Facial Clefts and Their Surgical Management In View of Recent Research †

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INTRODUCTION

Once in every 770 live births there appears an individual with a cleft (hare) lip, a cleft palate or some combination of cleft lip and palate. (13). Although not so considered in the past, these individuals are crippled children in the truest sense of the word and their care and rehabilitation constitutes a problem of major proportions.

It has been taught quite universally that it was necessary to correct cleft lip and palate defects by surgery at as early an age as the infant could tolerate the operation. The reasons given for such intervention have been (1) the desirability of separating the nose and mouth cavities in order that the child might develop normal breathing habits, (2) the prevention of the return of food through the nose and the promotion of easier feeding, (3) the establishment of normal physiological aeration of the nose in order to assure development and to minimize middle-ear infection and (4) improvement of the appearance of the face.

In a proportion of these cases, all or most of the objectives enumerated above have been attained at the time of the operation but there has been a discouragingly large number in which the result at puberty has been far from satisfactory, from either a cosmetic or a functional point of view.

In addition to being subjected to multiple operations for the purpose of keeping the defect closed, these growing individuals have suffered added handicaps in the form of speech inadequacies, various nasal, oral and pharyngeal disturbances, badly deranged teeth and physiognomies that became steadily more repulsive as they approached adulthood. As a result they had a tendency to exhibit striking similarities in their psychological responses and frequently came to be looked upon as maladjusted or even mentally deficient persons. Their demand for rehabilitation has brought a realization of the magnitude of the problem and this in turn has begun to bring under scrutiny the methods that have previously been employed in their management.

During the past twenty-five years a great deal of research has been directed toward the growing child and a considerable part of this work has concerned itself with head and face growth. The development of the cranium and face have been studied in large samples of various populations by the methods of physical anthropology. These have been largely of a cross sectional or averaging nature, controlled by the usual statistical measures (16). In a similar manner, the dentition has been studied by the measurement of plaster casts of the dental arches. More recently

The clinical data herein presented is based on records from the University of Wisconsin, School of Medicine, Madison, Wisconsin, and from the Division for Service to Crippled Children, State of Wisconsin.

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(1930) a method was developed which afforded a more exact means of appraising growth of the individual. This method was cephalometric roentgenology (1), which made possible the measurement of the growing head from x-ray films with all of the accuracy formerly possible only in direct bone measurements. The apparatus permitted an identical positioning of the same individual over any interval of time so that the serial roentgenograms were strictly comparable to each other.

The growth patterns of numbers of growing children from twenty minutes after birth until fifteen years have already been accumulated (3) and other series upon which observation were started at older ages extend to the twenty-fifth year (1). In addition to these studies of the average child, others have been directed at children with various congenital deformities of the cranium and face (4). Until recently these researches have been of only academic interest to the practitioners of medicine and dentistry.

The x-ray method referred to yields exact information on the direction and magnitude of growth but is of course inscrutable as to *where* such growth occurs. For a study of the *sites* of growth a different method has been necessary. It consists of feeding or injecting a vital stain for which only growing bone has an affinity and it has been applied to animals including the monkey, whose growth pattern is very similar to that of man (10, 11, 12, 14). From the findings derived from the employment of these two methods the knowledge of the mode of growth of the head has been quite completely worked out and can now be applied to clinical problems such as the one here considered.

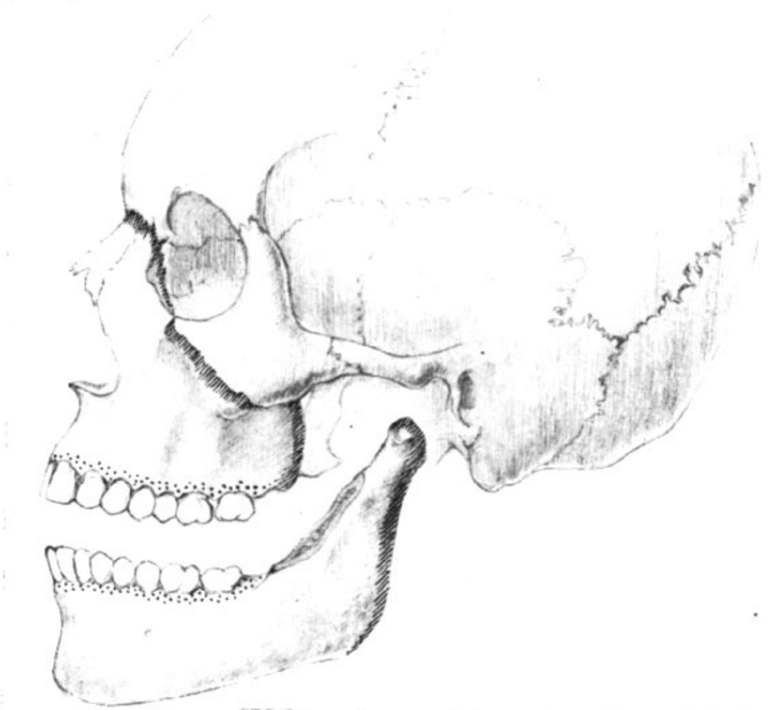
THE GROWTH OF THE HUMAN HEAD

The studies referred to in the introduction have yielded the following picture of the normal growth processes of the cranium and face.

