# Speech Results from the High Attached Pharyngeal Flap Operation

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The pharyngeal flap operation is performed by many surgeons to correct velopharyngeal incompetence in patients with cleft palate speech. However, some uncertainty exists regarding the effect of this procedure on palatal function, and there is division of opinion regarding the specific techniques for the operation. This divergence is most often expressed in consideration of the desirability of superiorly based versus inferiorly based pharyngeal flaps.

The purpose of the present investigation was to evaluate the effectiveness of pharyngeal flap techniques from the viewpoint of the speech results.

#### Procedures

SURGICAL. Blackfield, Owsley, and co-workers reported their early experience with the pharyngeal flap procedure in 1963 (1). The initial operative technique consisted of attaching a superiorly based pharyngeal flap to the posterior end of the soft palate on its nasal aspect. This was done in a standard manner without splitting the soft palate. No attempt was made to cover the exposed muscle on the undersurface of the pharyngeal flap nor to repair the donor defect on the pharyngeal wall. This technique may be described as the low attached, superiorly based pharyngeal flap, as illustrated in Figure 1.

Observations during the postoperative phase revealed that the flap contracted in all of its original dimensions. In conjunction with the scarring, reattachment occurred between the base of the flap and its donor area on the pharyngeal wall. This resulted in downward traction on the flap and the attached posterior edge of the soft palate. After complete healing, the soft palate was fixed to the posterior pharyngeal

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FIGURE 1. Sagittal view of the palate, showing low attachment of superiorly based pharyngeal flap to the soft palate at its posterior end.

wall by a bridge of scarred tissue (Figure 2). The point of this attachment was usually below the preoperative level of the posterior margin of the soft palate at rest. The result appeared to be identical with the condition effected by attachment of an inferiorly based flap to the posterior end of the soft palate. The similarity in the final appearance of the low attachment of the pharyngeal flap, regardless of whether the flap was superiorly or inferiorly based, has been reported by other experienced surgeons (3, 7).

Because of variations in the degree of scar contracture and shrinkage of the low attached pharyngeal flap, the size of the remaining velopharyngeal apertures on both sides of the flap cannot be predicted.

Improvement in speech is apparently related to the size of these openings and to the patient's ability to close the spaces effectively by pharyngeal muscle action during speech. Velopharyngeal closure in these patients occurs at the distal end of the palate, which is the site of the flap attachment. It would appear that closure is effected princi-



FIGURE 2. Cephalometric X ray and tracing from the film of a patient with a low attached pharyngeal flap. Palate at rest.

pally by a valving action produced by contraction of the palatopharyngeus muscles in the lateral pharyngeal area and the constrictor muscles in the posterior pharyngeal wall (4, 5, 7).

If there is inability to produce a complete closure by compensatory muscle function, the patients have significant residual rhinolalia. Cinefluorographic films of patients with a low attached pharyngeal flap demonstrate that the soft palate is tethered to the pharyngeal wall at a level below the normal site of velopharyngeal contact. In these patients, the low attached flap is seen to restrict palatal elevation, when compared with the excursion of the palate as observed on the preoperative cinefluorographic film (1, 2, 5, 7). Movement in the pharyngeal flap itself has not been observed in clinical examination nor on cinefluorographic studies.

As a result of these observations regarding the low attached pharyngeal flap operation, a modified technique for attachment of a superiorly based pharyngeal flap has been used since 1962 (5). This operation is termed the "high attached pharyngeal flap". In this procedure, the soft palate is split in the midline to the level of the posterior border of the hard palate. Through the exposure, a superiorly based pharyngeal flap, which includes the entire posterior width of the pharyngeal wall, is outlined. The flap is elevated from a plane overlying the prevertebral fascia to a point as high as possible toward the cranial base. The base of the flap is above the level of the arch of the atlas, which is the usual region of normal contact between the palate and the pharyngeal wall during velopharyngeal closure.

The recipient site for the flap is created in the anterior midregion of the nasal aspect of the soft palate as exposed by the central division. The palatal mucosa is reflected and turned back as bilateral flaps with a distal base. These flaps are made sufficiently long to create a complete lining for the exposed muscle on the undersurface of the pharyngeal flap to the point of its origin from the pharyngeal wall. The flap is sutured in place in the denuded area on the nasal aspect of the soft palate. The turnback flaps of nasal mucosa from the soft palate are similarly sutured to cover the remaining undersurface of the flap (Figure 3).

In certain cases in which the soft palate is extremely short, the lining flaps will not be of sufficient length to reach to the base of the flap. For these patients, the pharyngeal flap is combined with a palatal lengthening procedure such as the V-Y Wardill operation. The flap is attached in the region of the junction of the mucoperiosteal flaps from the hard palate and the soft palate. After attachment of the flap, the divided soft palate is repaired in layers over the flap. No effort is made to close the donor area of the pharyngeal flap. The mucosal lining, which covers the exposed muscle surface of the pharyngeal flap, prevents reattachment to the pharyngeal wall and subsequent



FIGURE 3. Sagittal view of the high attached pharyngeal flap with the lining flaps of palatal mucosa sutured in position.

downward displacement of the base of the flap due to scar contracture. The high attachment along the plane of normal palatal elevation is maintained after healing has been completed (Figure 4).

