Orthodontic Treatment of Cleft Lip and Palate, Birth to Adulthood

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Introduction

For a long time the major goal in planning for the rehabilitation of an individual with a cleft of the lip and palate has been one of providing for the multiple needs of that individual so that he might mature into a well-adjusted, contributing member of society. This implies that the individual will be capable of pursuing his role in life in a socially acceptable manner, and that he will be successful in withstanding a variety of environmental pressures.

Success in personal adjustment is said to be largely dependent upon the development of social skills with which an individual is able to manage the intricacies of life. It seems that the emergence of such skills is not entirely dependent upon differences within the individual with a cleft of the lip and palate, but perhaps, more importantly, by the reaction of other people to his biologic difference. The behavior of other people during the formative years in the life of a cleft lip and palate child will frequently build up within him lasting individual attitudes and expectations. Self-evaluations, then, are influenced to a great degree by the child's evaluation of his own physical appearance and social adequacy as determined by the reaction of others to his appearance and by their reaction to his speech or communicative efforts. In other words, how he looks and how he talks will be two very important factors in terms of personality growth and development. Unfortunately, the child with a cleft lip and palate has a defect which can disturb appearance and speech communication because of its physical location, on the external aspect of the face and within the oral cavity.

The needs of any individual with a cleft lip and palate are fundamentally those of any "normal individual". Therefore, a transition toward normalcy, because it can tend to encourage the development of a "well-adjusted" cleft palate individual, is to be desired. This will largely be determined by how well specialistic therapy can fulfill the cosmetic and communicative needs of that individual. Orthodontists, in cooperation with other professional disciplines, have made and can continue to make major contributions toward fulfilling these needs in cleft palate individuals. To enumerate the contributions, one by one, would be meaningless and the importance of their application to the cleft palate problem would be lost. As maturity progresses, every individual with a cleft lip and palate develops new needs, new problems, and new relationships. Therefore, an attempt will be made to discuss the different contributions that can and have been made at different age levels in the chronologic development of a cleft lip and palate individual from birth to adulthood.

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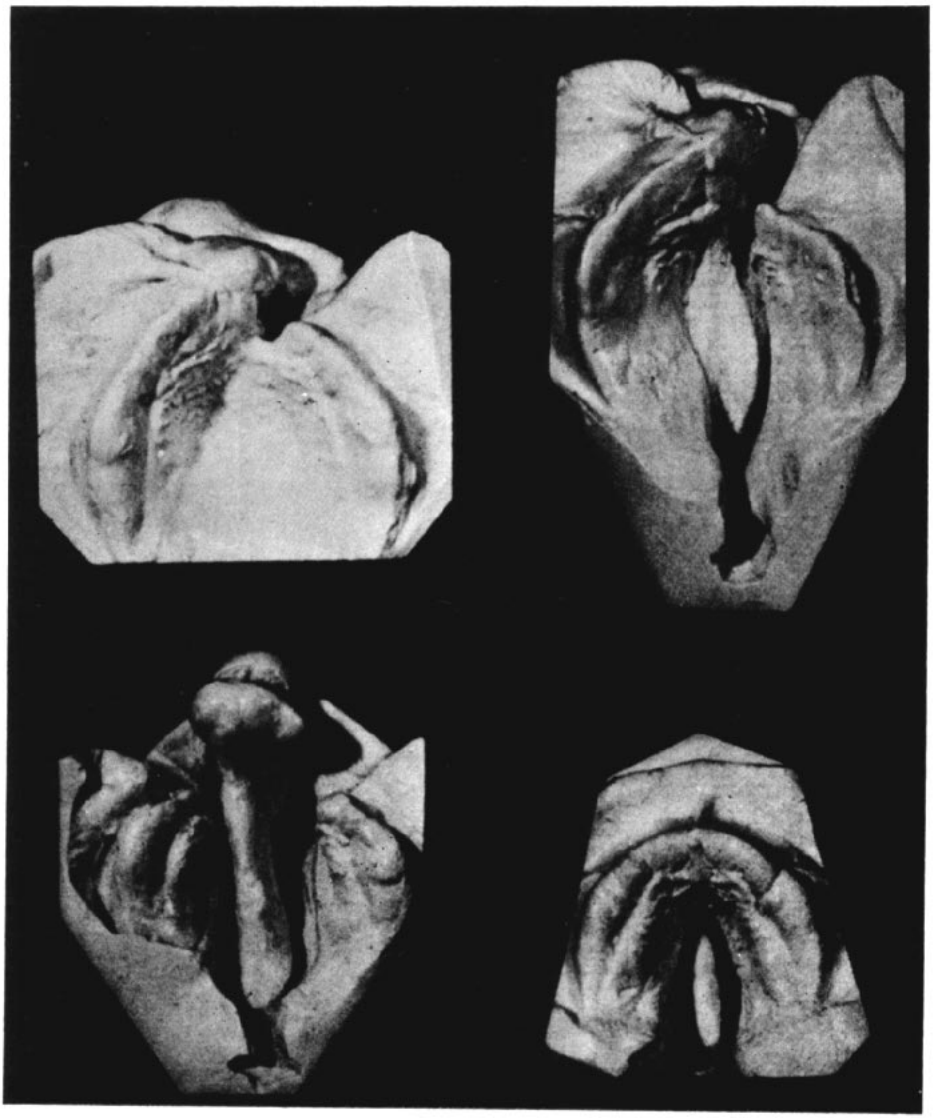

Fig. 1 Dental casts made from impressions of infants with clefts of the lip and palate taken at the Cleft Palate Center of the University of Illinois. Upper left: Cleft of the lip and alveolar process; no cleft of the palate. Upper right: Unilateral cleft of the lip and palate. Lower left: Bilateral cleft of the lip and palate. Lower right: Posterior cleft of the palate.

Contributions at the Neonatal Stage of Development

For a long time it has been known that people who are interested in the cleft palate problem must see the problem from the beginning, from the time of birth, in order to more fully understand it. Today, in many different areas of the world, controlled and reproducible records are being obtained on infants with clefts of the lip and/or palate as soon after birth as possible. These records consist of plaster cast reproductions made from impressions taken of