The brain-case, after recovery from birth molding (within three days following normal delivery on the average) assumes its typal pattern. This is thought to be determined by the size and form of the brain. Extension of the margins of the vault-bones continues until the fontanelles are closed and the sutures are established. In the base of the cranium there are certain synchondroses (spheno-occipital, sphenoethmoidal, jugular, and others) which remain almost to adulthood and slowly increase the dimensions of this area by cartilage proliferation. Both sutures and cartilaginous junctions grow slowly postnatally, the cranium being relatively large at birth.

In the face itself there is generalized growth on almost all surfaces of all bones until about the fifth year. After this, surface growth tends to disappear or become so slight that it is not discernible by any method except microscopy. Certain specific sites of growth remain, however. These have been very active from the begining and they continue at a high rate of activity almost to the completion of growth. For the purposes of this paper only a few of the major sites will be considered, viz, the frontonasal suture, the zygomatico-maxillary suture, the pterygo-maxillary suture and the head of the mandibular condyle (6, 7, 8, 9, 15). It will be noted that all of these except the last constitute junctions made by the maxilla with various supporting bones. These are the sites at which a vital dye, such as Alizarine Red 'S', is always found in the experimental animal.

When the disposition of the dye at the above named sites is studied (Fig. 1), it is readily apparent that it is always located on the maxillary side of the suture, indicating that it is this bone that is responsible for most of the growth changes. Thus, upward growth occurs at the maxillo-frontal junction, backward growth at the pterygo-maxillary junction and upward and backward growth at the zygomatico-maxillary junction. Combined, these lead to a downward and forward positioning of the face.



*Diagramatic representation of sites of growth of the face. (Fronto Maxillary), Zygomatic-Maxillary, Pterygo-Maxillary, Posterior Surface and Condyle of Mandible.

FIG. 1. Growth Sites of the Face

The serial roentgenographic study of individuals during the growth period reveals that the contributions made by these sites are so harmoniously integrated that the total pattern remains remarkably stable from birth to adulthood. The floor of the nose, the occlusal level of the teeth, and the various frontal planes maintain parallelism as age progresses and the angular relations between them remain constant (3).

The mandible, although an independent bone, shows a similar orderliness in its growth and a similar integration with that of the middle face. Its most important growth center is the superior, posterior surface of the condylar process which, by cartilage proliferation similar to that of an epiphysis, causes a downward and forward positioning of the entire bone. Again, this growth is so integrated with that of the middle face that the lower mandibular border descends in a parallel manner and maintains a constant angular relation to stable planes of reference in the cranium. Thus the total face may be viewed as a mosaic, each part of which enlarges during growth in just the proper direction and amount to maintain the stability of the whole (2, 5, 15).

*From Lippincott Handbook of Dental Practise.

What is of equal if not greater interest to the clinician is the fact that congenital deformities behave in an identical manner. Longitudinal studies of children exhibiting such defects reveal the same tendency toward stability of the pattern. These aberrations have their inception during the early embryonic period of intra-uterine life and are probably of short duration. Once recovery has occurred, however, the various parts pursue their now relatively normal paths and grow at normal rates. The original distortion or disproportion remains but it becomes no worse unless a specific growth or adjustment site has been permanent.y affected. This is most readily demonstrated in cases where one of the synchondroses of the cranial base is obliterated or where the cartilage at the head of the mandibular condyle has been temporarily affected.

Only in the case of the mandibular condyle has it been possible to demonstrate experimentally the effects of interference with a specific growth site. The proliferative activity of this area is subject to damage by a variety of agents. Injury resulting from falls or blows, middle-ear infections, arthritis, surgery, or other traumatic agents all may be factors. The resulting deformity is most striking. Growth in the ramus of the mandible is arrested immediately and the bone can no longer keep pace with the development of the middle face. It falls steadily behind and develops a typical form that is characterized by a marked antegonial notch and a bending down of the body. The deformity is progressive until growth ceases.

A comparison of operated and non-operated patients with clefts of lip and palate points strongly to the possibility that something of a similar nature occurs in the maxillary area as result of surgical interference. The degree of the deformity seems to depend upon the extent of the surgery and the time at which it is performed. Such surgery involves one of the chief areas of growth and adjustment of the middle face and if it results in even a diminution of the circulation to the parts it imposes a handicap that will never be entirely overcome.