This operation was performed on 114 patients between 1962 and 1967. All patients except one showed satisfactory primary healing. This one patient, who developed a hematoma causing flap separation, subsequently had an operation to reattach the flap, and the result was then satisfactory.

The preoperative presence of palatal mobility and significant muscular contraction in the area of the posterior and lateral pharyngeal wall was evaluated by clinical examination and cinefluorographic studies. Palatal motion during speech was studied on the cinefluorographic film (Figure 5), and pharyngeal muscle contraction was assessed by clinical examination.

The site of velopharyngcal closure can be easily observed in the



FIGURE 4. Cephalometric X ray and tracing from the film showing healed position of the high attached pharyngeal flap.



FIGURE 5. Superimposed tracings from cinefluorographic film of patient with high attached pharyngeal flap. Elevation of the soft palate is shown during velopharyngeal closure on phonation.

patient with the low attached pharyngeal flap. However, it should be emphasized that the flap attachment in the site of velopharyngeal contact following the high attached flap operation is hidden behind the soft palate. This area can be observed only by indirect viewing with a laryngeal mirror or other special instrument.

In the first few months after operation, very little motion of the palate can be observed by oral examination. Subsequently, the palate loses its postoperative induration, and the site of flap attachment in the anterior midportion of the soft palate can be viewed by oral examination. Elevation of the palate can be observed during phonation. This elevation results from contraction of the palatine levator muscles on both sides of the flap. Velopharyngeal closure is effected by palatal elevation in association with constriction of the pharyngeal musculature (Figure 6). The high position of the flap appears to utilize the palatine levator function to achieve elevation and closure of the palate at or near the normal site of velopharyngeal contact. This clinical observation has been confirmed by cinefluorographic films.

SUBJECTS. Twenty-one patients with low attached flaps and 56 patients with high attached flaps were available for detailed yearly postoperative studies.

The patients included individuals with cleft palate, submucous cleft



FIGURE 6. View of the high attached pharyngeal flap with aid of a laryngeal mirror. *Left*, palate at rest. *Right*, elevation of the palate with closure of the lateral velopharyngeal apertures.

TABLE 1. Distribution of patients with high attached haps and low attached ha	with high attached flaps and low attached flaps.
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diagnosis	N high attachment	N low attachment
repaired cleft palate	33	20
unrepaired submucous cleft palate	$\frac{2}{2}$	
velopharyngeal dysfunction with no cleft	19	1
totals	56	21

palate, or velopharyngeal dysfunction without a cleft. The distribution of patients according to diagnosis is shown in Table 1. Subjects ranged in age from 5 to 33 years.

SPEECH EVALUATION. The 21 patients with low attachment and the series of 56 patients with high attachment were examined preoperatively and annually up to five years postoperatively.

High fidelity tape recordings were made of each individual's speech, both prior to and following the surgery. The samples were rated in-

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dependently by three speech pathologists for a) the degree of nasality and b) intelligibility. A 4-point rating scale ranged from 0, denoting satisfactory speech, to 3, indicating the most severe deviation. The final ratings assigned were the means of the ratings by the three speech pathologists. The preoperative and postoperative samples of the patients' speech were rated as though they were unrelated: the judges did not know whether a given recording was a pre- or postoperative sample, nor were the patients identified.

After completion of all ratings, the means for the preoperative and postoperative recordings of each patient were compared. A patient's speech was considered "improved" if the postoperative rating was higher than the preoperative rating. The change for each patient was classified according to four postoperative categories. For nasality the classifications were: improvement with satisfactory quality, improvement with minimal nasality, improvement with moderate nasality, and no improvement. Intelligibility was categorized as follows: improvement with satisfactory intelligibility, improvement with mildly defective intelligibility, improvement with moderately defective intelligibility, and no improvement.

### Results

NASALITY. No patient's postoperative rating was lower than the preoperative rating. Table 2 shows the distribution in postoperative categories for both groups of patients. Of the series of 21 patients with low attached flaps, four demonstrated satisfactory voice quality in terms of absence of hypernasality, and six showed improvement with minimal residual nasality. Eight were in the group exhibiting improvement but with moderate residual nasality and three in the group with no improvement.

Of the 56 patients with high attachment, 27 had satisfactory quality and 21 evidenced improvement with minimal nasality. Seven demonstrated improvement but with moderate nasality, and one showed no improvement.

For purposes of chi-square analysis, the patients showing satisfactory quality and those with minimal nasality were included in one category. Comparably, those patients manifesting moderate nasality and those with no improvement comprised one category.

The chi-square test on the difference between the group with high attachment and the group with low attachment demonstrated that this difference was significant at the .01 level (Table 2).

