Noninvasive Electrometric Detection of Nasal Escape in Patients with Rhinophonia

MUTAZ B. HABAL, M.D., F.R.C.S.(C)
OMAR H. MARDAM-BEY, Ph.D.
Indianapolis, Indiana 46202

The presence of nasal emission in patients post reconstruction of clefts of the secondary palate and in other physical or psychological conditions denotes an incompetence in the velopharyngeal valve mechanism (*2, 3, 5, 11, 12*). The problem in evaluation is usually present when there is deviation from the "obvious" which is complete incompetence of the valve. The incomplete incompetence of the velopharyngeal port can be hard sometimes to differentiate from articulation problems, neuromuscular incoordination, or functional nasality, in such conditions testing for nasal escape had been found to be helpful in differentiating the various problems encountered and to be a good adjunct in speech evaluation (*3, 4, 8*). The degree of nasal emission correlates well with nasality. Multiple, conventional and crude methods had been used by the speech therapist and the surgeon to detect the air escape during speech, such as fogging of a mirror, the blowing on small cotton threads, tissue paper or soap bubbles (*1*), placed in front of the nostrils, or pinching of the nostril to detect change in voice quality. All those methods are utilized during speech of a given standard phrase (test sentence), vowel, or consonant being sibilant or plosive. Spirometry measurement, air flow with the anesthesia mask (*9*), and ultrasound had been among the recently introduced modalities that the surgeon and speech therapist utilize for the same problems. More complex expensive and sophisticated modalities have utilized the use of transducer devices with oscilloscopic imaging (*7, 8*).

The following report is aimed at introducing a new, quick and reliable, nonrestrictive, nonobstructive and noninvasive electrometric detection test unit which is simple to construct and use for the detection of nasal emission in patients with rhinophonia. It is used as an adjunct to our present modalities of speech evaluation.

Dr. Habal is Assistant Professor of Surgery at the Indiana University School of Medicine and Attending Plastic Surgeon at the Indiana University Medical Center, Indianapolis; Dr. Mardam-Bey is a Teaching Fellow at the Department of Electrical Engineering at the University of Kansas, Lawrence.

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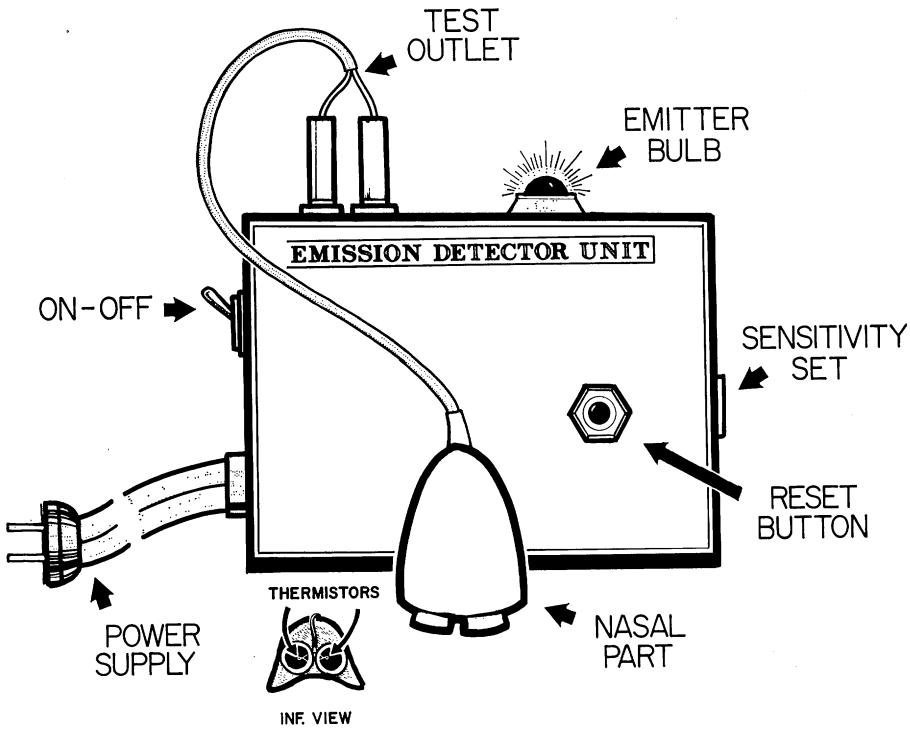

FIGURE 1. A diagram of the electrometric unit that is used to test for nasal emission. Note the key components in the unit, the emitter bulb, the reset button and the nasal part, an inferior view shows the placement of the sensors used, which are placed in front of the nostril.