As has been pointed out, the tuberosity of the maxilla, growing backward against the pterygoid process, a fixed base, is the agent responsible for the forward development of the middle face. Postnatal growth at this site is in an amount equal to the anteroposterior dimensions of three molar teeth. An equal amount of growth occurs in the palate at the transverse suture. The rich blood supply necessary for this prolific growth is derived principally from the posterior palatine vessels. One has only to examine a few cases in which multiple operations have been performed in this area and note the dense, unyielding nature of the resulting scar to realize the insurmountable handicap that has been imposed by surgery.

What has been said thus far pertains to the cleft palate and it will be noted that growth arrests in the vicinity of the maxillary tuberosity, whether due to surgery or other causes, result in a failure of the middle face to move forward at the same rate as the rest of the face. In short, it amounts to a failure in positioning.

The cleft lip is a problem of a different sort. In this defect the continuity of the labial and buccal musculature is broken but since the principal attachment of the muscle mass is on the maxilla itself there is no effect on the positioning of the bone. These defects influence only form.

The dental arches and alveolar processes are normally molded around the tongue by the action of the buccinator and lip muscles and the interplay of forces between them determines their size and form. Any break in the restraining action of the lips or cheeks permits the tongue to expand the dental segments. Not infrequently a child born with a cleft lip will exhibit a maxillary arch sufficiently wide to fall completely outside that of the mandible. The chief objective of cleft lip surgery should be the establishment of normal relationships between the tongue and the lips in order that the dental and alveolar arches may be molded into their correct forms. To accomplish this, certain principles of development and growth must be kept in mind.

Embryological processes are strikingly similar regardless of the part or organ that is forming. First the anlage appears, composed largely of undifferentiated cells. Then histodifferentiation occurs with its cellular changes and this is followed by the delineation of form. Immediately thereafter growth or enlargement commences.

It should be remembered that all parts are not initiated simultaneously. In the head region the brain is the first part to be differentiated and it goes through its various stages and begins its growth before there is any indication of other parts. These appear one after the other and each goes through the various stages mentioned above. Thus there is overlapping of stages, one part beginning its growth before another has even been initiated. When an interruption occurs it affects all processes taking place at that instant.

In the case of the cleft lip the only failure may be that of nonunion between the globular process and the adjacent lateral nasal process and the cause might be operating for a very short period of time. Events occuring either before or after would not be affected and the globular process would be endowed with all of its normal potentialities, viz, the differentiation of teeth, muscle and epithelium. True, it would not have a normal appearance since it had not been influenced by the restraining forces of adjacent parts but it should be viewed as a part endowed with the potentialities of normal growth and normal form.

APPLICATION OF RESEARCH FINDINGS AND METHODS TO SURGERY OF THE CLEFT PALATE AND LIP

If conclusions based on the above investigations are valid they impose certain conditions on surgical procedures involved in cleft palate and cleft lip correction. They strongly suggest that there must be no unwarranted trauma to soft tissues and no interference with its blood supply. Any fracturing of bone or stripping of periosteum in the effort to gain approximation is to be avoided if permanent damage to growth sites is not to result.

For the past five years one of the authors has followed these precepts as closely as possible in the handling of a sample of 1349 cases and although no pretense is made that all problems have been solved the results are encouraging enough to warrant this report.

In order to follow the growth progress of the children involved in this study, cephalometric x-rays, head plates, plaster models and photos were the main methods of record. Cephalometric studies were made with the head oriented in such a position that the axial ray passed through the external auditory meati. Tracings were made of the films and certain anatomical points of reference were employed for the determination of planes and angles that were used in comparison with normal controls. Fig. 2

represents a tracing of a well developed facial skeleton of a 12 year old male and indicates some of the points, planes and angles employed in the study.

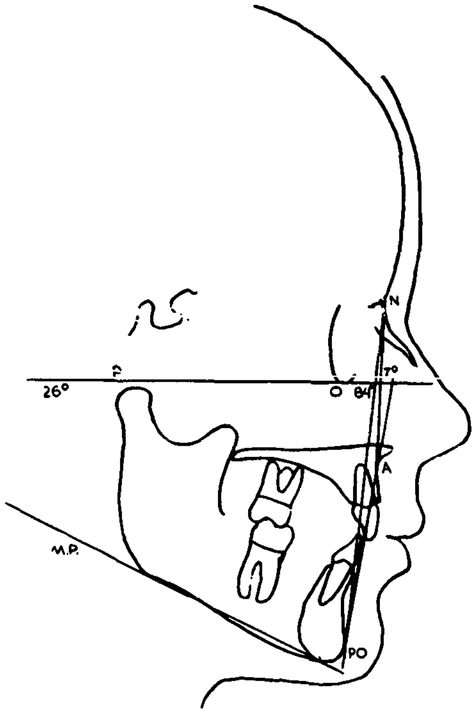


FIG. 2. Tracing of cephalometric study of a 12-year-old male whose general measurements are within normal limits. P. O. The Frankfort horizontal plane. N. Po. The facial plane. N. S. Po. The angle of convexity or concavity measured (+ or —) by its amount of deviation from the straight line N-Po. M. P. The mandibular plane angle.

