Activation of the Incompetent Soft Palate by Means of Muscle Transplants: A Preliminary Report on Sixteen Cases

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Most of the multiple surgical techniques that have been devised to improve cleft palate speech have been based on the principle of diminishing the palatopharyngeal space so that the direction of speech flow would be through the mouth instead of through the nose. These efforts began in 1875 when Schoenborn (*2*) attached the velum of the palate to the posterior pharyngeal wall.

Several techniques which attempt to diminish the palatopharyngeal space have made use of various materials, such as autografts of cartilage (*12*), bone and fascia, and also inert substances, such as Silastic (*3*), implanted in the posterior pharyngeal wall. Rearrangement of local posterior pharyngeal tissue (*1, 5, 15, 19, 20, 21, 23*), as exemplified in the Hynes (*13*) and the Wardill (*22*) palatoplasties, also aims to diminish the pharyngeal space.

The retropharyngeal flap popularized in this country by Conway (*6, 7, 8*) has been used extensively throughout the world (*9, 11, 16*) and has definite value in improving the speech of some cleft palate patients. Its disadvantage, as with all the techniques that have been used to diminish the palatopharyngeal space, is that its effect is largely static, as it pulls the soft palate higher into the nasopharynx and acts as a bow string. Stark (*18*) has aptly called it a 'flying buttress'. It is probably no more than healed pedicle graft which keeps the palate in an immobile position and thus interferes with the normal functioning of the nasopharynx. Conversely, Broadbent and Swinyard (*4*) who used a flap that included a healthy section of superior constrictor muscle, reported that in all palatopharyngeal flaps tested by electromyography, normal

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motor units were demonstrated. On this basis, they concluded that the pharyngeal flap is probably a dynamic muscular unit.

In considering this problem, it seemed that if the palate could be elevated into a higher position to diminish the nasopharyngeal space without interfering with normal function and if some dynamic mobility could be added to complement or replace the static condition of the nasopharyngeal flap, this would constitute the most desirable surgical procedure. The operation to be described aims to add dynamic power to the postsurgical incompetent cleft palate and the congenitally nonfunctioning soft palate. It is adapted from a technique that has been used successfully in the reconstruction of the paralyzed lower lip, where the masseter muscle has been employed to add motor power to the corner of the mouth, for example, in seventh nerve palsy (*14*).

To apply this technique to the nonfunctioning palate, whatever its cause, a search was made not only for the most convenient muscular power source but also for a muscle that would contribute proper directional force when it is attached to the palate. This force must move the palate in an upward direction to diminish the space between the palate and the pharyngeal roof. After studying the available muscle attachments in the vicinity of the soft palate, the temporalis and the masseter muscles were chosen to supply the kinetic energy which would enhance the functioning of the soft palate.

It is often forgotten that the insertion of the temporalis muscle extends into an aponeurotic attachment along the entire anterior border of the ascending ramus of the mandible (Figure 1) downward nearly to the third molar tooth. This anterior border of the muscle lends itself very well to the purpose of obtaining length and strength after its partial removal from the ascending ramus, thereby allowing it to be inserted into the palate. It is easily accessible under general anesthesia when the mouth is propped open.

If, upon opening this area, the temporalis muscle is found to be deficient in its attachment along the ascending ramus, as is sometimes the case, the masseter muscle can be used instead. This important strong muscle has two attachments to the mandible—the large, commonly known attachment covering the lateral surface of the ascending ramus of the lower jaw and another attachment which arises from the medial border of the zygomatic arch and is fixed to the lateral surface of the coronoid process of the mandible. This can be used as a substitute source of energy to the palate and a portion of it can be stripped from its attachment and sutured to the fascial transplant by using the following technique:

Technique

The patient is anesthetized through an endotracheal tube which is curved down over the midline of the mandible. The first step in the

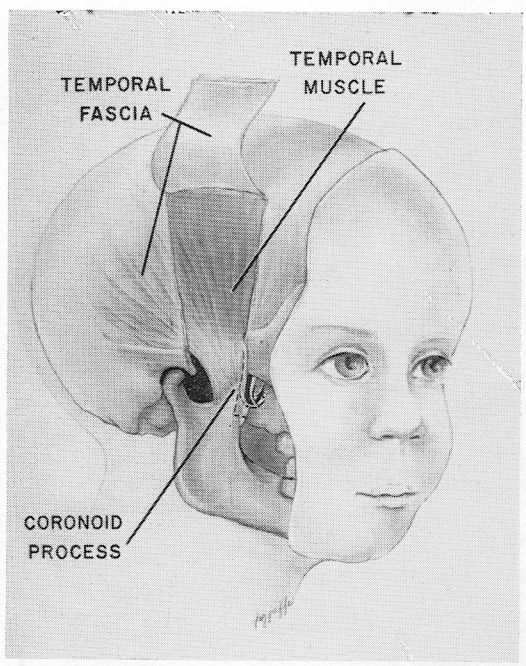

FIGURE 1. Diagram showing attachments of temporalis muscle and fascia in relation to the coronoid process.

procedure is to take a fascial graft from the thigh with a fascial stripper (Figure 2). This is done before any surgery is performed in the palatal region, to prevent possible contamination of the wound in the thigh from the mouth.