INTELLIGIBILITY. Of the patients in the group with the low attached flap, ten were assigned to the category showing improvement with satisfactory intelligibility, and five had improvement but with mildly defec-

classification	low attachment N	high attachment N
	nasality	
improvement, with satisfactory quality	4	27
improvement, with minimal nasality	6	21
improvement, with moderate nasality	8	7
no improvement	3	1
totals	21	56
chi-square	9.28	
	intelligibility	
improvement, with satisfactory intelligibility	10	23
improvement, with mildly defective intelligibility improvement, with moderately defective intelligibil-	5	19
ity	2	8
no improvement	4	6
totals	21	56
chi-square	2.8	

TABLE 2. Postoperative nasality and intelligibility ratings for patients with high attached pharyngeal flaps and patients with low attached pharyngeal flaps.

tive intelligibility. Two demonstrated improvement but with moderately defective intelligibility, and four had no improvement.

For the group with high attachment, 23 of the 56 patients exhibited improvement to the level of satisfactory intelligibility, and 19 had improvement but with mildly defective intelligibility. Eight were improved but with moderately defective intelligibility, and six evidenced no improvement.

The chi-square test on the intelligibility ratings showed no significant difference between the patients with low attachment and those with high attachment (Table 2).

#### Discussion

In interpreting the findings reported herein, it should be recognized that the two groups do not lend themselves readily to precise statistical analysis. In the initial evaluation of the results obtained from the low attached flap, it had been found that the speech was not satisfactory in a certain proportion of the patients. In analysis of the reasons for these limitations, it appeared that the high attached flap would take better advantage of the potential functional properties of the palatal

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and pharyngeal structures than did the low attachment. Additionally, in the selection of patients who could be expected to benefit from the high attachment, cognizance was taken of the apparent effect of preoperative palatal and/or pharyngeal mobility. It had been observed that patients who demonstrated very limited or no preoperative mobility in the palatal and/or pharyngeal musculature, did not show speech results which were as satisfactory as those of patients with relatively good mobility. Accordingly, this characteristic became a selective factor in determining the patients who should be considered for the high attached flap.

NASALITY. The present findings demonstrate that the high attached flap was more efficacious than the low attached flap in the correction or reduction of hypernasality in the patients studied. The principal explanation for this difference would appear to be the closer approximation which the high attachment bears to the physiological function of normal velopharyngeal closure. In addition, the predominantly selective factor of preoperative mobility of the palatal and/or pharyngeal musculature in the group with high attachment could also have contributed to this result.

INTELLIGIBILITY. Although there was improvement in intelligibility in most of the patients in both groups, there was not a statistically significant difference between the two groups. This lack of differentiation is probably related to the fact that the pharyngeal flap procedure is designed essentially to alter velopharyngeal incompetence per se. Hence, only those speech deviations (specifically, excess nasality and nasal emission) which are associated with velopharyngeal dysfunction would be affected by surgical correction or modification of the palatal incompetence. Other factors which influence intelligibility would continue to be operative after the surgery, irrespective of whether the procedure was a high attached or low attached flap. Such conditions include: the concomitance of delayed patterns of development in articulation, observed particularly in younger children; distortions in articulation associated with dental abnormalities; and dysarthric components resulting from disturbances in neuromuscular coordinations in those patients with borderline neurologic involvement.

#### Summary

The speech results of the high attached versus the low attached pharyngeal flap procedure were studied in 77 patients with velopharyngeal incompetence associated with a cleft palate condition or with no overt cleft. Speech was evaluated in terms of reduction of nasality and improvement in intelligibility. Comparison of the patients with the high attached flap and those with the low attached flap demonstrated a significantly higher incidence of nasality reduction in the group with the high attachment. However, with respect to speech intelligibility. there was not a significant difference between the two groups.

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## References

- 1. BLACKFIELD, H. M., J. Q. OWSLEY, E. R. MILLER, and LUCIE I. LAWSON, Cinefluorographic analysis of the surgical treatment of cleft palate speech. Plastic reconstr. Surg., 31, 542–553, 1963.
- 2. BLACKFIELD, H. M., J. Q. OWSLEY, E. R. MILLER, and LUCIE I. LAWSON, Cinefluorographic studies of palato-pharyngeal anatomy and function. Proceedings of the Third International Congress of Plastic Surgery, 66, 209. Amsterdam: Excerpta Medica Foundation, 1963.
- 3. CONWAY, H., and R. B. STARK, Pharyngeal flap procedure in management of complicated cases of cleft palate. Annals Surg., 142, 114, 1955. 4. MORRIS, H. L., and D. C. SPRIESTERSBACH, The pharyngeal flap as a speech mecha-
- nism. Plastic reconstr. Surg., 39, 66-70, 1967.
- 5. OWSLEY, J. Q., LUCIE I. LAWSON, E. R. MILLER, and H. M. BLACKFIELD, Experience with the high attached pharyngeal flap. Plastic reconstr. Surg., 38, 232-242, 1966.
- 6. OWSLEY, J. Q., G. CHIERICI, E. R. MILLER, LUCIE I. LAWSON, and H. M. BLACKFIELD, Cephalometric evaluation of palatal dysfunction in patients without cleft palate. Plastic reconstr. Surg., 39, 562-568, 1967.
- 7. Skoog, T., The pharyngeal flap operation in cleft palate: a clinical study of eightytwo cases. Brit. J. plastic Surg., 18, 265, 1965.