The Frankfort horizontal plane (P — O) is one used generally by the physical anthropologist to relate cranial and facial structures. It represents a plane that travels through the two porion points and the lowest point of the rim of the left orbit. The facial plane (N — Po) is a frontal plane which travels through nasion and is tangent to the bony chin at pogonion. The angle made by this plane and the Frankfort horizontal is taken as a measure of the relation of face to cranium, i.e., whether retrusive or protrusive. The angle of convexity (N — A — Po) is constructed by connecting nasion and pogonion with A (the most recessive point below the anterior nasal spine). This angle is a measure of the degree of forward development of the maxillary base. M. P. (mandibular plane) is constructed as a tangent to the lower border of the mandible near the angle and at the cross-section of the symphysis. The mandibular plane angle is the angle formed by this plane with the Frankfort horizontal.

Figure 3 represents the tracing of a 19 year old male, born with a unilateral cleft of lip and palate. Closure of the lip had been done at 19 months of age and closure of the palate at 12 years of age. The soft tissue damage to the nose at the time of closure of the lip is evident in the tracing. Although the growth of the middle face has been retarded to only a moderate degree, the normal mandible appears protrusive by comparison. This results in the concavity in the facial angle that has often been de-

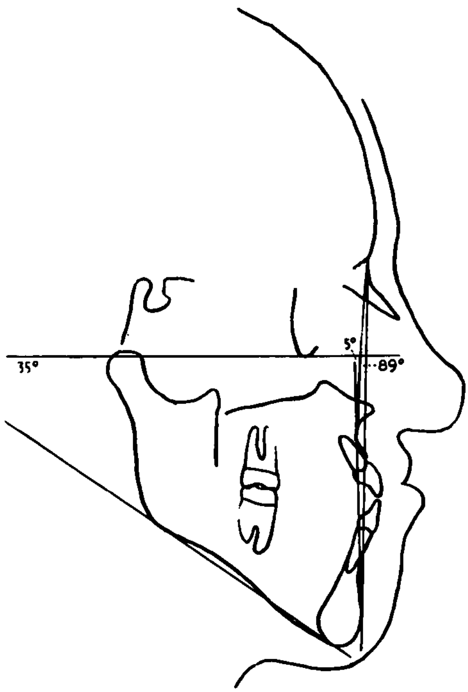


FIG. 3. This case represents the damage that can be done even when the patient is older. This 19-year-old boy had a unilateral cleft of lip and palate. The lip was closed at 19 months of age and the palate at 12 years of age. There is fairly normal bone growth but the extensive soft tissue damage is shown in the profile outline, particularly in the nose.

scribed as the classical facial expression of a person with a cleft of the lip and palate. It must be credited to the growth interference induced by too much or improperly timed surgery.

Figure 4 represents the tracing of an 11 year old boy whose palate was closed at 15 months and lip at two years. In this case there was an extreme mandibular growth arrest which tended to mask the maxillary arrest producing a fairly passable soft tissue profile. Overlying tissues soften the harsh bony angulation that would otherwise be evident with such an extreme mandibular plane angle.

The case presenting the greatest damage to growth centers ever encountered in our clinic is shown in Figure 5. This female, aged 23, was born with a unilateral cleft lip and palate. She was subjected to an op-

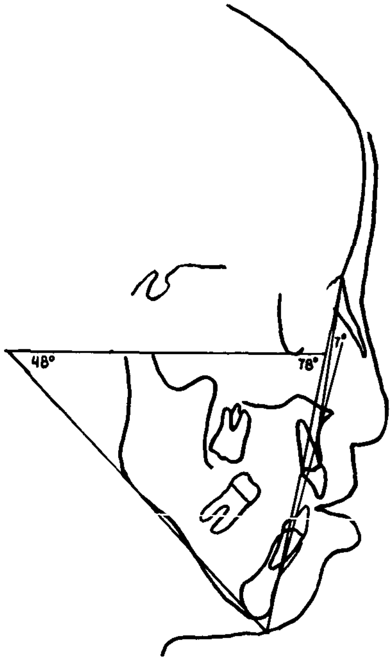


FIG. 4. Cephalometric tracing of 11-year-old boy indicating the changes that may be expected following surgery on the palate at 15 months and the lip at two years of age. In this case there was, in addition, a marked mandibular growth arrest. The combined deficiencies resulted in a fairly passable soft tissue profile.

