# CASE REPORT: EMG-BIOFEDBACK TRAINING OF SPASTIC TONGUE PARESIS DUE TO CEREBROVASCULAR SEQUELA

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Summary: This pilot study suggests that EMG-biofeedback training of the tongue was useful for rehabilitation of lingual and eating function. 75 yrs patient suffered from R-hemiplegia and L-side of the tongue (Miller-Gubllard syndrome).

In EMG-BFT, electrodes were fixed on both sides of the hyoid bone. Before BFT his tongue of was crooked L-side and the utmost limit of stretching was 2 cm from L-angle of the mouth in a bacili form. After about 100 sessions, he was able to stretch his tongue 5cm straight in flat form. He could pronounce "a","i", "o" and "u", however not "e" due to rigidity in the tip. He improved in jargon and eating.

Key-words: EMG-biofeedback training; tongue paresis, stroke; Millar-Gubllard syndrome; rehabilitation

As a sequela of cerebrovascular accidents, speech disturbance is frequently observed as well as other sequelae such as paresis of extremities.

Electromyographic biofeedback training (EMG-BFT) has been used for rehabilitation therapy for cerebrovascular accidents like stroke and cerebral infarction (Basmajian, 1975).

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This therapy achieved successful results when used as a technique of rehabilitation in flaccid or spastic paresis in the upper or lower extremities. However, no study has yet been reported regarding the application of EMG-BFT to patients with speech disturbance due to the tongue paresis. Therefore, there is no established method for selection of target muscles or no established procedures involving EMG-BFT.

The authors report this trial approach in the expectation that this report will contribute to methodological development and progress in this field.

## CASE

H.T., 75 years old, male.

**Chief complaints:**

1) Speech and eating disturbance due to the tongue and mouth
2) paresis of the right extremity.

**Diagnosis:**

Sequela of cerebrovascular diseases. Miller--Gubllard syndrome (R-hemiplegia and paresis of L-face & tongue), Diabetes mellitus.

**Past history:**

Essential hypertension since 65 years old and he was suffered from stroke at 70 years old. He was admitted in the rehabilitation center and treated for 6 months. He improved in the R-foot, but not in the right upper extremity nor ligual function of eating and speech.

**Present status:**

Patient's conscious was clear and his complexion was good, but dysarthria was severe. His phonation was cat-like or segull-like (cris de chat) and unintelligible. He spilled milk and soup from left angle of the mouth. The left eye remained cosed and the right eye could be opened to moderate degree. His nasal grooves were asymmetrical and L-groove was deeper and downward than the right one.

The tongue was bacilli-formed and thick showing flexion to the left. The tongue tip was protruded 2cm from left mouth angle when he was told to stretch his tongue.

The right upper extremity showed ankylotic flexion at the elbow joint and the fingers formed a fist, Slight rigidity remained in the L-leg, however the joints were movable allowing wlaking.

**Loboratory data:**

*Hemtologic examinations:*
Red blood cells, 381x10/mm ; white blood cells, 14,000/mm ;Hemoglobin, 11.7g/mm ; Hematocrit, 35.7%.
*Liver function test:*
t-protein,6.6mg/dl.; GOT, 15IU/l.; GPT, 10 IU/l; Alkaline phosphatase, 6.6IU/l.; Total cholesterol, 91mg/dl.; HDL-cholesterol, 28mg/dl.; triglyceride, 37mg/dl.; beta-lipoprotein, 1.6mg/dl.; uric acid, 2.8mg/dl..
*ECG:* right bundle branch block & ventricular extrasystole.
*Chest-X-ray:* left ventricular hypertrophy.

Fig. 1

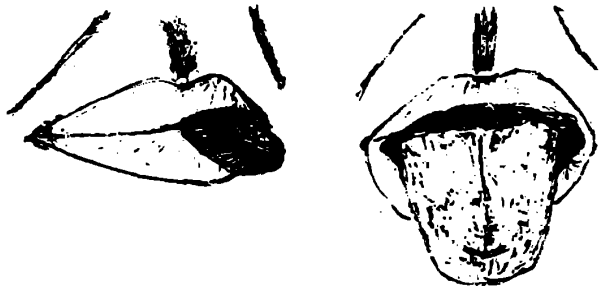

Fig. 2

After 5 months' BFT, he was able to stretch his tongue as much as 5cm from his mouth in a flat form and the nasal grooves were almost symmetrical