The mouth is propped open with a side mouth gag. This allows the coronoid process to be brought forward. Then the anterior border of the ramus of the mandible is palpated through the mucosa. A vertical incision is made over the crest of the process. The buccal fat may protrude and can be retracted, exposing the coronoid process. The temporalis muscle is uncovered and its aponeurotic attachment is removed as far down the anterior border of the ascending ramus of the mandible as possible. It is stripped superiorly so that it will be free of the coronoid tip. A suture must be placed in the muscle to prevent its retraction upward under the zygomatic arch. Without this precaution, it can be completely lost.

The same procedure is repeated on the other side.

If the temporalis muscle is not available or suitable, then the masseter is used by detaching it from the coronoid process on each side.

The fascial graft, previously taken from the thigh, is then sutured to a curved fascial carrier. The fascia is passed through the muscles of the soft palate by way of the original incision and just anterior to the uvula (Figure 3). Great care must be taken to keep the fascia in the substance of the soft palate so that no part of the graft is exposed except where it

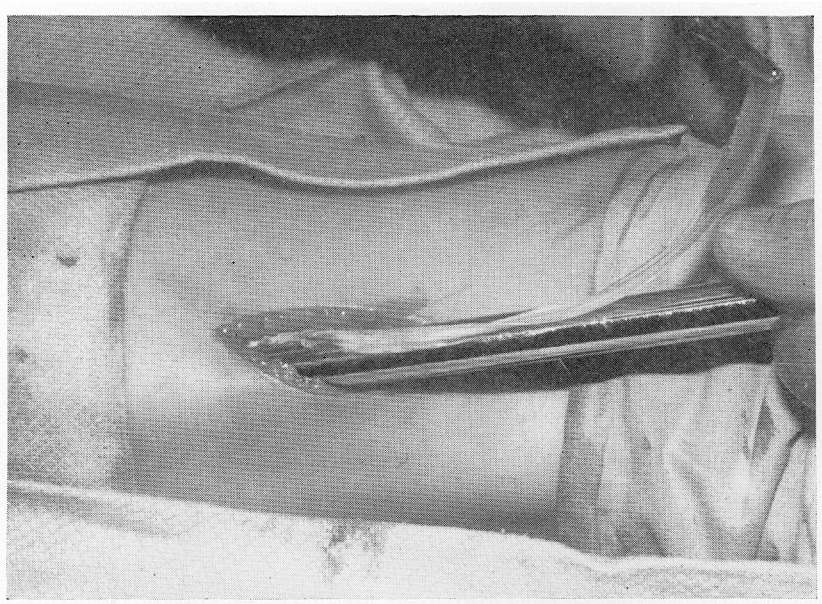

FIGURE 2. Removal of fascial graft from thigh with fascial stripper.

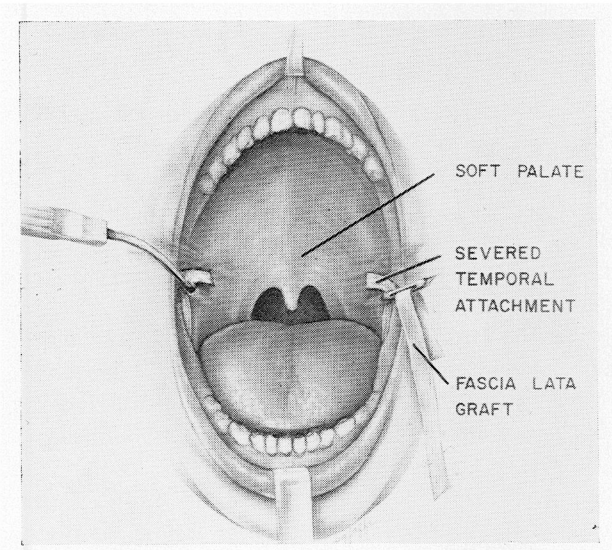

FIGURE 3. Placement of the fascia lata graft through the palate.

is to be attached to the temporalis muscles, or to the masseters, if the latter are used. The end of the fascia is then sutured to the detached temporalis muscle strip (Figure 4), or to the detached masseter muscles, as the case may be. This anastomosis is then allowed to retract up under the zygomatic arch. The other end is sutured to the temporalis strip on the opposite side as tightly as possible.