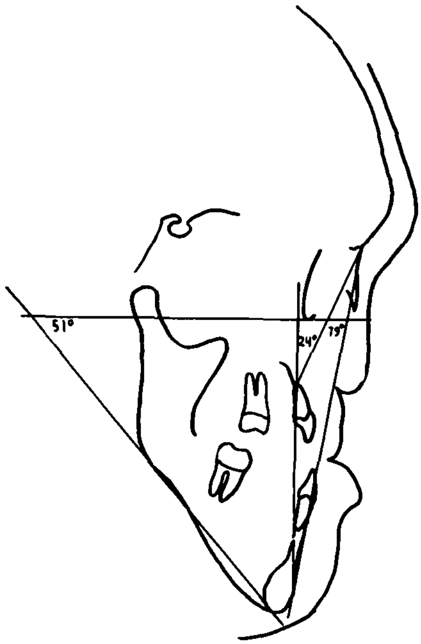


FIG. 5. Case presenting the greatest damage to growth centers of any case seen in our clinic. Patient is a 23-year-old female, born with a unilateral cleft of lip and palate. Surgery was undertaken each year for the first 14 years of her life. The result was described as satisfactory, by the operating surgeon, because the lip was intact and the palate closed.

The wide free-way space and the binding scar tissue masses limit the amount of reconstruction that can be done either by surgery or by means of a prosthetic appliance.

eration on either her lip or palate, or both, every year for the first 14 years of her life. Her surgeon described the final result as satisfactory because the lip was intact and the palate closed. But the patient has a very natural and strong desire to look "normal." Her wide free-way space limits the amount of building up that can be done with a prosthetic appliance. She exhibits phenomenal adaptation of the deformed structures

FIG. 6. Patient who had been operated for closure of a bilateral cleft of lip at an early age. The philtrum was used improperly to reduce the tension on the columella. The usual resulting tight lip is evident.

which enables her to speak well. The rehabilitation of this case will necessitate orthodontia, surgery and prosthetic restoration.

The next three cases are inserted here to indicate the measures that are necessary when the attempt is made at rehabilitation of individuals who have suffered growth arrests.

Figure 6 illustrates a patient who had been operated at an early age for closure of a bilateral cleft. The philtrum was used as a columella with the result that there was too much tissue in the inferior border of the nasal septum. The resulting tension inhibited the development of the maxilla and in order to give her a passable profile (Fig. 7) it was necessary to free the lip and insert a prosthetic appliance over her own teeth. This yielded the result shown in Figure 8.

FIG. 7. The anteroposterior dimension of the maxilla has been increased by placing a prosthesis over the existing dentition. Although a passable cosmetic result is obtained it is felt that the basic surgical principles were violated by too much surgery at too early an age resulting in retardation of growth throughout the middle third of the face.

In Figure 9 the tracings of a 16 year old male indicate the results of surgical closure of a unilateral cleft of the palate at 15 months of age and of the lip at 3 years. The benefits that could have been gained by first closing the lip and permitting it to act as a molding agent have been overlooked. This tracing was made after extensive orthodontic treatment and after the insertion of a prosthetic appliance designed to increase the anterior-posterior dimension of the maxilla. The tracings reveal that even with the central incisor of the appliance overriding the lower central incisors, the maxilla cannot be brought forward enough to give a good cosmetic result.

Figure 10 shows the tooth arrangement of an 18-year-old male who was born with a bilateral cleft of the lip and palate. An early repair was made of the lip only. The premaxilla with its contained four anterior teeth is completely free from attachment with the maxilla. Figure 11 shows the teeth of this same patient eighteen months later. The premaxilla and teeth have been repositioned solely by orthodontic methods. The left lateral

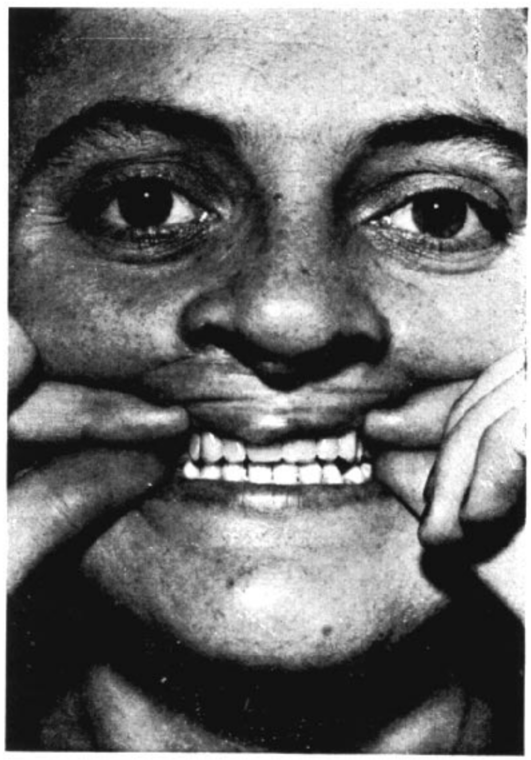


FIG. 8. The final result gained by surgical mobilization of the lip and the insertion of a prosthetic appliance over the natural denture.