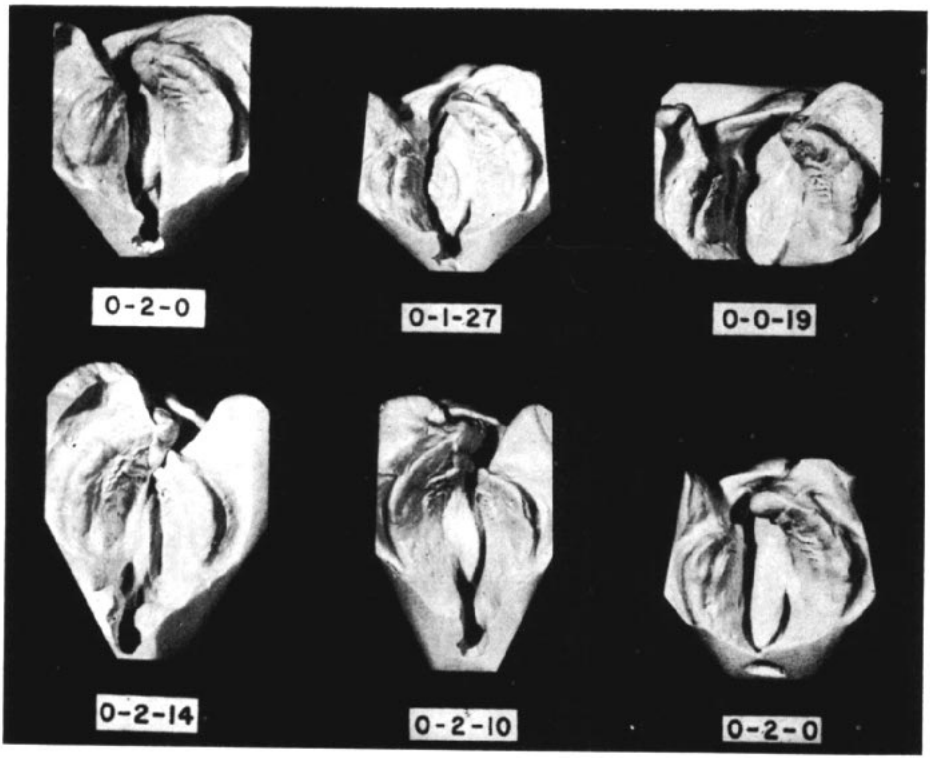

Fig. 2 Dental cast reproduction of different infants with unilateral clefts of the lip and palate. Variation in the width of the cleft and in the relationships of the divided parts is noted. (Courtesy of S. Pruzansky — The Cleft Palate Center, University of Illinois).

the face and jaws, as well as photographs and oriented x-rays of the structures of the head and neck.[1] Much information has already been accrued from these records. People who were interested in cleft palate soon came to realize that the morphology of cleft palate can differ dramatically from one individual to another. Variation was found to be the rule, rather than the exception. For example, one learned in accordance with an old sage expression, "never judge a book by its cover". In some instances a cleft of the lip was observed to exist with or without a corresponding cleft of the palate (Figure 1). In other instances clefts of the palate were observed to exist with or without a corresponding cleft of the lip. The concept of variation is being introduced to emphasize the need of evaluating specific morphologic and physiologic relationships in each individual with a cleft of the lip and/or palate. Many factors must be evaluated. As one examines many infants with clefts of the palate, differences in the widths of the clefts may be noted. Thus, in addition to the extensiveness of the cleft, in terms of the structures involved, there is variability in the width of the cleft. There are also concomitant differences in the relationships of the parts that border the cleft (Figure 2).

The question of whether there is a basic deficiency of tissue or a marked displacement of tissue in cleft palate individuals has also produced an answer involving individual variation.

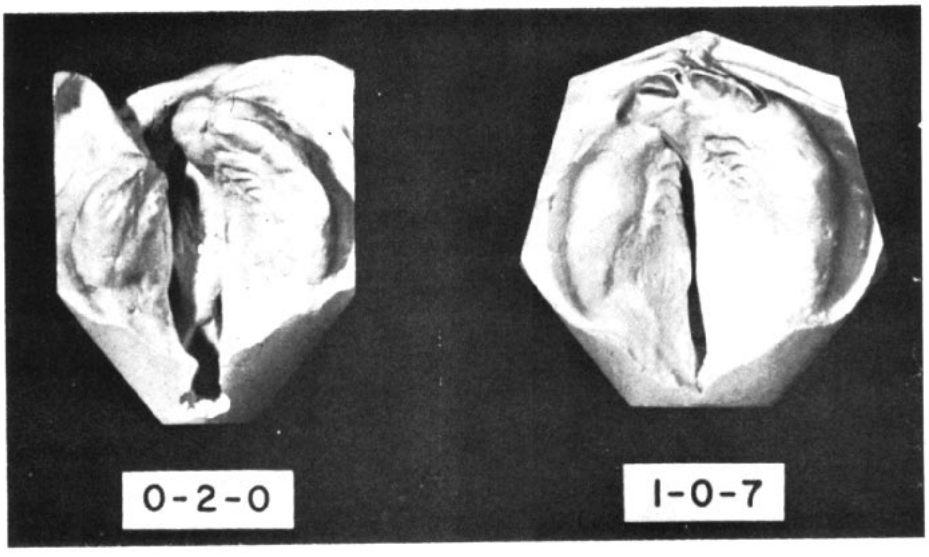

Fig. 3 Dental casts of the same child with a unilateral cleft of the lip and palate at two different ages, depicting a narrowing of the palatal cleft. Cast at two months of age — prior to lip surgery; cast at one year of age — subsequent to lip surgery and growth. (Courtesy of S. Pruzansky — The Cleft Palate Center of the University of Illinois).

For example, cephalometric laminagraphy was used to study one hundred twenty-seven cleft palate children in an attempt to determine whether there was a deficiency or displacement of tissue or both in cleft palate children.[2] The dimensions of the hard palate shelves were measured to determine the amount of bony tissues present and were compared with similar measurements in noncleft children. The distance between the lateral walls of the nasal cavity was also measured and compared with noncleft children to determine the possibility of maxillary jaw displacement. Deficiency of hard palate tissue was found to exist in all types of clefts involving the hard palate. The bilateral clefts were found to exhibit the greatest amount of tissue deficiency, whereas the unilateral clefts exhibited the least amount of palatal tissue deficiency. These observations were true on an average basis and it must be emphasized that some of the individual cases did not show any actual deficiency in palatal tissue. This serves, again, to emphasize the need of evaluating each case on an individual basis; it cannot be categorically stated that deficiency of tissue is the rule in each case. However, it can likewise be stated that one of the basic differences between *some* cleft palate children and noncleft palate children could be found in the quantity of hard palate tissue. A difference in the spatial position or in displacement of the hard palate tissue was also noted. Once again, in this study, the greatest displacement was found in the bilateral clefts. Thus, displacement of tissue as well as deficiency of tissue can and does exist in cleft palate subjects, although this is not true in all cases. Individual variation could be noted.

These records have obviously served to demonstrate the great variation encountered in the cleft palate problem, but their value far exceeds the demonstration of variation. They form a basis for observing and evaluating changes

occurring with time and growth as well as those incident to therapeutic procedures. They are not only valuable for diagnostic purposes, but also form a permanent record from which continued observations and evaluations can be made. For example, with continued increment in age, it became obvious that, in some cases with a cleft of the lip and palate, the cleft in the palatal region became narrower as the child grew older (Figure 3). Aside from growth itself, what factors are associated with the narrowing of a cleft? In some instances the surgical correction of the lip undoubtedly has been instrumental in accounting for some of the change. Surgical correction of the cleft lip frequently changes the relationship of the alveolar segments evident at birth. Upon healing, the reconstructed lip frequently creates pressures on the alveolar segments and usually initiates a molding influence. In some cases the molding action can bring about an approximation of the alveolar segments anteriorly and in other instances can be of sufficient strength to overrotate the maxillary alveolar segments medially (Figure 4). This narrowing movement in the anterior regions of the mouth frequently results in a concomitant narrowing of the palatal cleft in the more posterior regions of the mouth.

