MID-FACIAL CONTOUR IN PATIENTS WITH CLEFT LIP AND CLEFT PALATE

Robert F. Hagerty, M.D., and Milton J. Hill, M.S.

Cleft Lip and Cleft Palate Center and the Division of Plastic Surgery, Medical College of South Carolina

THE PEDIATRICIAN with the responsibility for directing the care of a child with a cleft lip and cleft palate is confronted by conflicting points of view in the literature, especially in regard to the effects of palatal surgery on facial growth and contour. For many years the majority of plastic surgeons have recommended repair of the cleft lip in the first few months of life for both functional and cosmetic reasons. The repair of the palate is usually carried out during the latter part of the second year of life to obtain optimal speech and to prevent reflux of food into the nasal fossae and internal auditory meati.

In recent years a sharp attack has been made on the results of cleft palate surgery in regard to the ensuing high incidence of facial disfigurement. These criticisms arise, for the most part, from a group in the Chicago area trained in cephalometric techniques. Their work has been characterized by the presentation of studies of patients with cleft palate exhibiting postoperative deformities and whose facial and dental defects they attributed to “early and traumatic” surgery of the palate. This disfigurement is said to result either directly from operative interference with the maxillary growth centers, or indirectly from postoperative cicatricial contracture. Examples of this point of view are seen in the following quotations from Graber:

“What may be a beautiful surgical success at 2 years of age, may be a facial deformity at 20. A nice soft tissue closure of a palate that has been relieved of tensional stress through fracture of the hamular processes and incisions of the posterior pillars, and has been well sutured in the middle, may end up at 20 as a flat, fibrous, functionless scarified diaphragm that has been successful only in its steel-like grip on futilely struggling maxillary growth centers.”

“Cleft palate individuals as a group show deficient patterns of maxillary growth, laterally, anteroposteriorly, and vertically. Early and traumatic surgery results in the greatest deformity.”

“Refinements in surgical procedures and advances in asepsis have only served to amplify the shortcomings of cleft palate correction.”

“And more specifically of interest to us, can orthodontics be expected to recover the mistakes of nature, upon which have been superimposed severe man-made limitations, where surgical interference with growth centers and a dense unyielding band of fibrous scar tissue make any hope of normal development a dubious one?”

Since the type of cleft palate surgery under study was not stated, many readers have interpreted these very serious criticisms as applying to conventional repair of cleft palate. These criticisms reached such a point that national periodicals in 1951, 1953, and 1954 stressed ideas of the detrimental effects of surgery, advising postponement until the fourth or fifth year of life. Because of the “disservice of surgical intervention,” prostheses were suggested as the better means of rehabilitation for the individual with cleft palate. Two unfortunate consequences have resulted: 1) Conventional cleft palate surgery is presented as a “mutilating” procedure, and 2) palatal surgery has been postponed in many cases, resulting in less than optimal speech for the patient.

Since almost all surgery for cleft palate repair is early if one considers that facial...
growth progresses for the first 19 years of life19—and all surgery is traumatic if one considers the damage done to the divided cells—it would appear that ascribing poor results of palatal surgery to "early and traumatic" surgery has so little specificity that it is all but meaningless. The face grows so rapidly in the first few years of life that if surgery has any deleterious effect on growth, that effect would be most marked if the surgery were performed prior to the age of 3. In any study of this sort, one must at least state the type of surgery that was carried out, the age at operation, and their relation to facial growth. In addition, postoperative and unoperated groups of the major classes of palatal clefts should be studied individually.