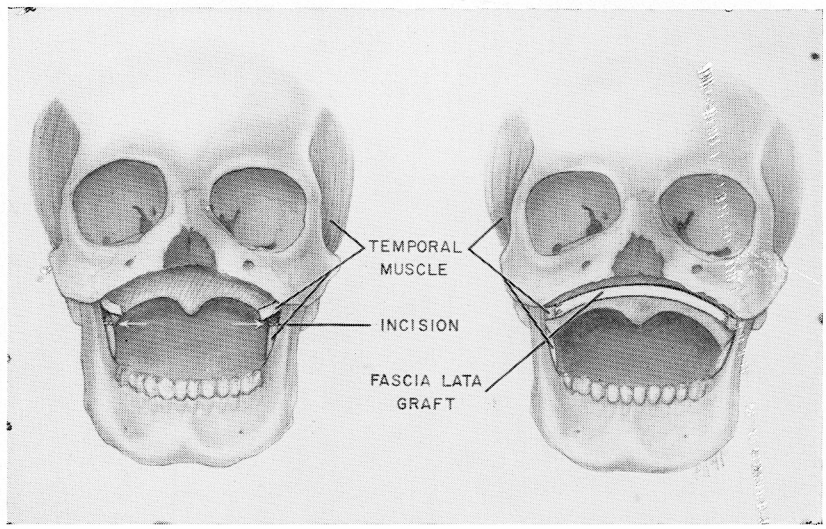

FIGURE 4. Graft attached to the temporalis muscle strip.

The mouth incisions are then closed with ⅀0000 catgut. The fascial graft can then be palpated as a ridge in the soft palate, and as the muscle contracts, the palate is pulled superiorly.

Comment

This technique may allow the palatal muscles to function better as gravity is counteracted. Hypoplasia of tissue is a constant factor in almost all congenital anomalies. The operation permits whatever small degree of muscular function of the palate is present to exert its maximal effect as the force of gravity is opposed by the action of the temporalis or masseter muscles.

Placement of the fascial graft is of great importance in obtaining the optimal action from the muscles to which it is attached. It is somewhat difficult to evaluate where this should be placed for its greatest efficiency. Possibly it should be placed more toward the midportion of the palate, since Blackfield and associates (*2*) have stated that the action of the palatine levator muscle which causes the elevation of the mid-portion of the palate is the normal site of physiologic closure between the soft palate and the pharyngeal wall. The combined action of both the levator palatine and the superior pharyngeal constrictor on both sides produces the nasopharyngeal sphincter.

We are still investigating the possibility of using other muscles for supplying necessary motor power to the palate and also trying to determine the optimal placement of the fascial graft to secure the most satisfactory results. It may be that eventually a fascial grafting procedure, combined with some other technique, such as the retropharyngeal flap, may prove better than either operation alone. In one patient on

whom we performed a combined procedure, with the fascial graft and a retropharyngeal flap, the improvement in speech which occurred almost immediately after operation was remarkable.

Preliminary Clinical Data

Transplantation of a fascial graft and attachment to either the temporalis or masseter muscles to supply kinetic energy to the non-functioning palate has been performed on sixteen patients, in one of whom, as just mentioned, it was combined with a retropharyngeal flap. This girl, aged 13, and three other patients had non-functioning palates and had had no treatment. The other twelve patients had true cleft palates and all had had previous operations. The fascial transplant alone was performed on fifteen patients, to test the rationale and the results of the procedure.

In all sixteen patients there has been improvement in speech following the operation and in most it has been satisfactory or encouraging, according to our clinical impression and the opinions of family, teachers, and speech therapists. The best results so far have been obtained in those with paralyzed palates, that is, those with cleft palate speech but without true clefts (forme fruste?). Randall and associates (*17*) and Crikelair and associates (*10*) have presented classifications of patients with velar dysfunction in the absence of cleft palate. The latter authors stressed the importance of two types, those with downward fixation of the soft palate with otherwise normal function and those with neuromuscular impairment which is sometimes apparently of central origin. They suggest that some children whose cleft palates have been repaired with poor speech results may also have neuromotor dysfunction of central origin. The visible cleft in some instances may have been only one manifestation of an abnormal development which also affected the pathways of neuromuscular function.

In most of our patients, additional improvement after operation has been gained following speech therapy, although some have improved markedly without additional speech training. Those who have had training subsequent to the operation have been found to reach a higher plateau of speech efficiency than had been possible for them before undergoing the muscle transplantation procedure. Investigations are still in process which will provide more objective evaluation of speech improvement by means of voice prints, cinefluorography, tape recordings, and electromyography. Preliminary findings in these studies corroborate the subjective impressions of substantial improvement in speech postoperatively.

Summary

This preliminary report on sixteen cases is presented primarily to suggest a new approach to the surgical treatment of the cleft palate and

velar insufficiency which aims to provide kinetic energy to the non-functioning palate by a fascial-graft attachment to neighboring muscles which will lift the palate more nearly into its normal functioning position. The technique described is not regarded as final or standardized, and may well be modified with respect to muscles to be used, positioning of the graft, and possibly combination with a retropharyngeal flap or some other procedure.

The point we wish to emphasize is that the aim of any operation on the cleft palate should be not merely a rearrangement of local tissues or a filling-in of the retropharyngeal space in some artificial or static way, but in addition it probably should provide kinetic energy from other muscles to stimulate dynamic function. This possibility should be thoroughly explored and exploited.

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