incisor is attached to the permanent retaining appliance. The original tooth in this area was literal y moved out of its retaining bone by the orthodontic repositioning. An extra tooth on the right side between the cuspid and lateral incisor was placed to maintain contour and establish a continuous dental arch. This case shows a good cosmetic result coupled with good functional relationship between the upper and lower jaw with almost a complete natural complement of teeth. The premaxilla is still fréely movable. The point to be noted is that additional surgery might have given this patient a stable premaxilla but only at the expense of a failure of some development of the middle third of the face.

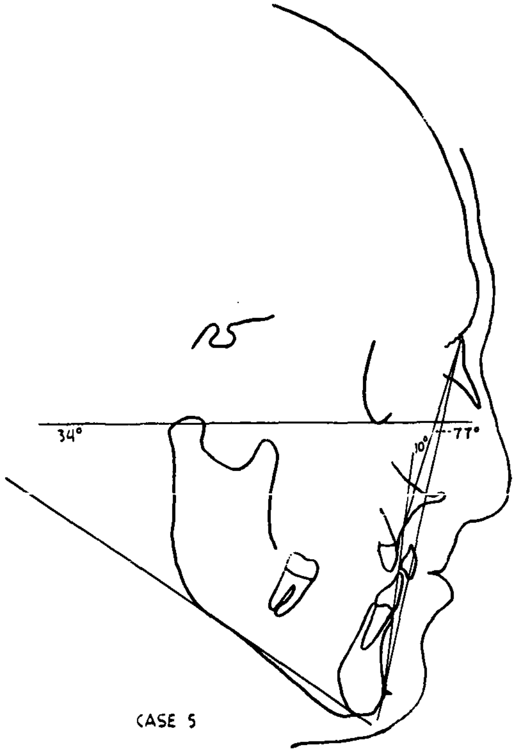


FIG. 9. The tracing of this 16-year-old male reveals the results of closure of a unilateral cleft of the palate at 15 months of age and the lip at 3 years of age. The benefits that could have been gained by closing the lip first and permitting it to act as a molding agent have been overlooked.

This tracing was made after extensive orthodontic treatment and after the insertion of a prosthetic appliance designed to increase the anteroposterior dimensions of the maxilla. The tracing shows that even with the central incisor of the prosthesis overriding the lower central incisors the desired facial configuration is not attained.

FIG. 10. Teeth of an 18-year-old male with repair of bilateral cleft of lip but no surgery of the alveolar ridge or palate. There is complete freedom of the premaxilla in this case.

FIG. 11. Same patient as that shown in Fig. 10, 18 months later. The premaxilla has been repositioned solely by orthodontic means. The lost teeth have been replaced on the combined permanent retainer and obturator. A highly satisfactory functional and cosmetic result has been obtained.

FIG. 12. Patient W. B. shows the marked changes in contour resulting from closure of a bilateral cleft in one stage. The cephalometric tracings of this patient show a normal configuration of the mandible with failure of growth of the maxilla, not only in its anteroposterior dimensions but in the vertical and transverse dimensions as well.

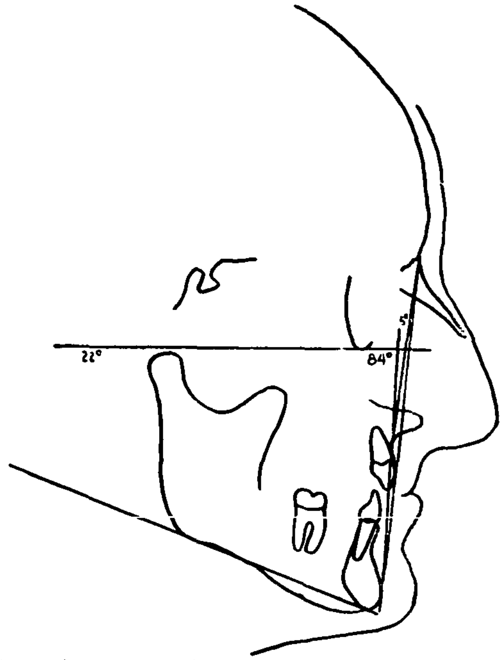


FIG. 13. Cephalometric tracings of a 19-year-old female showing the minimal growth interference following inadequate surgery for closure of a unilateral cleft of lip and palate. The palate and lip were operated upon when the patient was 16 months of age but the palate opened throughout its entire length shortly thereafter. The lip was closed by skin and mucous membrane only, there being no evidence of muscle across the cleft. It is assumed that the surgery was so inadequate that there was only slight interference with the maxilla as shown by the facial angle which is a —5°.