In a recent report from Graber,17 a member of the Chicago group opposing "early and traumatic" palatal surgery, there has been some attempt to conform to this standard in regard to stating the age at operation. Over one-third of the postoperative patients studied were reported to have had palatal surgery within the first 6 months of life. The most serious facial deformities were found in these cases. It is obvious that the surgical techniques of Brophy are heavily represented in these studies. Brophy's conception of the cleft palate is as follows:

"The deformity, the statements of many authors to the contrary notwithstanding, is not the result of congenital deficiencies of the parts in question, nor arrested growth of the palate. All children who have congenital cleft palate, with rare exceptions, have in the palate at birth the normal amount of tissue. The palatal plates, however, are misplaced upwards and ununited in the middle line. The palate is cleft. Later in life the tissues may atrophy for want of use. Therefore, a cleft palate is a fissure, a non-union of well developed parts, not, with rare exceptions, the result of arrested development nor failure of a normal quantity of tissue to enter into its structure."18

Brophy's statements to the contrary notwithstanding, the modern view recognizes that the parts fail to grow to adequate size. Thus, fundamentals are involved, rather than an evaluation of the relative merits of surgical techniques. He recommended compression of the dental arch in the first few months of life, and the wiring together of the two palatal halves over lead plates.19

Brophy was a most industrious worker in the Chicago area during the first part of this century and, for a time, had many able and sincere followers, such as Logan,20 Blair,21 and Ulrich.22

It is not surprising that these cases operated upon by the Brophy technique have now grown to maturity and represent a significant percentage of the postoperative cleft-palate and cleft-lip population in the Chicago area. It cannot be classed as a major medical breakthrough, however, that cephalometric studies of these cases reveal an unusual degree of facial disfigurement. It must be borne in mind that over one-quarter of a century ago this was pointed out with great clarity by Federspiel,23 Kirkham,24 Rayner,25 and a host of others, resulting in the abandonment of this procedure a generation ago.

Other groups studying the problem of facial growth, using the cephalometric technique in postoperative cases of cleft palate, have failed to find the exaggerated differences from the normal as reported in the Chicago area. In reports of studies elsewhere26-28 and in our own study, the operative procedure is described, the age at operation stated, and the cases grouped in accordance with the major classifications of the original defect.

Moore and Ponterio26 presented 41 postoperative cases of cleft palate in a study of such precision and thoroughness that it can well serve as a model for all such future work. A soft-tissue surgical technique of the Langenbeck type was used in all cases by the chief surgeon or members of his staff. The initial palatal surgery was carried out, for the most part, during the first 2 years of life. Comparisons were made of the major groups of cleft palatal defects with normals in regard to facial growth, and the linear and angular measurements statistically analyzed. These authors concluded
that there was a favorable trend in regard to normality among these children, and that the anteroposterior and vertical growth of the maxilla were essentially the same as seen in the control group.

Jolley's reported his findings in the cephalometric examination of 94 postoperative cases of cleft palate. The types of surgical technique under study were: 1) the Langenbeck, 2) the Veau, and 3) the Wardill procedures, all of a soft-tissue type. The major classes of original cleft-palate defect were compared individually. Those operated upon under 2 years of age showed no more restriction of growth than did those operated upon between 3 and 5 years of age. As a result of his studies, the author recommended palatal repair at 18 months of age, using the simplest operation possible.

MacCollum reviewed postoperative results in 112 patients whose cleft palates had been surgically repaired by the use of a soft-tissue technique carried out primarily during the first 2 years of life. All of these operative procedures were done by a single surgeon. Analysis of the facial growth revealed no statistical differences between the cases under examination and a group of normals.

In addition, a preliminary report by Peer et al. outlined the results of cephalometric examination of 138 cases (94 bone-flap, 44 soft-tissue techniques), and reported no remarkable underdevelopment of the maxilla in the postoperative cases of cleft palate in either group.

SUBJECTS AND PROCEDURES

In the present study, a group of 99 subjects with cleft palate was compared with a group of 99 subjects with normal palates. The groups were equated as to age and race, but not sex.* There were no severe cranio-facial deviations other than cleft lip or cleft palate in either group.

The subjects with cleft palate in this study were the first 99 patients seen for complete evaluation at the Cleft Lip and Cleft Palate Center, Medical College Hospital, Charleston, South Carolina. These subjects came from throughout the state, and those who were postoperative had, for the most part, been operated upon by general surgeons in the State. The usual operative procedure had been a modified Langenbeck or soft-tissue technique.