FIGURE 2. Diagrammatic view of a patient during testing for nasal emission. Note the position of the nasal part, the unit is placed in front of the patient undergoing testing for observation by the treating therapist, physician or the patient.

The unit is composed of two parts, a nasal part and an electronic memory unit connected together with a two wire cord (Figure 1). The unit is powered from 110 volts AC and can be very easily converted to DC power to be supplied by pen light batteries. The nasal part is made of a silastic mold that has two small openings leading to small ½ cm tubes for aiding the directional air flow from the nose. The sensors (thermistors) in the nasal part detect air flow when present, due to nasal emission and transfer the signal to the unit via the cord when it is converted to a small current that turns on a light bulb (the indicator light). When the light goes on, a reset button is used to reset the unit and turns the light off for repeated testing. The electronics of the unit are simple and inexpensive and can be assembled in any small electronic laboratory (6).

Method of Testing

The nasal part is held in front of the patients nose so that the mold sits on the bridge of the nose and the sensors will be positioned just in front of the nostril as to their location in the mold so they detect any nasal emission. The "on-off" switch is turned "on" after the unit has been plugged to a regular wall outlet. The patient is then asked to speak "loud and clear" a given standard set of phrases or single words (test sentence), and if there is any nasal emission, the indicator light turns "on" as it gets activated by the presence of nasal emission. The reset button is used to turn the light "off" for repeated testing. A "yes" or "no" answer can be obtained immediately (Figure 2). We have found that the use of the following letters to be helpful, i.e., consonants as S for sibilant sounds and P for plosives, the vowels used to give an idea also of voice tone as E, and O in a given standard sentence. The use of nasal resonance letters (M, N) will activate the light in the unit, failure of such response will be in ruling out denasality. Increase nasal airway resistance will interfere to a small degree with testing, while nasal obstruction will not allow the testing to be performed.

The following are some of the applications we found this noninvasive electrometric testing to be useful:

1. It can be used as a simple test for detection of nasal emission in patients with border line or questionable rhinophonia.
2. It can be used by the patient himself or with his speech therapist during therapy sessions, or speech exercise to detect any air leak during speech, especially when it is variable.
3. Postoperatively (pharyngeal flap) to test the adequacy of the (v-p) port after such procedures and detect when nasal emission is present, and a good measure for detecting denasality, especially when mild.
4. It can be used to differentiate dysarthrophonia, neuromuscular incoordination and physical defects from nasality due to incompetent velopharyngeal valve mechanism.

5. It provides an objective rather than a subjective means of looking at post palatal reconstruction results, if a scaler is added to the unit.

The unit is safe and easy to use and is well admired by children. It is used as an adjunct to the present methods of speech evaluation. Air emission at the initiation or termination of speech can be excluded, due to positive detections when the patient inhales since it is hard to differentiate inflow and eflow of nasal air, during breathing and account for emission during speech only. We have used this method in over 100 patients and found it to be helpful and reliable method.

In conclusion, advances made in recent years with electronic devices allowed us to construct this simple, noninvasive unit for use in detecting nasal emission.

Summary

A new concept of a simple, noninvasive and nonrestrictive electrometric detection of nasal emission is introduced. The application of this technic is easy. A definite answer can be obtained immediately. It is helpful in differentiating nasal escape from articulation problems and other related abnormalities when rhinophonia is mild. The unit was built by the authors and can be easily constructed in any small electronic laboratory. The test was used on over 100 patients with quite quick reliable and reproducible results. It is an added adjunct to our conventional methods of speech evaluation.

reprints: *Indiana University School of Medicine*
Indianapolis, Indiana 46202 (Dr. Habal)

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