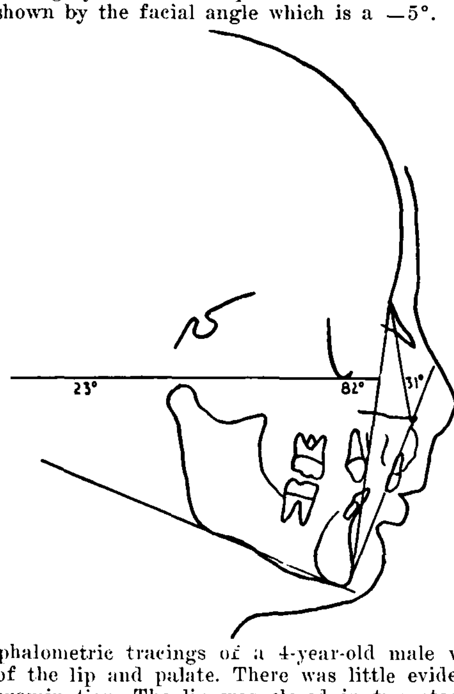


FIG. 14. The cephalometric tracings of a 4-year-old male who had an extremely wide bilateral cleft of the lip and palate. There was little evidence of a columella or philtrum on initial examination. The lip was closed in two stages and the palate by apposition of soft tissue flaps only.

This child now exhibits a growth pattern within normal limits except for the convexity of the facial angle due to a prominent and anteriorly displaced premaxilla. This case is shown to emphasize the fact that growth was not disturbed by the surgery. The anterior displacement of the premaxilla was corrected subsequently by orthodontia.

Figure 12 portrays the result of lip surgery alone. This individual was subjected to closure of a bilateral cleft lip in one stage. Cephalometric tracings revealed a mandible normal in form and size but a maxilla inhibited in its anteroposterior growth.

In contrast to the previous three cases Figure 13 represents the tracing of a 19-year-old female. She was born with a unilateral cleft of the lip

FIG. 15. Case B. K. at 2 weeks of age. The premaxilla is displaced anteriorly and to the left.

and palate both of which were repaired at 16 months. The lip was intact over the area of the cleft but the tissues were very thin because of inadequate apposition of muscle tissue. The palate showed little effect of the surgery except a scar along the edges of the cleft which was still open. There was some evidence of failure of growth in the region of the anterior maxillary spine but this was not marked. It was assumed that the surgery in this case had been so inadequate that it had not interfered with the subsequent growth of the maxilla itself nor with that of the overlying soft tissues.

The following three cases indicate the possibilities of long term results when conservative measures are employed in the surgical management of cleft lip.

FIG. 16. The left side of the defect closed first. After 4 months the left nostril is in fair position with the premaxilla approximating the maxillary ridge on the left side. The lip has actually forced the premaxilla further out of line on the right side.

Figure 14 shows the tracings of a 4-year-old male. This child had an extremely wide bilateral cleft of lip and palate. The lip was closed in two stages in order not to interfere with bone growth. At the time of the first operation there was little gross evidence of a philtrum or columella. The soft tissue closure in stages avoids much of the interference with bone growth. If the space between the cuspid and lateral incisors were closed, this child's general configuration could be within normal limits. However, if this space were to be forcefully closed, even at this late date, additional damage to growth centers would result. This space can easily be closed by orthodontic means, but even this must be carried out by one who is aware of the damage that can be done in this area by excessive orthodontic movement.

Fig. 17. At 3 years of age B. K. is seen to be developing a fairly normal facial pattern. Of particular interest is the good position of the nose with a fairly normal philtrum and columella. The premaxilla is still detached but the palate proper is closed.

Figure 15 shows the condition of patient B. K. when first seen at 2 weeks of age. The clefts were unusually wide and the premaxilla was markedly displaced anteriorly. The left side of the defect was closed first. Figure 16 shows the child 4 months later and it will be noted that the premaxilla was further out of position on the unoperated side than was the case originally. However, the floor of the nostril on the operated side is at approximately its normal level. The right side was operated and the cleft closed shortly after this photograph was taken. Figure 17 shows the patient at 3 years of age and it will be noted that the nose and lip are symmetrical and the facial pattern seems quite normal. The teeth in the premaxilla have erupted to a normal level, permitting functional occlusion with the mandible and although the premaxilla is still completely detached it is in good relation to the two maxillae.