In Table I is seen the distribution of cases according to the operative state and original defect, together with the mean ages of operative repair and mean ages of both the cleft-palate and normal groups at the time of examination for this investigation. Type I represents cleft of the soft palate, Type II cleft of the soft and hard palate, Type III cleft of the entire palate and alveolar ridge unilateral, and Type IV represents cleft of the entire palate and alveolar ridge bilateral. The age range of the unoperated, Type III group was 6.7 to 37.9 years. The age range of the corresponding normal group was 20.4 — 26.1 years.

<table>
<thead>
<tr>
<th>Type*</th>
<th>No. Cases</th>
<th>Mean Age at Time of Palatal Repair (mo)</th>
<th>Mean Age at Time of Lip Repair (mo)</th>
<th>Mean Age at Time of Examination (yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type I &amp; II, Unop.</td>
<td>12</td>
<td>20.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type I &amp; II, Postop.</td>
<td>24</td>
<td>73.5</td>
<td>14.3</td>
<td></td>
</tr>
<tr>
<td>Type III, Unop.</td>
<td>12</td>
<td>23.9</td>
<td>20.9</td>
<td></td>
</tr>
<tr>
<td>Normal Group</td>
<td>12</td>
<td>20.9</td>
<td>20.9</td>
<td></td>
</tr>
<tr>
<td>Type III, Postop.</td>
<td>36</td>
<td>22.2</td>
<td>14.5</td>
<td></td>
</tr>
<tr>
<td>Normal Group</td>
<td>36</td>
<td>14.5</td>
<td>14.5</td>
<td></td>
</tr>
<tr>
<td>Type IV, Unop.</td>
<td>5</td>
<td>4.7</td>
<td>23.2</td>
<td></td>
</tr>
<tr>
<td>Type IV, Postop.</td>
<td>10</td>
<td>26.1</td>
<td>2.1</td>
<td>12.3</td>
</tr>
</tbody>
</table>

* Type I represents cleft of the soft palate; Type II cleft of the soft and hard palate; Type III cleft of the entire palate and alveolar ridge unilateral; and Type IV cleft of entire palate and alveolar ridge, bilateral.
TABLE II
MEAN ANTEROPOSTERIOR AND LATERAL DIMENSIONS OF SKULL (IN CM)

<table>
<thead>
<tr>
<th></th>
<th>Type III Unop.</th>
<th>Type III Norm.</th>
<th>Type III Postop.</th>
<th>Type III Norm.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caliper measurements</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AP</td>
<td>19.04</td>
<td>19.38</td>
<td>19.23</td>
<td>19.46</td>
</tr>
<tr>
<td>Lat</td>
<td>15.80</td>
<td>15.85</td>
<td>16.20</td>
<td>15.98</td>
</tr>
</tbody>
</table>

Caliper measurements were obtained with standard x-ray calipers; film measurements from roentgenograms of the skull along supraorbital and nasion-sella planes.

RESULTS

The results of this study are shown in Table III in which the measurements and angles found in the Type III groups, both postoperative and unoperated, are recorded and comparisons made with normal groups matched as to age and race. All 12 of the unoperated cases of cleft palate had repaired complete unilateral cleft lips. Thirty-three of the 36 postoperative cases of cleft palate had repaired complete unilateral cleft lips, the remaining three had repaired unilateral incomplete clefts of the lip.
FIGS. 1, 2, 3. Diagrams showing derivation of linear and angular measurements.

FIG. 4. Diagram showing derivation of linear and cross-sectional measurements of lips.

postoperative group of cases of cleft palate as compared with the other two groups. Soft tissue studies of the lips (13 to 16 inclusive) show a lack of normal projection of the upper lip and a significant increase in the cross-sectional area of the lower lip only in the postoperative group of cases of cleft palate.