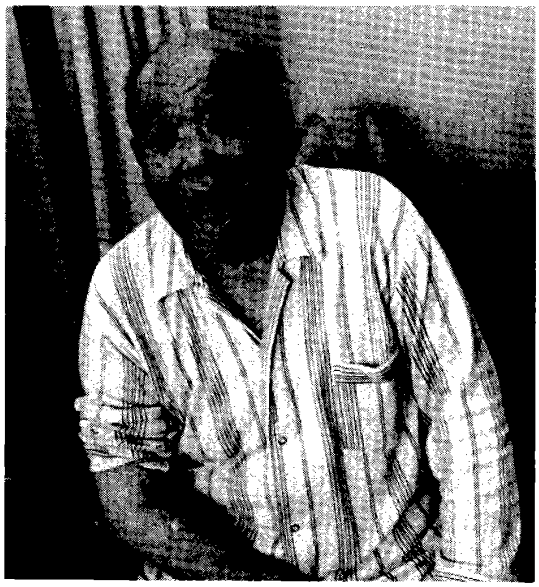

Fig. 3

## TREATMENT

The biofeedback apparatus is UT-201(Unique medical Co.Ltd.) which is portable EMG auditory biofeedback system and covers the range from 0 to 40 micro-volt in two steps. As a form of relaxation training of rigid(spastic) tongue muscles, electrodes were placed over the bilateral external sides of the hyoid cartilage where the homo-hyoid muscle and thyro-hyoid muscle were in the superficial layer. In aged patients like him, the neck skin was too loose that it was difficult to find a stable site electrode placement specially in the depth of the submandibula.

The above-mentioned site was the most stable in this patient.

The procedure was as follows; After finding EMG threshold and setting EMG level for training, the patient was encouraged to make sound and stop sound with nurse's verbal lead. The training was 30 minutes in a session and 6 days a week. The greatest weak point in this program was that we did not take record EMG level in the course of training. This patient was the first case for us that we were not accustomed to take EMG for one reason, and for second reason, the apparatus did not show exact digital readings.

Around 30th session, his lip and nasal grooves became more symmetrical in visible grade. From around 50th session, this patient showed observable improvement in lingual function. He did not spill soup nor water from his mouth end. We began additional voice training with help of nurses. Through this training, he could pronounce easily "a", "i", "o" and "u", however, he had difficulty in pronouncing "e". This seemed to be attributable to the upward flexion and rigidity of his tongue tip(Fig.2 &3) since the tip should have been curved to downward to form a sound "e".

His jargon disappeared through the training and his voice became clear. In the course of time, he learned how to utter simple words such as "ha-i"(yes) and "o-ha-yo"(good morning).

When a nurse tried to teach "i-i-e" which was a polite word equivalent to English "no", this patient could not pronounce with sessions of training possibly due to above-mentioned reason. After he was suggested to pronounce "i-ya"(casual expression of "no") in which the tongue tip should be curved downward, he was successful.

After 5 months" BFT, he was able to stretch his tongue as much as 5cm from his mouth in a flat form and the nasal grooves were almost symmetrical (Fig.2&3).

He could not regain no more than 20 simple words although he and medical staffs practised hard for many vocabularies. He learned only words which his wife and a nurse taught repeatedly. Although he could understand simple words by silent reading, he could not read aloud unless they suggested him to follow their reading. It was disclosed that he had been complicated with aphasia.

## DISCUSSION

The hightlight of this BFT was to find the target muscles for stable electrode placement. The direct monitoring of EMG level from the tongue surface was not possible because the tongue was wet for one and secondly for technical problems.

After we noticed that EMG level of the hyoid muscle group reflected those of the tongue, EMG-BFT was set off by indirect monitoring of the tongue muscle. This simple method was enough for relaxation training of the tongue. Recently Kanamori and his group developed a technique of monitoring EMG directly from wet tongue surface. However, this sensor should be prepared for each patient to fit the shape of the mouth, gingiva.and tooth alignment. So this is not available yet at present. As mentioned above, due to trial and error of finding appropriate target muscle and shortage of experience, we could not record the course of EMG level in this treatment.

As an extension of this study, we reported(Saito, et al.1984) that EMG-BFT was an effective approach in the treatment of idiopathic oral dyskinesia in the aged.

Although BFT has been applied in every stage of age, the authors expect that EMG-BFT of the tongue will be one of the representative treatments like BFT of fecal incontinence (Engel,1974) for the aged.

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