This sequence of events may also lead to a constricted maxillary arch in

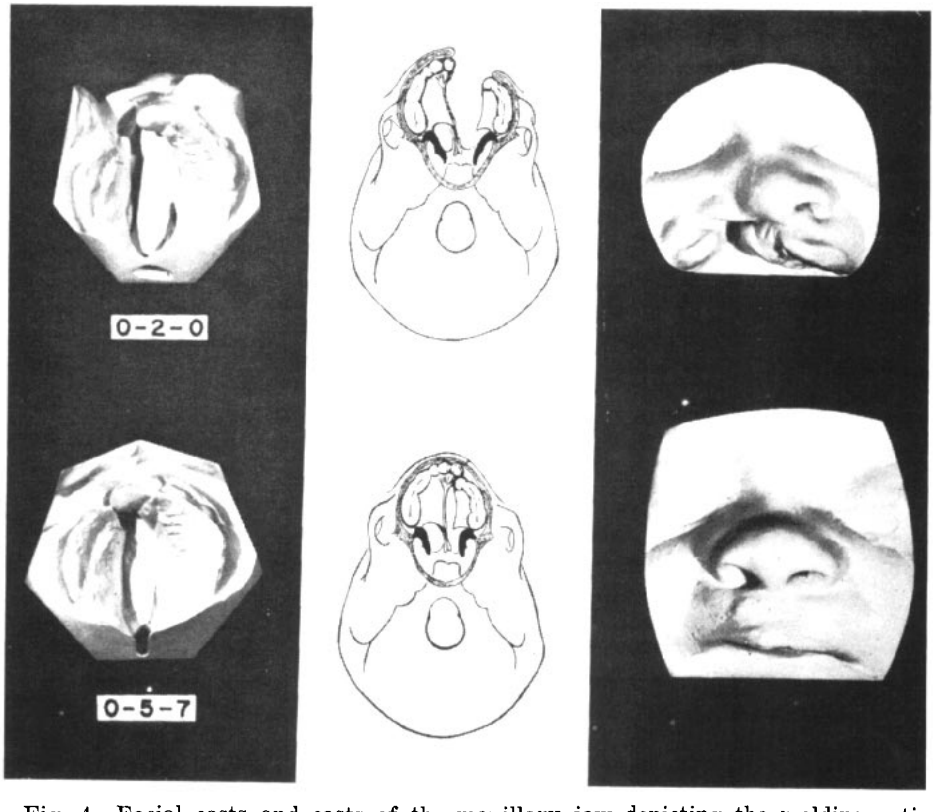

Fig. 4 Facial casts and casts of the maxillary jaw depicting the molding action of the lip. Approximation of the alveolar segments, anteriorly, is evident. Casts were obtained at the Cleft Palate Center of the University of Illinois. Center illustrations show the relationship of the surrounding musculature before and after lip surgery; the lip and cheek musculature continuing with the superior constrictor pharyngis muscle.

the child with a cleft of the lip and palate. As a result of lip surgery alone, the alveolar process of the smaller maxillary segment may have been moved by muscular forces into a lingual relationship with the corresponding aspect of the lower jaw. The molding action of the lip is not restricted to alveolar bone alone, but may cause an architectural rearrangement involving each part of the maxillary jaw bordering the cleft.[3] If one or both of the maxillary segments is overrotated medially, the displacement may result in an orthodontic problem in these children, a constricted maxillary arch. This frequently results in a crossbite malocclusion in one or both of the buccal segments of the dental arches.

Until recent years orthodontic correction in these cases was usually not undertaken until after the eruption of all of the deciduous teeth, at approximately three years of age or later. However, in recent years clinicians in some areas of Europe and, of late, clinicians in some areas of this country have come to believe that orthodontic correction should start shortly after birth.[4,5,6,7,8,9] Some of these people feel that a constriction of the maxillary jaw cannot be avoided after lip surgery. As a consequence, they recommend the repositioning of parts before lip surgery. It is felt that the parts bordering the cleft are easily moved shortly after birth. Technically, an impression is taken of the neonate and a plaster model is poured. The model is sectioned and the maxillary segments are repositioned to what is judged to be a more correct relationship. A simple appliance is constructed to the corrected position of segments. The appliance is worn by the neonate resulting in a molding of the alveolar process and a repositioning of the maxillary segments. Many times the divided parts are expanded into position. This procedure may have to be repeated several times before the orthopedic correction is completed, and may take from two to six months. It is at this time, subsequent to the orthopedic repositioning of the segments, that the cleft lip is surgically corrected. It is reasoned that presurgical orthopedics will facilitate lip surgery since parts are brought closer together. At the time of lip repair, bone is frequently grafted into the alveolar region. The bone graft is placed for many reasons which have been enumerated as follows: to help maintain the orthopedic repositioning of the maxillary jaw segments; to fill the defect which supposedly results from a bony deficiency in the alveolar region; to eliminate the necessity of a retention appliance to maintain the orthopedic correction, since the bony implant accomplishes a bony stabilization of the parts of the maxillary jaw in a cleft lip and palate infant; to insure good growth of the maxillary jaw; and finally to improve facial appearance by adding support to the reconstructed lip and to the floor of the nose.

It should not be assumed that all orthodontists consider this to be an advisable procedure to be routinely accepted and followed. There are several potential disadvantages to be considered. Presurgical orthopedics, of course, postpones the surgical correction of the cleft lip which can create obvious socioemotional problems and does not require further elaboration. Then again, the implant of bone is frequently based on the assumption that tissue deficiency is the rule in children with clefts of the lip and palate. As previously mentioned, variation is the rule. On the basis of well-documented studies it cannot be categorically assumed that all individuals with cleft lip and palate exhibit deficiency of tissue. Some individual cases, upon mensuration, do not show any deficiency at all. In fact, many of these cases had been found to exhibit an actual displacement

of the divided parts and this could easily present the most important consideration.

It has been noted that the surgical correction of a cleft lip usually initiates a molding action. It is important to emphasize that this molding action may create a constricted maxillary arch but, in so doing, there is frequently a concomitant narrowing of the palatal cleft (Figure 3). Each part of the divided maxillary jaw can be displaced toward each other resulting in a narrower palatal void or cleft. To my mind, this can have important implications when future palatal surgery is indicated. The cleft in the soft palate area can be reduced in width as well as the cleft in the hard palate area. The narrower the cleft, the smaller the dimension over which soft palate tissue must be manipulated to obliterate a void. It would seem that the narrower the void, the better the potential would be for a longer soft palate and possibly, a more functional soft palate. Under equally favorable circumstances it could easily be assumed that less tension should be evident in the case of manipulating soft palate tissue over a narrow void rather than a wider void. Presurgical orthopedic manipulation of the parts of the upper jaw could serve to initially widen the palatal cleft in both the hard and soft palate areas. The placement of a bony implant and/or a mechanical retentive appliance at the time of lip surgery may serve to prevent a narrowing of the palatal cleft as well as the maxillary arch. It is conceivable that this procedure may eventually complicate soft palate surgery, sometimes affecting its potential length and efficiency (Figure 5). This recent orthopedic procedure should be studied with accurate and adequate documentation and evaluated on a longitudinal basis. To accomplish this will take many years. At present, caution must and is to be desired in some of these