DISCUSSION

It is well known that many people having a cleft extending through the palate, alveo-
lar ridge and lip, have an abnormality of facial contour characterized by a depression or flattening of the mid-face. This has been ascribed by some to the injurious effect of palatal surgery on the growth of the maxilla. In this study no marked differences in bone growth were seen between the postoperative and unoperated cases of cleft palate (Figs. 5-7). The abnormality of facial contour which was seen, therefore, cannot be ascribed to a lack of maxillary growth resulting from conventional soft-tissue palatal surgery.

On the other hand, lingual version of the incisor teeth, both maxillary and mandibular, was a significant finding in the postoperative cases of cleft palate, but not in the unoperated cases. It is difficult to see how palatal surgery could be responsible for this result. If one considers the age at which the lips were repaired, however, an important factor comes to light. In the unoperated cases of cleft palate, the cleft lips were closed at a mean age of about 24 months. Apparently the same factors which were in force to prevent palatal surgery affected a delay in lip repair in these cases. As a result of this delay, the infants were appreciably larger, with a resultant simplification of the lip surgery for the surgeon. Perhaps other

### TABLE III

**Means of Linear and Angular Measurements of the Type III Unoperated and Postoperative Cleft-Palate Groups and Their Corresponding Normal Groups, with t Values of the Differences**

<table>
<thead>
<tr>
<th></th>
<th>Postop.</th>
<th>Normal</th>
<th>t</th>
<th>Unop.</th>
<th>Normal</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. PC to ANS</td>
<td>92.5 mm</td>
<td>97.2 mm</td>
<td>2.187*</td>
<td>92.6 mm</td>
<td>98.9 mm</td>
<td>1.418</td>
</tr>
<tr>
<td>2. Ptm to ANS</td>
<td>34.5 mm</td>
<td>35.5 mm</td>
<td>0.413*</td>
<td>34.7 mm</td>
<td>38.3 mm</td>
<td>2.578*</td>
</tr>
<tr>
<td>3. % Ptm to ANS</td>
<td>56.76%</td>
<td>57.09%</td>
<td>0.456</td>
<td>56.90%</td>
<td>59.0%</td>
<td>2.109*</td>
</tr>
<tr>
<td>4. PC to Pg</td>
<td>116.8 mm</td>
<td>114.6 mm</td>
<td>0.669</td>
<td>117.9 mm</td>
<td>117.9 mm</td>
<td>0.96</td>
</tr>
<tr>
<td>5. ANS to N</td>
<td>34.7 mm</td>
<td>34.9 mm</td>
<td>0.113</td>
<td>35.9 mm</td>
<td>36.5 mm</td>
<td>0.322</td>
</tr>
<tr>
<td>6. Angle of convexity (NA-PgA)</td>
<td>1.23°</td>
<td>3.31°</td>
<td>1.108</td>
<td>4.13°</td>
<td>2.17°</td>
<td>0.714</td>
</tr>
<tr>
<td>7. Facial angle (NPg-FH)</td>
<td>79.47°</td>
<td>80.36°</td>
<td>0.854</td>
<td>80.3°</td>
<td>82.29°</td>
<td>0.986</td>
</tr>
<tr>
<td>8. Mandibular plane angle (FH-M)</td>
<td>35.8°</td>
<td>30.85°</td>
<td>3.363**</td>
<td>33.5°</td>
<td>26.96°</td>
<td>2.809*</td>
</tr>
<tr>
<td>9. Inter-incisal angle</td>
<td>140.15°</td>
<td>128.74°</td>
<td>3.619**</td>
<td>134.17°</td>
<td>132.92°</td>
<td>0.191</td>
</tr>
<tr>
<td>10. Max. inc.-FH plane angle</td>
<td>97.58°</td>
<td>105.42°</td>
<td>3.618**</td>
<td>101°</td>
<td>104.88°</td>
<td>0.961</td>
</tr>
<tr>
<td>11. Man. inc.-FH plane angle</td>
<td>58.09°</td>
<td>53.92°</td>
<td>2.235*</td>
<td>55.0°</td>
<td>57.42°</td>
<td>0.597</td>
</tr>
<tr>
<td>12. Man. inc.-man. plane angle</td>
<td>84.7°</td>
<td>95.0°</td>
<td>5.467**</td>
<td>91.04°</td>
<td>95.46°</td>
<td>1.181</td>
</tr>
<tr>
<td>13. Projection of upper lip</td>
<td>12.1 mm</td>
<td>15.8 mm</td>
<td>3.702**</td>
<td>12.6 mm</td>
<td>14.2 mm</td>
<td>0.867</td>
</tr>
<tr>
<td>14. Projection of lower lip</td>
<td>11.0 mm</td>
<td>9.2 mm</td>
<td>1.425</td>
<td>11.8 mm</td>
<td>10.1 mm</td>
<td>0.611</td>
</tr>
<tr>
<td>15. Cross-sectional area of upper lip</td>
<td>353.0 sq. mm</td>
<td>368.0 sq. mm</td>
<td>0.589</td>
<td>314.0 sq. mm</td>
<td>369.0 sq. mm</td>
<td>1.540</td>
</tr>
<tr>
<td>16. Cross-sectional area of lower lip</td>
<td>336.0 sq. mm</td>
<td>288.0 sq. mm</td>
<td>2.248*</td>
<td>290.0 sq. mm</td>
<td>284.0 sq. mm</td>
<td>0.213</td>
</tr>
</tbody>
</table>

