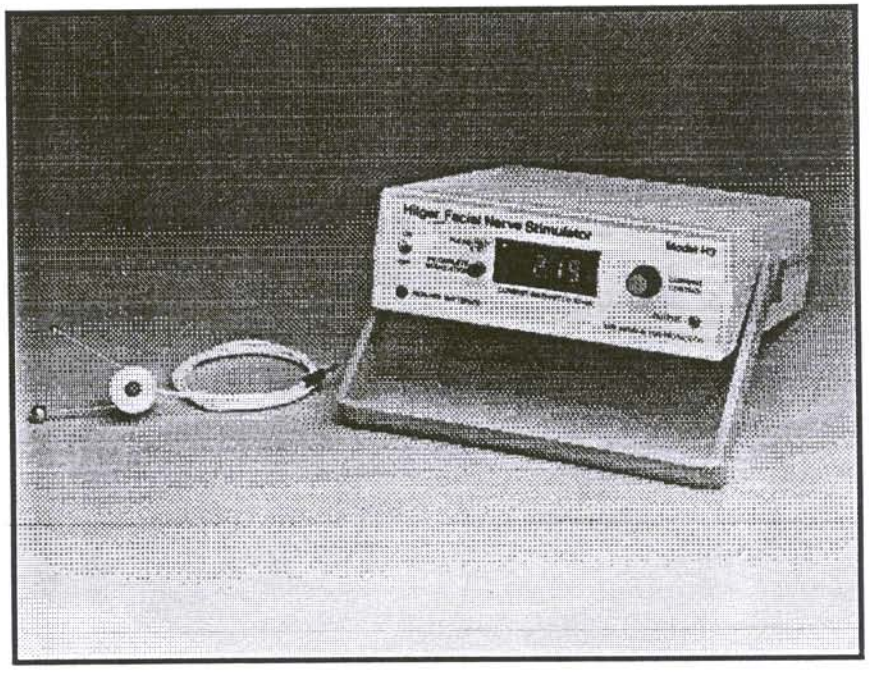
GLOBAL MST

Predicting Prognosis for Bell's Palsy and
Ramsay Hunt Syndrome Patients:

- *94.7 percent accurate*
- *Easy to perform*
- *Excellent patient tolerance*
- *Minimal equipment requirement*
- *Low cost*



Hilger Facial Nerve Stimulator

for Accurate Clinical Electrodiagnosis
A must for any physician treating patients with acute facial paralysis.

GLOBAL MAXIMAL STIMULATION TEST (MST)

Handbook for predicting prognosis for Bell's Palsy and Ramsay Hunt Syndrome patients

PROGNOSIS

Making a reliable prognosis in early stages of facial paralysis is difficult. Electrodiagnostic testing attempts to predict prognosis by determining the physiologic extent of nerve damage. However, results of available electrical tests (nerve excitability, facial nerve latency, evoked and volitional electromyography, and strength duration determination) show abnormality from days to weeks after degeneration. In the case of a severed nerve, nerve excitability, facial nerve latency, and ENOG results are normal for 72 hours.

All stimulatory nerve test results reflect what has occurred three days earlier, and volitional electromyography results do not become abnormal for two to three weeks. Moreover, once stimulatory electrical test results become abnormal, they remain abnormal and cannot be used to monitor regeneration and reinnervation. In cases in which regeneration is expected, electrical test results are good prognostic indicators but differ in interpretation on the basis of the bias of various authors.

The findings from all electrical testing must be correlated with the clinical and pathologic process causing paralysis. In general, test results are useful only during the first weeks of disease. Because degree of regeneration is related to degree and rate of denervation, serial electrical tests are performed. If denervation has progressed from minimal to severe degeneration in seven to ten days, a greater and earlier return of volitional muscle motion can be expected than in patients who have progression from minimal to severe denervation in three to four days.

If test results indicate equal muscle response on both sides of the face, the patient can be expected to have complete return of facial function in three to six weeks without complications of faulty nerve regeneration. The most common complications of faulty nerve regeneration are contracture, synkinesis (associated facial motion), and facial spasms (tics). An uncommon complication is gustatory tearing ("crocodile tears").