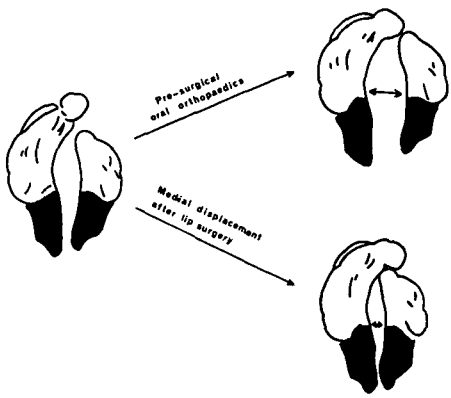

Fig. 5 Illustration of a complete unilateral cleft of the lip and palate indicating the possibility of widening the palatal cleft incident to presurgical orthopedics (upper right). Increase in width at the maxillary tuberosity region could increase the cleft in the soft palate (black) region as well. Molding action of the lip could decrease the palatal cleft (lower right) if no presurgical orthopedics is indicated.

clinical procedures until more information is forthcoming. In the meantime, we must rely on the documented information that has been provided over the past years. To quote an old adage, "One must not lose sight of the forest for the trees". A constricted dental arch may be undesirable, but an inadequate velopharyngeal mechanism and a poor speech result may be even more undesirable. The malocclusion, or the constricted maxillary arch, can usually be readily corrected at the proper time.

Furthermore, it has been recently demonstrated that variation is also the rule relative to the molding action of the lip. That is, there are different degrees of reaction to the constriction effects of the lip. Pruzansky and Aduss[10] examined 33 cases of complete unilateral cleft lip and palate on whom longitudinal records were available from infancy to the age of complete eruption of the deciduous dentition. Collapse of the maxillary arch was evident in only 40 per cent of the cases. In 11 of the 33 cases, no crossbite mal-

occlusion was evident; in an additional 8 cases, only the deciduous cuspid was found in a crossbite relationship. One case remained excessively wide and the remaining 13 cases had varying degrees of excessive crossbite malocclusions. Thus, only 13 out of 33 cases gave strong evidence of crossbite malocclusion attesting to the marked improvement of surgery today in comparison to yesteryears. To progress further, it has been shown that presurgical orthopedics and bone grafting do not necessarily prevent the development of a malocclusion. Some centers in Europe have reported that, whereas they were successful in placing a bone graft, they were not routinely successful in preventing an orthodontic collapse subsequent to palatal surgery. In one instance, at a center in Germany, an almost equal percentage of orthodontic collapse was noted in the cases which had undergone early orthopedic repositioning and bone grafting as did the cases with the more conventional approach.[11] In this center these statistics have caused them to discontinue this procedure. In another instance, at a center in Sweden, results indicated that a bone graft will not necessarily maintain an orthopedic result and eliminate the need for retention. The group reported a high percentage of orthodontic collapse, as represented by a crossbite in the deciduous dentition, of the cases which had been subjected to the bone grafting procedure. The collapse was particularly noticeable after palatal surgery. Their feeling seemed to be that the placement of a retention appliance is indicated prior to palatal surgery to prevent the resultant orthodontic problem which was noted in well over fifty per cent of their subjects.[12] These reports point out the strong need to study this presurgical oral orthopedic procedure on a longitudinal basis with accurate and adequate documentation. These subjects will, of necessity, have to be evaluated over a great number of years, from infancy to adulthood, before final and definite judgments concerning this procedure can be made. Unfortunately, in problems and procedures related to cleft palate, the proof of adequacy or desirability is never in the early ages, but must await the critical examination of late adolescence or early adulthood.

Procedures Following Eruption of Deciduous Teeth

In this country many orthodontists have recommended early orthodontic correction for the child with a congenital cleft of the lip and palate.[13,14,15] In most instances treatment would be initiated after the eruption of the deciduous dentition, at approximately three years of age. As has been previously mentioned, the surgically reconstructed lip exerts pressures on the bony segments of the maxilla and initiates a molding action. The forces exerted by the musculature may displace one or both of the maxillary segments medially which can create a distorted and constricted maxillary alveolar arch (Figure 6). A continued influence of these forces and an additional constrictive influence of palatal surgery may lead to the development of a crossbite malocclusion in the deciduous dentition (Figure 7). Knowledge of the evolution of the constricted maxillary arch indicates that the initial phase of orthodontic correction in cleft lip and palate cases should be directed toward counteracting any adverse muscular forces. The alveolar segments must be orthodontically repositioned in order to establish a more normal maxillary arch form (Figure 8). Orthodontic forces must expand the maxillary dental arch and its supporting bone.

It has been substantiated that orthodontic forces applied in some children with a cleft of the lip and palate may actually move the unfused segments of

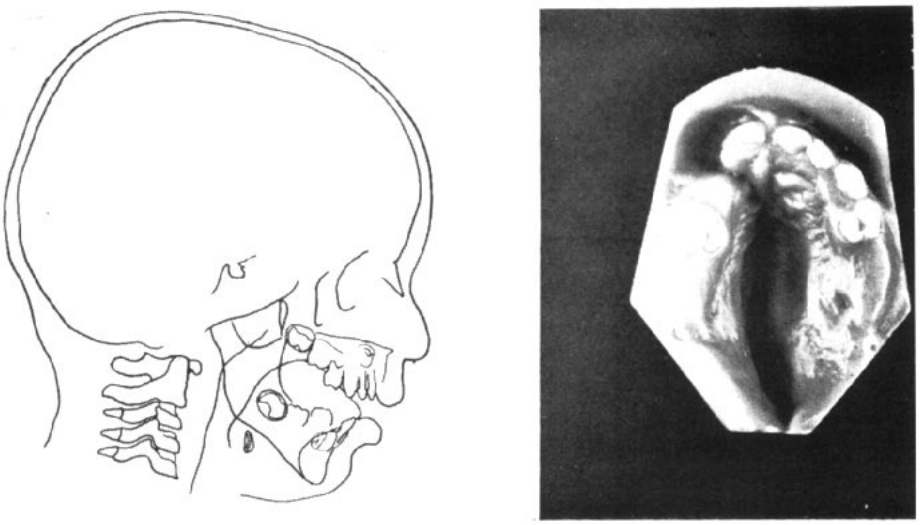

Fig. 6 Cephalometric tracing and maxillary dental cast of a one year-nine month child with a unilateral cleft of the lip and palate. The lip has been surgically repaired; at this early stage of development a constriction of the maxillary arch is evident. This case will be followed, with changes incident to growth and treatment, in succeeding figures, 7 to 11.