* Denotes significance at 5% level.
** Denotes significance at 1% level.
Figs. 5, 6, 7. Superimposed profiles representing average measurements of the Type III group of postoperative cases of cleft palate, and the Type III group of unoperated cases of cleft palate, and their corresponding normal groups.
factors, such as the maturity of the dentition and the extent of the calcification of the maxilla at the time of lip surgery, also play a role in the eventual facial contour.

The postoperative cases of cleft palate had lip repair carried out at a mean age of 3 months. To effect a loose full lip in small infants of this age requires considerable surgical skill, coupled with a sound plan of plastic repair. Small technical errors, with failure to utilize all possible tissue, can lead to gross irregularities and a tight lip in ensuing years.

If it is true that the lingual version of the incisor teeth in these cases is a result of a tight postoperative cleft lip, then one would expect to see a protuberant lower lip. It appears to be a general finding in cases of this type that the tighter the upper lip the more protuberant and redundant the lower lip. As an indication of this, one can shorten his upper lip between his fingers and thereby produce an abnormal fullness and projection of the lower lip. Corrective surgery of a tight upper lip, by rotating a flap from the redundant lower lip (the Abbé-Estlander procedure), is frequently used to correct this anatomic phenomenon. The decreased anterior projection of the upper lip in the postoperative group most probably represents the lack of support provided by the lingually displaced maxillary incisor teeth, since the cross-sectional area of the lip is not reduced. An increased cross-sectional area of the lower lip is found in this group of cases only, and gives further substance to the argument that a tight upper lip contributes significantly to this deformity. The possibility that a tight upper lip may play a role in limiting anteroposterior growth of the maxilla must also be kept in mind, especially in view of the fact that in a recent study 18 Type III cases, almost entirely unoperated in regard to both lip and palate, were found to have no abnormalities of the angle of convexity or the facial angle.

