Electromyographic Verification of Viable Muscle Tissue Following A Double-Pendulum Flap Procedure for Surgical Repair of Bilateral Cleft Lip

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Introduction

Cleft lip, a congenital nonunion of the lip, appears in varying degrees, ranging from minimal defects of the vermillion portion of the lip to complete extension into the nasal vestibule. Cleft lip may occur as part of the cleft palate syndrome or it may occur with no disturbance of the hard palate or velum. This anomaly, occuring once in 750 births, can be surgically reconstructed resulting in a favorable cosmetic effect, but total muscular function is rarely restored (*1*).

Review of the literature

In cases of compound cleft, that which affects both palate and lip, labial surgery is generally completed before closure of the palate and velum. It is advocated that surgical intervention occur within the first year of the child's life. Early restoration of the lip aids greatly in encouraging proper growth and labial function, conformation of the maxillary arch and approximation of the alveolar border (*5*). Muscular realignment is the primary concern of the surgeon in the restoration of the lip.

It is generally agreed that any operation for the repair of clefts of the lip should attempt to conserve a maximum amount of available tissue. Surgery should be based on the definite facial landmarks and be adaptable to a variety of clefts (*5*).

Of the various surgical procedures presently in use for reconstruction of bilateral cleft lip; rotation-advancement, quadrilateral flap, triangular flap, and the double pendulum flap; the latter is the only procedure that purports to restore total muscle function to the orbicularis oris.

The purpose of the present investigation is to determine the presence or absence of viable orbicularis oris muscle in the double pendulum flap surgical repair of bilateral cleft lip.

Procedure

Five subjects provided data for this study; four males, one female. The subjects ranged in age from seven years, three months to nineteen years, seven months.

Each had undergone surgery two to eight months prior to the electromyographic investigation.

The surgical procedure on each of these subjects can be considered to be a secondary procedure since primary closure of the lip by other surgical methods had failed to establish satisfactory results. Prior to this secondary procedure each subject had displayed the whistling deformity.

Equipment

Hook wire electrodes, commercially produced by Medwire Corporation, were used for the EMG pick-up. All wires were stainless steel, .003 inch in diameter, coated with .0014 inch teflon insulation.

Two wires were threaded through a 26 gauge, 5/8 inch hypodermic needle, thus forming an active and reference electrode for each pair. The hypodermic needle was used as the electrode transport vehicle.

The wires were connected to the Honeywell Corporation Accudata 135 biomedical preamplifier via a locally made coupling device. Output data from the amplifier was coupled to the Honeywell Corporation 1508A, 14 Channel visacorder, which is a light writing oscillograph using photosensitive paper.

Method

Two pairs of electrodes were inserted in the superior labia. The first pair was inserted two millimeters superior to the vermillion and two millimeters lateral to the columella. The second pair was inserted at the superior vermillion line four millimeters lateral of columella. Both pairs were inserted on the side of surgical reconstruction. This electrode placement assured that the hookwire electrodes were recording from the double pendulum flap tissue which was transferred in the surgical procedure described by Kapetansky (*4*).

Patients were seen individually. Each was seated in an adjustable, reclining chair and advised to relax. The area for site of electrode insertion was cleaned with isopropyl alcohol.

Recording instrumentation was then stabilized. The Accudata 135 Preamplifier was set at 40 millivolts for full scale deflection at 50 millimeters per second paper speed, and time line intervals of .01 second.

The subject was requested to purse his lips as in whistling or kissing. This lip activity elicited active muscle contractions which were recorded on the photosensitive paper.

Results and Discussion

Based on the electromyographic data obtained from the present investigation, all five subjects displayed muscular action in the double pendulum flap (Figure 1). The onset of muscle activity is abrupt and demonstrates an interference pattern consistant with normal muscle activity.

Visual inspection of each subject during pursing action displayed symetrical lip movement, possible only with complete restoration of orbicularis oris.

Reports from the subjects substantiate restoration of orbicularis oris function.

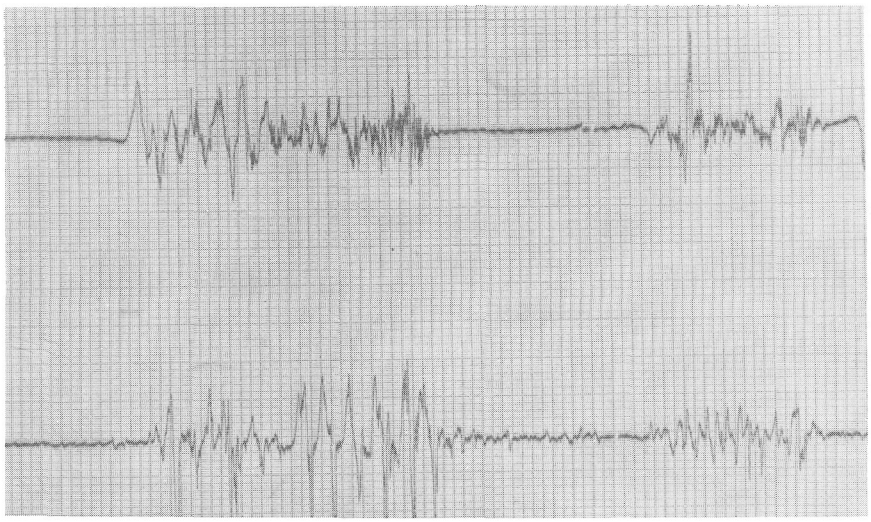

FIGURE 1. E.M.G. verification of viable muscle tissue following double-pendulum flap procedure for surgical repair of cleft lip.

The assumption can be made that a complete lip function exists in these repaired lips. Thus, the double pendulum flap is the surgical procedure for the correction of cleft lip that can habilitate orbicularis oris to maintain active muscular contractions. The major implication of restored orbicularis oris function would appear to be in maintenance of the superior dental arch.

Garlinger (*2*) has stated that the primary etiology to anterior displacement of superior dental arch can be traced to insufficient pressures from an improperly functioning orbicularis oris. It is also generally agreed by orthodontists that there is a higher incidence of anterior displacement of the superior dental arch in children with cleft lip (*3*).

Since the present study has demonstrated continuity of viable orbicularis oris muscle tissue in the repaired cleft lip, it is the author's opinion that there is a reduced probability that the superior dental ridge in these patients will be displaced anteriorly and require orthodontic intervention.

In the event that there are other physical anomalies which result in a discontinuity of a specific muscle, a surgical procedure similar to that described by Kapetansky (*4*) may feasibly result in reestablishing continuity of muscle tissue and thus better muscle function. If the above mentioned surgical procedure is modified to be performed for other anomalies, it is suggested that electromyography is the method of choice to investigate muscle competency.

Summary

Five patients were seen in an electromyographic study of the double pendulum flap method of bilateral cleft lip repair. All five patients displayed active orbicularis oris muscle tissue. By bringing lateral lip segments to the center of the cleft, the double pendulum flap method restores muscular function and improves

cosmetic appearance. This surgical procedure may be modified to be performed on other anomalies resulting from a discontinuity of muscular tissue.

References

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