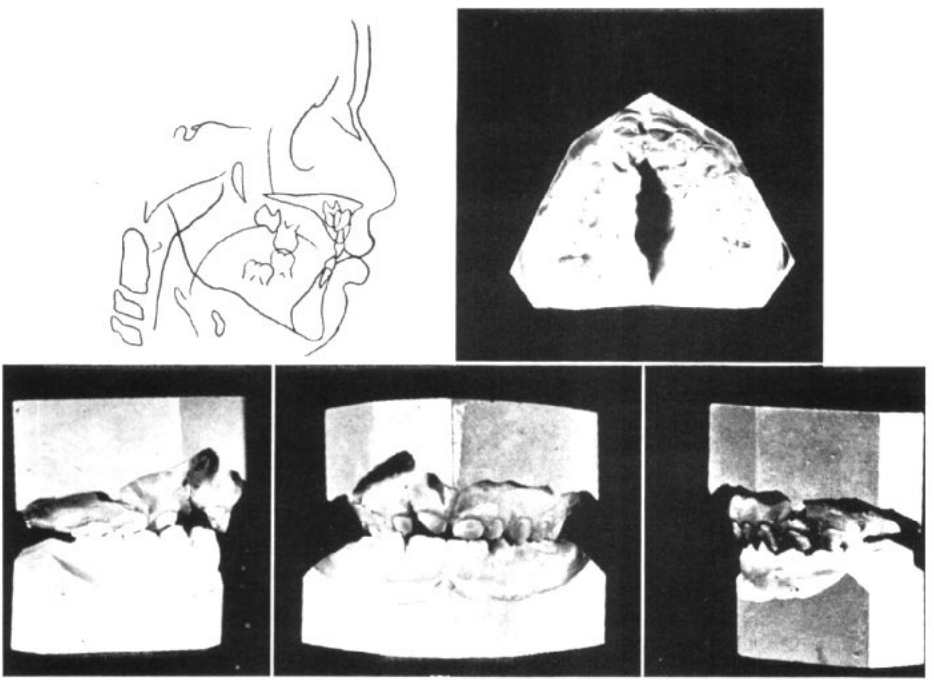

Fig. 7 The same individual (Figure 6) after the full eruption of the deciduous dentition at four years of age. A crossbite malocclusion in the right buccal segment region is evident.

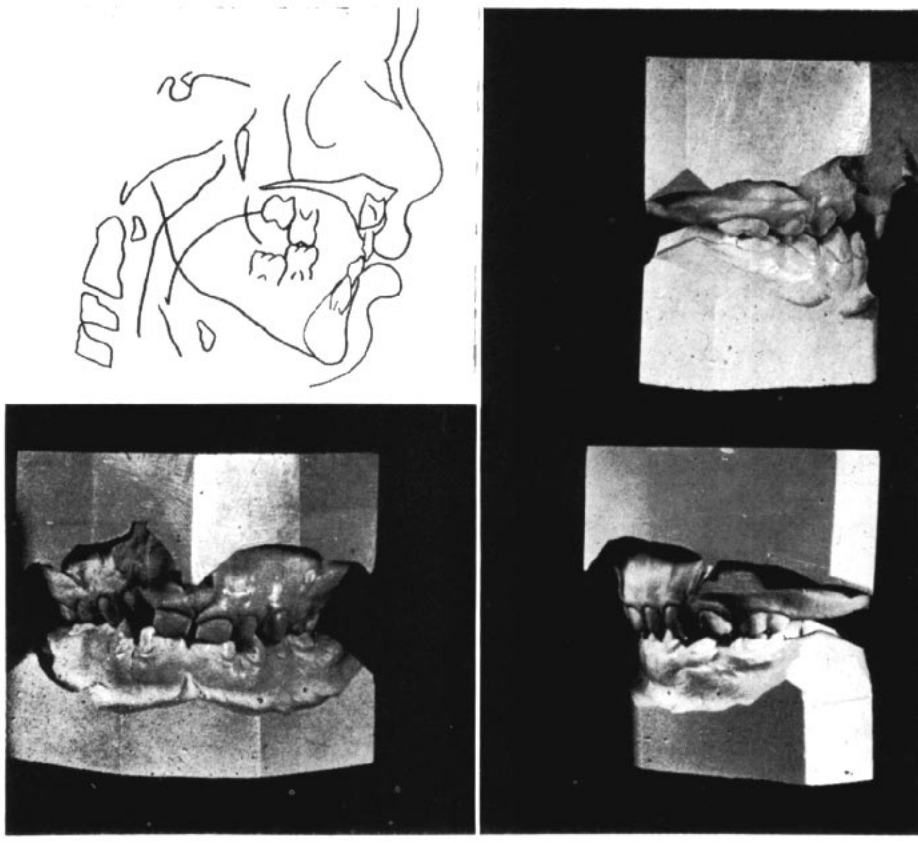

Fig. 8 The same individual after the correction of the crossbite malocclusion in the deciduous dentition. An Arnold expander was used in the maxillary arch to correct the position of the right buccal segment.

the maxillary jaw. By reconstructing the oral architecture and placing the segments in their proper locations the orthodontist can provide the potential for more normal alveolar growth. If the construction has resulted in the containment of one alveolar segment within another, the alveolar process may not be able to develop fully and optimally, since one alveolar segment is buttressed against another. The overlap may serve to mechanically impede growth and an accompanying sacrifice of alveolar growth may result. It is important, therefore, that these segments be unlocked during the early stages of development when growth is most rapid. Advantage may then be taken of the greatest possible growth potential, from as early an age as possible. This provision for a fuller expression of growth may also improve the potential for a more harmonious facial appearance. Repositioning of the alveolar segment may serve to create a more normal foundation for the support of the surgically reconstructed lip. A fuller expression of alveolar growth should provide a better support for the upper lip and help reduce any tendency for a depression in the middle third of the face. In addition, if orthodontics is done at an early age, the maxillary architecture may be brought closer to the normal at a time when basic speech habits are being rapidly established.

This may be of considerable value in speech learning since it may reduce or minimize the development of the common misarticulations of a cleft palate child frequently evident at a later age. It can be assumed that the earlier the oral mechanism has achieved its potential for normalcy, the sooner the general tongue activity may more closely approximate normal function during speech. Compensatory adjustments of the tongue, dictated by narrow, abnormal oral configurations may be avoided. It should be pointed out that there is clinical and research evidence that compensatory adjustments can be developed by cleft palate children in their efforts to produce intelligible speech when a disproportionately sized palate and a distorted roof of the oral cavity exists.[16]

It must be emphasized that early orthodontic treatment in children with cleft lip and palate is a philosophy that is strongly approved. The question really revolves around "how early"? For the reasons enumerated, oral orthopedics will usually be initiated after the eruption of the deciduous teeth which is usually a considerable period of time after palatal surgery rather than during the early months of life prior to lip surgery. The question is not "can presurgical orthopedics be done?", for unquestionably it can be done. The question is "is it advisable to do it routinely"?

At this point it may be wise to emphasize that other members of the dental specialties play very important roles. Orthodontic correction and the repositioning of the displaced parts of the maxillary jaw are dependent upon the presence of the deciduous teeth. These teeth serve for the support of the orthodontic appliance. Therefore, dental care of the deciduous teeth is imperative. At this age, as well as at later ages, natural teeth must be maintained in a healthy state. Loss of maxillary teeth through caries may delay orthodontic treatment or lead to a less favorable prognosis. In these children teeth are frequently malposed and not in position for ready and easy cleansing. Therefore, an early and regimented program of dental care is often a prerequisite for successful therapy. The dentition must be in good health, not only to permit the application of orthodontic forces, but also to permit the placement and prolonged use of a retention appliance. Once the maxillary segments have been adjusted into position, retention is necessary to maintain them in the desired position. This is especially true since it is virtually impossible to stabilize the adverse muscle influences exerted by the lip. Failure to retain the expansion will permit a rapid return of the bony segments to the initial constricted configuration. These retention appliances may serve other useful purposes. If openings remain in the hard palate region, the retention appliance can adequately cover and obturate these openings. It is also of considerable value as a space-maintaining appliance during the time when deciduous teeth are lost and are being replaced by the permanent dentition.