CONCLUSION

In studies of facial contour one must consider all the elements concerned: the bony structures, the teeth and the overlying soft tissues. A severe deficiency in any one of these three elements, or partial deficiencies in two or more of them, can lead to obvious abnormalities of appearance. In this study, as in several others, the bony contribution to facial contour was not seen to be markedly deficient by conventional linear and angular measurements. The bone growth in the postoperative cases of cleft palate subjected to conventional soft-tissue palatal surgery did not differ significantly from that of the unoperated cases of cleft palate. There was some lag, however, in anteroposterior maxillary growth in both the postoperative and unoperated cases of cleft palate. This limitation was quite similar in the two groups and may represent an abnormality fundamental to the congenital defect or the compressive effect of tight lip surgery. If this is true, attention should be directed to that field where improvement in surgical technique will enhance facial contour, that is, to lip surgery. The recession of the mid-face seen in so many conventionally repaired clefts involving the entire palate, alveolar ridge and lip may be due, to some degree, to an inherent limitation of anteroposterior growth of the maxilla, which at the present time is not subject to correction. Surgery of the lip, however, is subject to improvement and plays a most important role in facial contour. A tight upper lip has a compressive effect on the growing maxillary teeth, producing lingual version by steady pressure. The upper lip, from lack of support, comes to lie in a posterior position, while the lower lip becomes rather full and redundant.

In recent years, important advances in lip surgery have been made. A full loose lip can be secured by the complete utilization of all tissues. The use of a palatal bar to prevent collapse of the dental arch at the time of lip closure is an important adjunct. In conventional surgery for the repair of cleft lip and palate, it is the surgery of the lip which should be given primary consideration to obtain the best possible facial contour.
SUMMARY

Ninety-nine cases of cleft palate were studied with conventional and soft tissue cephalometric roentgenograms. The Type III cases (clefts of the entire palate, alveolar ridge and lip) were studied in detail and statistically evaluated. No gross differences were seen in bony growth of the postoperative and unoperated cases of cleft palate of this group. In the postoperative cases of cleft palate, where the lips had been repaired at an average age of 3 months, there was a significant lingual version of the incisor teeth, posterior displacement of the upper lip, and exaggerated fullness of the lower lip. This was not seen in the unoperated cases of cleft palate, where the lips were closed at an average age of 2 years. These contoural abnormalities are believed to be related to a tight, early, lip closure and not to the effects of palatal surgery. In general, facial contour abnormalities in cases of cleft lip and cleft palate after conventional surgery are believed to be more the direct result of a tight lip following unsatisfactory surgical repair, resulting in a collapse of the supporting incisor teeth, than the result of interference with maxillary growth centers by palatal surgery. It is believed that surgical techniques developed in recent years will be most effective in helping to eliminate such results.

In view of the foregoing, it would appear that conventional palatal surgery can be carried out before the end of the second year of life without detriment to the facial contour, and with maximal opportunity for the development of good speech. It is most important to effect a loose lip-closure to obtain a more normal facial contour.

Acknowledgment

This work was carried out in close cooperation with Drs. Wendell L. Wylie and Clarence E. Calcote, to whom we are deeply indebted.

REFERENCES

# MID-FACIAL CONTOUR IN PATIENTS WITH CLEFT LIP AND CLEFT PALATE

Robert F. Hagerty and Milton J. Hill

*Pediatrics* 1960;26;387

<table>
<thead>
<tr>
<th>Updated Information &amp; Services</th>
<th>including high resolution figures, can be found at: <a href="http://pediatrics.aappublications.org/content/26/3/387">http://pediatrics.aappublications.org/content/26/3/387</a></th>
</tr>
</thead>
<tbody>
<tr>
<td>Permissions &amp; Licensing</td>
<td>Information about reproducing this article in parts (figures, tables) or in its entirety can be found online at: <a href="https://shop.aap.org/licensing-permissions/">https://shop.aap.org/licensing-permissions/</a></td>
</tr>
<tr>
<td>Reprints</td>
<td>Information about ordering reprints can be found online: <a href="http://classic.pediatrics.aappublications.org/content/reprints">http://classic.pediatrics.aappublications.org/content/reprints</a></td>
</tr>
</tbody>
</table>
MID-FACIAL CONTOUR IN PATIENTS WITH CLEFT LIP AND CLEFT PALATE
Robert F. Hagerty and Milton J. Hill
Pediatrics 1960;26;387

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://pediatrics.aappublications.org/content/26/3/387