Maximal Stimulation Test (MST)

The observer is placed so as to see both sides of the face simultaneously. The stimulating probe is applied to the nerve branch at that intensity which produces a just-visible muscle twitch. When the first contraction is observed, the area is explored to find the most sensitive point—that which displays the maximal amount of muscle motion. The current is then increased one to two mAmp above this threshold to obtain maximal nerve excitability stimulation. Test results are expressed as the difference in facial muscle movement when comparing the affected side of the face with the normal side; those results are recorded as equal or decreased movement. Additionally, when muscle response to maximal nerve excitability stimulation is decreased, the observer notes whether this decrease response on the affected side is minimal, moderate, or severe compared with the nonaffected side. The findings equate very well with the degree of denervation. No response indicates complete denervation of the nerve branch being tested.

GLOBAL MST

The degree of neural degeneration is not always equal in every branch of the facial nerve. Therefore, to reflect more accurately the status of the entire peripheral nerve branch system and refine statistical analysis, a modified method of reporting MST results, similar to that used for electromyographic reporting, was devised.

Electromyographic technicians report the estimated degree of muscle action potentials (known as interference patterns) on a scale of 0 to 4, with 0 being no muscle action pattern and 4 being a normal response. For MST reporting, 4 is assigned to equal muscle response on both sides of the face, 3 is assigned to minimally decreased, 2 to moderately decreased, and 1 to severely decreased response compared with the response of the same branches on the unaffected side. A GLOBAL MST can now be computed for the entire face. An example of such a computation using the Hilger Facial Nerve Stimulator (WR Medical Electronics Co., Stillwater, MN) is shown in Table 1.

Table 1. Method for computing GLOBAL MST results using the Hilger Facial Nerve Stimulator

Branch	Decreased response	Score
Forehead	minimal decrease	3
Eye	moderate decrease	2
Mouth	severe decrease	1
	GLOBAL MST Score (3 + 2 + 1) / 3 =	2

This hypothetical patient suffered a "moderately" degenerated facial nerve, and recovery would be delayed with sequelae. A score ≤ 2.7 is 94 percent accurate in predicting incomplete final recovery with mid-face contracture with synkinesis (Table 2).

Table 2. Prediction of recovery based on GLOBAL MST scores using the Hilger Facial Nerve Stimulator

GLOBAL	RECOVERY		Sequelae**	HOUSE GRADE
Scores	%	(weeks)	(severity)	(I to VI)
4	100	3 - 6	none	I
3 - 3.9	75 - 100	4 - 8	minimal	II
2 - 2.9	75	6 - 12	moderate	II - III
1 - 1.9	50 - 75	8 - 12	mod. / severe	II - III
0 - 0.9	<50	12+	severe	IV - V

**contracture with synkinesis

Although facial nerve excitability testing is a simple procedure, determining location of the peripheral branches requires experience. The branch to the frontal muscle is usually found about one centimeter lateral to the eye; the branch to the orbicular muscle of the eye is stimulated at the lateral border of the orbit. Location of the branch to the orbicular muscle of the mouth varies the most of all the three branches, but is usually just anterior to the notch where the facial artery traverses the mandible. The stimulating probe may need to be moved to determine point of maximal response, as the facial nerve can branch in many directions beyond the stylomastoid foremen (Figure 6).

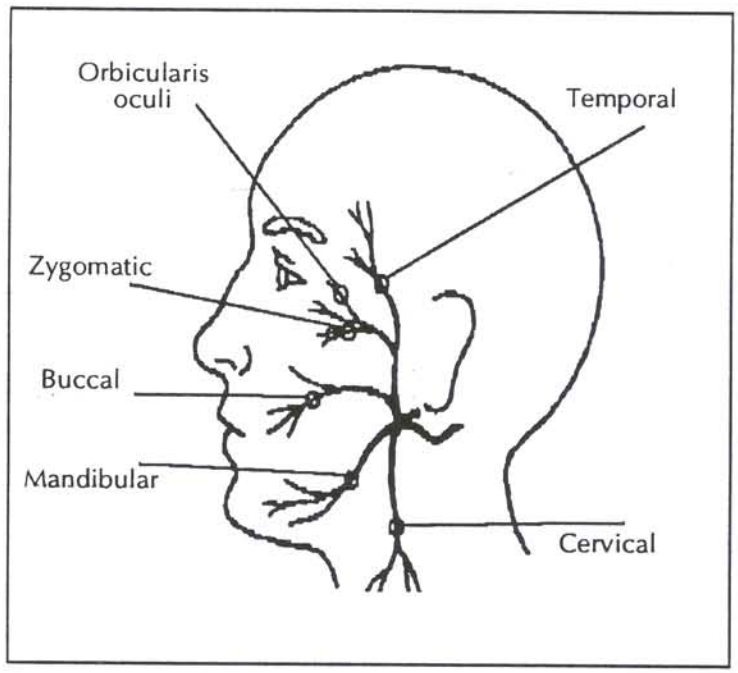


Figure 1: Facial nerve branches.