Time of Transitional Dentition

By initiating orthodontic treatment at an early age and establishing an acceptable occlusion of the deciduous dentition, it is feasible to assume that the permanent teeth will erupt in a more favorable position. However, orthodontic repositioning of segments in the deciduous dentition does not necessarily eliminate the need for orthodontics at later stages of development. The permanent anterior teeth, especially those closely bordering the cleft in the region of the alveolar process, will usually erupt in a malposition and frequently in a severely rotated and poor-

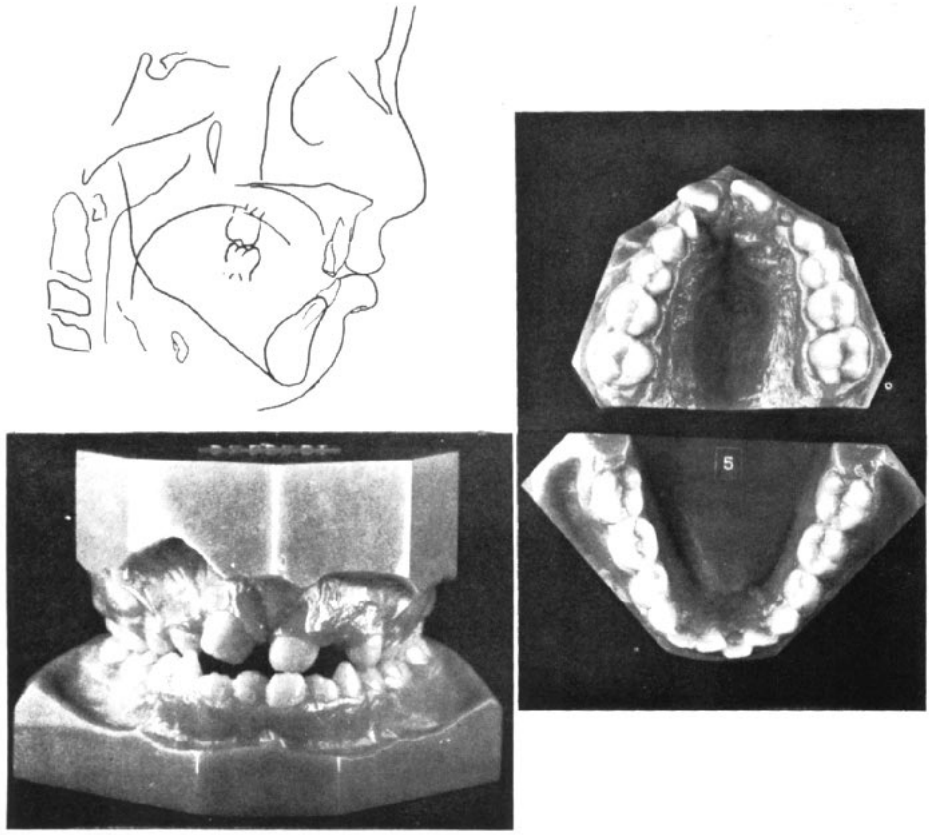

Fig. 9 Cephalometric tracing and dental casts of the same individual at seven years, eleven months of age. As can be noted, irregularities associated with the eruption of the permanent incisors are present.

ly inclined relationship (Figure 9). Thus additional orthodontic treatment during the time of transitional dentition is usually necessary even after early orthodontic expansion has been accomplished subsequent to the eruption of the deciduous teeth. In order to extend as many assets as possible to the speech development of cleft-palate children, including those related to tongue-tip contact, it is considered advisable to undertake the correction of such malalignments shortly after the eruption of these teeth. Chronologically, this may be approximately seven to nine years of age or older. Of course, the positioning of these permanent incisors can and is readily accomplished by the orthodontist (Figure 10). Banding and the use of archwires seems to be the best approach in correcting the malpositioned incisor teeth. In addition to advantages to be accrued relative to tongue-tip contact, there are other advantages to be gained by early correction of the maxillary anterior teeth. These alignments are easily accomplished shortly after eruption and are more easily retained and maintained subsequent to early correction. Furthermore, the adverse influences of rotated and malpositioned maxillary teeth on the mandibular anterior teeth are eliminated. This, in itself, could be of considerable benefit to the developing occlusion. During this peri-

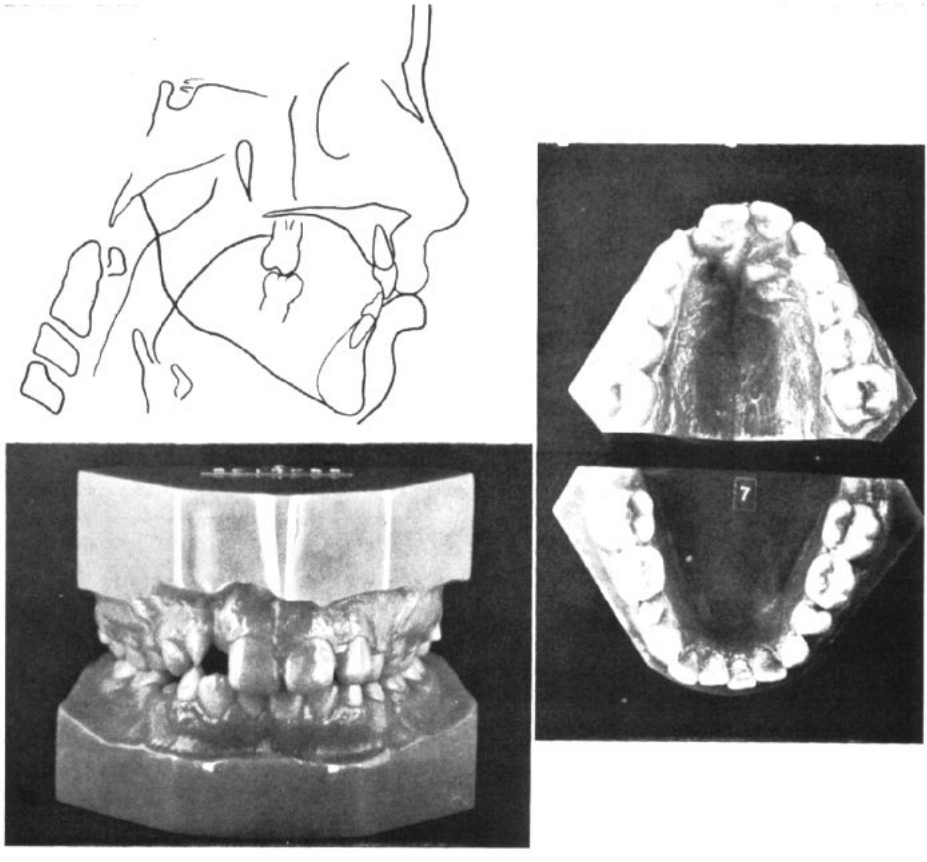

Fig. 10 Cephalometric tracing and dental casts after correction of the discrepancies in the incisor region.

od it is frequently necessary to accept certain limitations in treatment. For example, midline relationships are a fairly consistent problem and it is sometimes impossible to attain a correct midline relationship. Because of the cleft it may not be possible to move the adjacent central incisor in a lateral direction or root structure may be exposed as it approaches the cleft. The proximity of the alveolar cleft may preclude the attainment of an excellent maxillary midline relationship with the corresponding mandibular midline.