At no time during the surgical procedure was bone cut, fractured, or "molded." The contouring was accomplished by the lip tension that was created. The soft tissues were handled with the greatest care. Skin hooks

FIG. 18. Demonstrating the use of "skin hooks" to retract tissue in the second stage repair of bilateral cleft of the lip. No clamps or ties are used that might interfere with subsequent blood supply and eventual bone growth.

(Fig. 18) were used rather than hemostats and no clamps of any type were employed that might damage the blood supply. The movement of the premaxilla was slow in this case but the distance it had to be moved was greater than usual.

In contrast to this is the case shown in Figure 19. This baby presented with a complete bilateral cleft of the lip and palate, with considerable tissue in the philtrum but with little demonstrable columella.

The total time elapsed between the photos represented in Figures 19 and 20 was 70 days. This child showed the fastest movement of the soft tissues and the premaxilla that has been seen in our clinic. The photo in

Figure 20 was taken two weeks after his second operation and already there had been much fading of the scar and improvement of the mucous membrane line.

This two-stage procedure demonstrates that closure can be effected without fracturing the maxilla or premaxilla and without "molding" or otherwise forcing tissue into position. The use of wires or retaining appliances cannot be condoned because their use violates anatomical and physiological principles.

FIG. 19. Infant D. G. 2 weeks of age with bilateral cleft of lip and palate.

DISCUSSION

The rehabilitation of the patient afflicted with cleft lip and/or cleft palate has, in the past, been too often the responsibility of individuals working independently. Thus the surgeon has considered his chief role to lie in the closure of the defect at as early a date as possible. The apposition of parts has been the end sought, even though it might necessitate repeated operations. He has been concerned primarily with the result at the time of operation and if the closure was maintained and an immediate satisfactory cosmetic result achieved he has considered his work ended.

As the child approached school age its speech deviations were apt to become noticeable and the services of a speech teacher would be sought. This individual usually attempted to adapt the speech mechanism to deformed anatomy but in a number of cases the deformity proved too great and an orthodontist would be called to attempt correction of the mouth parts. This worker found such cases all but hopeless and, after weary years of effort, would watch his result collapse almost over night unless

FIG. 20. Infant D. G. 70 days after photo shown in Fig. 19. This child's lip was closed in 2 stages. Photo taken 2 weeks after the second operation. The rapid movement of the premaxilla into a fairly normal position was unusually rapid as compared with other similar cases. The scar can be expected to improve. No "molding," fracturing or forcing of bone was done at any time.

some permanent form of retaining device were worn. The wearing of such a device usually meant a breaking down of the teeth at the areas of retention which in turn meant extensive and expensive restorative dental work. All else failing, the prosthodontist came into the picture to construct an appliance that would, in some small measure, compensate for the deficiencies of the previous types of management.

Our concept of cooperation of specialists is one embodying all the above services plus those of the anesthetist and pediatrician but all operating as a group, carrying out procedures only after all members of the team concerned with the child's welfare are aware of and approve of the steps to be taken.

There have been some noteworthy exceptions to this general pattern of disjointed services, incidents where surgeon and prosthodontist, surgeon and orthodontist have worked harmoniously together; but even under these conditions the successful end results have been discouragingly few. The patient, all too frequently, had need for psychiatric care before he reached adulthood because of his awareness of his glaring inadequacies.

Of recent date there have been signs of a dawning realization that better care could be given this type of patient under a system of inter-professional cooperation. Various centers have sprung up where the attempt has been made to bring the special skills of the several specialties together and focus them on the individual patient. In some cases the moving spirit has been the surgeon, in some the orthodontist, in some the prosthodontist and in some the speech therapist, but all have stressed the necessity of cooperation. This report is based on five years experience in such a center, one where all specialties contribute to the final result.

But the cooperative approach to the problem is not of itself the final answer although it is a long step forward. The most skillful application of present day methods, regardless of how administered, still leaves too much to be desired in the average final result. Methods of the future must be based on different concepts than those that have governed this work in the past. Procedures must rest on a more solid foundation than the subjective judgments of single clinicians. Only intensive research will indicate the nature of improvements to be made. Because of the nature of the problem it will be necessary to observe and interpret results over a period of years. Fortunately, a considerable amount of such research has already been done and waits only to be applied.

CONCLUSION

The evidence is already at hand that surgery can and does inhibit normal growth. This interference is directly proportional to the amount of injury to growth centers and to diminution of blood supply to the parts concerned. Other evidence is available to show that congenitally deformed parts, unless permanently damaged, grow at normal rates. These two findings alone should cause us to examine our concepts and procedures very carefully. Together they indicate that surgery poorly executed or poorly timed, can do more damage than good in the long run.

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