Electroneurography (ENOG) versus MST

Although ENOG permits study of muscle excitability and the state of muscle fibers and provides useful information regarding conduction properties of nerve fibers, the functional status of the nerve is assessed by comparing amplitude of the compound muscle action potentials on both aides of the face. The interval between nerve stimulation and start of muscle potential—facial nerve latency—can be accurately measured and is an acceptable indication of nerve function. This method is considered an improvement of MST. Instead of visual estimate, muscle action potential is recorded. However ENOG testing has yet to be standardized. The test-retest result variability between both sides of the face and between tests on different days ranged as high as 50 percent, with an average difference of 20 percent.

MST has the disadvantage of relying on a visual endpoint, and ENOG has the advantage of possessing a recorded and often reproducible endpoint. However, ENOG has the disadvantage of reliance on stimulating the nerve trunk. Because the facial nerve trunk is deep in the stylomastoid foramen, an increased stimulus level is required, which often triggers a reaction in the masseter muscle, the "trigeminal nerve artifact." Moreover, ENOG findings are interpreted on the basis of muscle reaction in only one part of the face. If the upper division of the facial nerve is cut, ENOG would record a compound muscle action potential equal to that of the other side. MST, which records individual peripheral branches, would accurately show abnormal absent muscle response. Because an electrical impulse can stimulate only neuropraxic fibers, none of the tests distinguish between axonotmesis and neurotmesis or second- and third-degree nerve injury. The recorded compound muscle action potential from a nerve with 25 percent of its fibers neuropraxic is the same, regardless of the degree of injury to the remaining fibers.

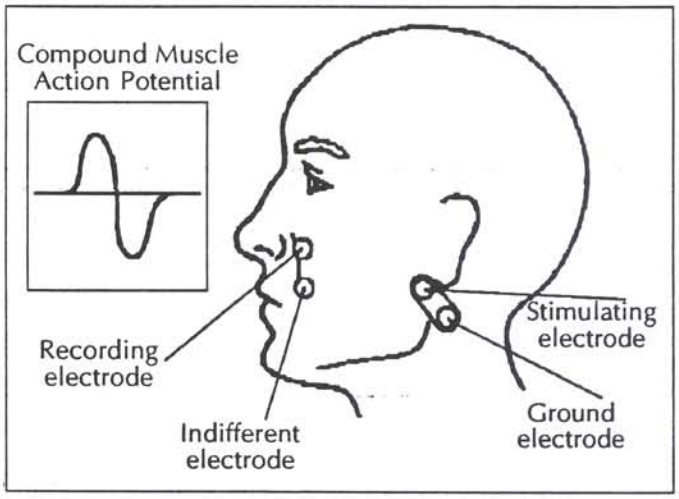


Figure 2: ENOG compound muscle action potential.

Comment

All stimulatory electrical facial nerve test results become abnormal three days after neural degeneration has taken place. The ostensible goal of facial nerve decompression is to prevent neural degeneration. Therefore, using any stimulator electrical test results to predict need for possible surgery is an anathema. Even though instrumentation is elaborate and recordings impressive, it is still apparent that ENOG cannot be considered sufficiently sensitive to select acute facial palsy patients for treatment. The sources of error are considerable: 1. electrode placement; 2. skin impedance; 3. masseter muscle artifact; 4. patient tolerance; 5. equipment variability; 6. lack of standardization; 7. inter-test results variance; 8. inter-side results variance; 9. lack of understanding that Bell's Palsy is a viral disease which causes longitudinal, not perpendicular, damage to the intratemporal facial nerve.

Conclusions

GLOBAL MST using the Hilger Facial Nerve Stimulator is an accurate, well-tolerated, easy-to-perform, cost-effective method of predicting prognosis in patients with acute facial palsy.

This article was written by a physician. No royalty or compensation was received for this work.
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