At times maxillary incisor teeth are lingually locked as they relate to the mandibular incisors. In these instances an acrylic inclined plane, cemented to the mandibular anterior teeth, may be a welcome auxiliary to the bands and archwires. In attempting to move the maxillary incisor teeth into a proper overjet relationship with the use of archwires, the establishment of proper anchorage is advisable. Not infrequently, in attempting to move the incisors labially, the maxillary molars can be observed to move excessively distally. It is assumed that the resistance of the surgically-repaired maxillary lip reduces the facility of labial movement of the maxillary anterior teeth.If this occurs the maxillary molars can subsequently be brought mesially into a more desirable position. However, it may be desirable to prevent this distal movement. At

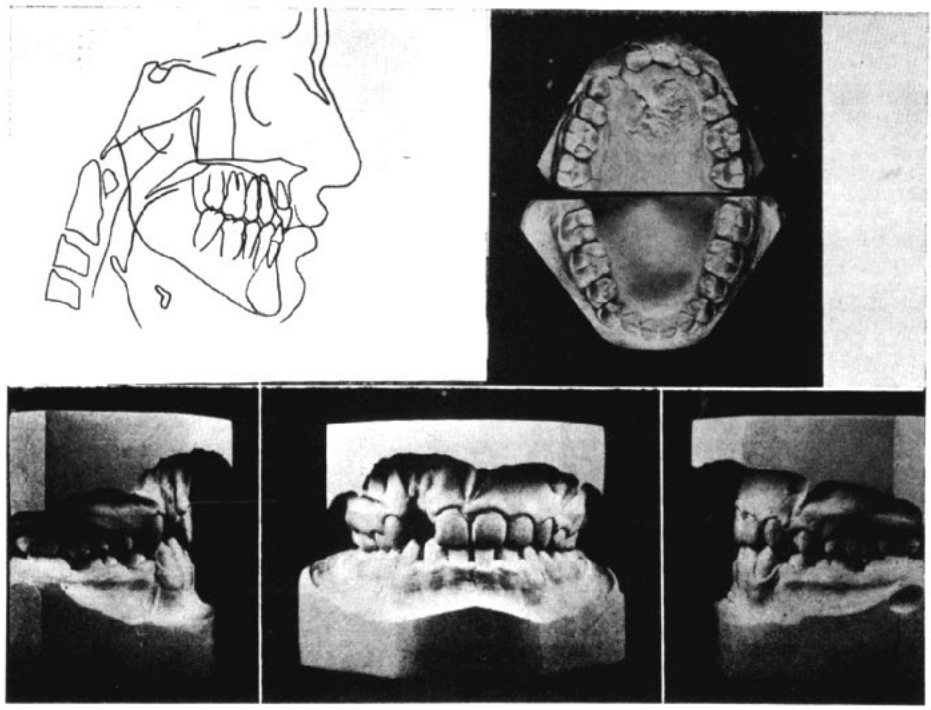

Fig. 11 Cephalometric tracing and dental casts of the same individual at sixteen years, six months of age, subsequent to extraction of four permanent bicuspids and full alignment of the dental arches. A retention appliance is replacing the missing lateral incisor; subsequently a fixed bridge will serve as permanent retention.

such times second deciduous molars may be used for anchorage or suitable anchorage appliances may be used. A maxillary bite plate may be helpful, especially in cases with some mandibular prognathism and/or cases with some problem in vertical development of the maxillary jaw. The maxillary bite plate will move the mandible in a downward and backward direction, to a degree, resulting in a slight reduction in the mandibular prognathism. Once the incisors and the molar teeth are properly positioned, a renewed period of retention is undertaken. Once again, this will turn out to be a prolonged period of continuous retention.

Procedures During the Adolescent Stages of Development

Close observation of individuals with clefts must be maintained until, and after, all of the permanent teeth have erupted. This, of course, will include all of the ages younger than the category of adulthood. By late adolescence the final orthodontic positioning of all the permanent teeth should have been accomplished (Figure 11). Whereas at an early age this positioning usually involved considerable bony segmental movement, at the later stages this usually involves individual tooth movement. At the time of eruption of permanent teeth it may be necessary to recommend the extraction of teeth in order to achieve a stable occlusion as well as an acceptable facial appearance. This may be particularly true in those instances where some underdevelopment of the maxilla relative to the mandibular jaw may exist. During the adolescent stages

of development it may be advisable to extract mandibular premolars so that an adequate overbite and overjet relationship of the anterior teeth could be attained. This may be necessary even in good mandibular arches where all of the mandibular dentition could be adequately accommodated. Such a procedure, although necessary, could lead to a potential disadvantage. The mandibular anterior dentoalveolar region could become more lingually disposed on the mandibular jaw than is usual, leading to slightly more facial concavity in the region of the lips than seems desirable. However, extraction may still be a necessary and important procedure. Some facial concavity is to be preferred to a staggered or protruded position of the lower lip which would be evident if the mandibular incisors were anterior to the maxillary incisors. This is further emphasized by the realization that extractions may be necessary in the maxillary arch since the bony segments may not be adequate to accommodate all of the maxillary permanent teeth. In these instances, whenever possible, maxillary second bicuspids are extracted to help minimize any distal positioning of the maxillary anterior teeth.

It is subsequent to orthodontic treatment, at a late stage of development during adolescence, that a bony implant into the anterior maxillary alveolar process may be advisable and desirable. It may help to stabilize the segments of the maxillary arch and maintain the results of final orthodontic positioning. Furthermore, secondary bone grafting procedures at later stages of development could be of great importance to facial appearance. It is at the adolescent stage of development that depressions at the level of the floor of the nose seem to become clearly evident and depressions in the lip seem to become pronounced. Cosmetically these depressions may be eliminated with the use of a bony implant, since the bony structure would add support to the floor of the nose and to the lip. It could also be pointed out that this bony support could be supplied at a rather propitious time since the cleft lip and palate individual may be approaching the chronologic, the physiologic and the emotional age when final revisions of the lip and nose could and should be undertaken surgically.

Adolescence is a transitional stage in emotional development; one that is difficult to deal with, and yet one that is extremely important to cope with effectively. This seems to be an age where a need to conform and to be just like all other adolescents is evident. Self image and self evaluation are very important at this age. With this as the focus of attention, some highlights from a recent study could be briefly, and perhaps profitably reviewed.[17] It was a study designed to evaluate the impact of a handicap on the personality of a near-adolescent individual. Two groups of children, ten and eleven years of age were studied; one group was handicapped and the other was not. Some very significant findings seemed to emerge from this study as they expressed their own feelings and preferences. From the verbal expressions of these children a very definite pattern of feelings seemed to evolve. A marked uniformity became apparent in the preference order for different disabilities as expressed by both the handicapped and the nonhandicapped children. Of course, the nonhandicapped child was ranked highest in preference order; the child with a leg brace and crutches was ranked second in order of preference; the child in a wheel chair was ranked third; the child with a congenitally missing left hand was ranked fourth and the child with a slight facial disfigurement was ranked fifth or next to last in preference, followed only by obesity. In other words, the ortho-

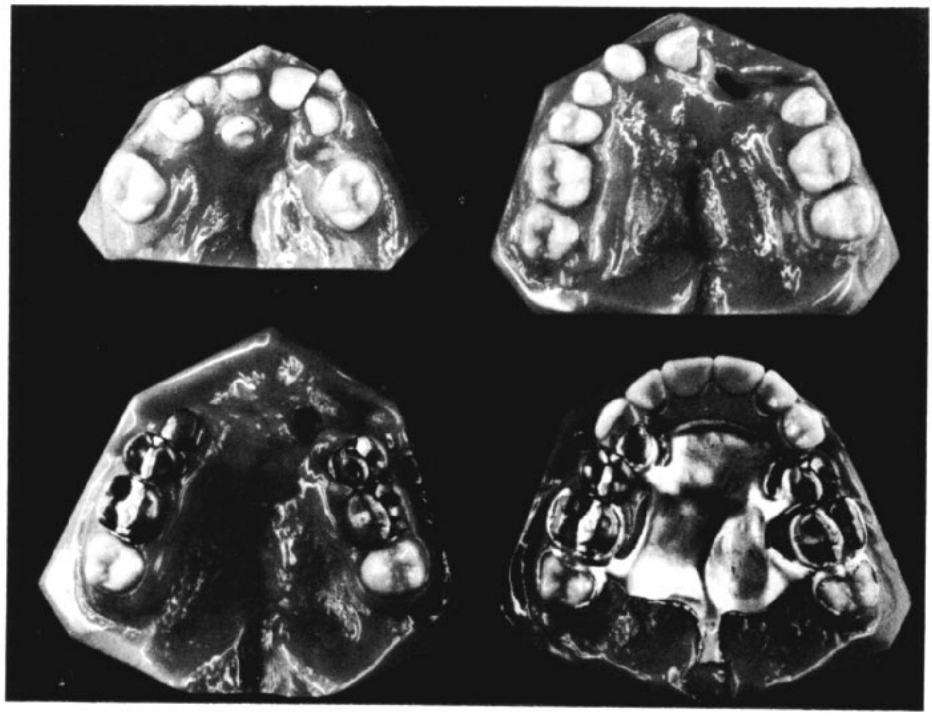

Fig. 12 A partial denture serving as a final, permanent retentive appliance. The partial denture replaces missing dental structures and serves as a foundation for the upper lip. Casts indicate the relationship of maxillary dental units before and after orthodontic treatment. Maxillary anterior teeth were extracted since it was impossible to attain a proper overjet, overbite relationship. Crowns were prepared prior to construction of the prosthetic appliance.

pedically handicapped child in a wheel chair had a great *functional* disability yet all of the children preferred a severe functional handicap to a difference in facial appearance. The impact of facial disfigurement was just as difficult to accept for the child who had the disfigurement as it was for the child who had none. The implication to be derived from this study is one which does not allow us to depreciate the value of cosmetic revision to the adolescent. In fact, procedures for improvement in appearance might well be encouraged in many preadolescents and adolescents. The potential impact on psychosocial health should be thoughtfully considered.

During the late stages of adolescence some form of permanent retention must be placed to maintain the orthodontic result and, usually, to replace missing dental units in the area of the cleft. This may take the form of a fixed bridge which serves as a splint and replaces missing dental units or it may be a partial denture type of appliance (Figures 12, 13). The partial denture has the advantage of giving added support to the upper lip extending it anteriorly, if this is required for cosmetic reasons. If there is some underdevelopment of the maxilla, the prosthetic placement may also bring out the upper lip into a more cosmetic relationship to the lower lip.

Changes Correlated With Final Growth Periods-Adulthood

Through the years there has been a

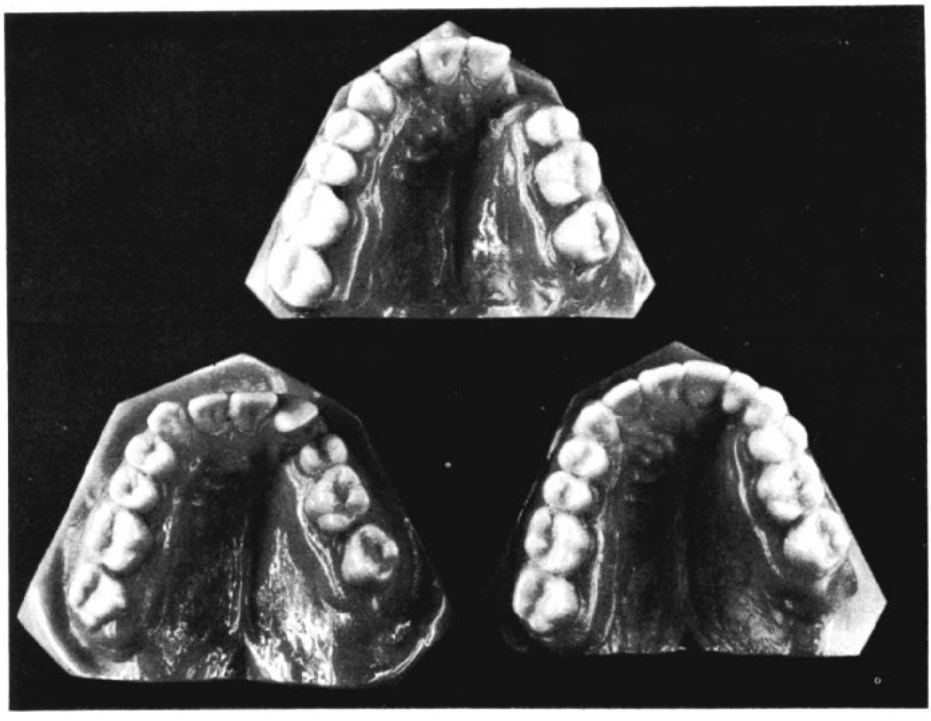

Fig. 13 A fixed bridge, replacing missing dental structure in a cleft lip and palate subject. The bridge serves as a splint and a final, permanent retentive mechanism. Casts indicate the relationship of dental units before and after treatment and after placement of the permanent bridge.

metamorphosis in the outlook and in the philosophies related to the care of individuals with clefts of the palate. Initially, that is, prior to the past twenty years or so, interest seemed to be centered on the adult with a repaired cleft of the palate. One was frequently faced with the "end results" of years of therapy and, not infrequently, with the apparent mismanagement of the therapy for the cleft palate individual. Many of these individuals of yesteryears, young and old, were afflicted with a retrusion of the midface, particularly in the area of the upper lip. This appearance at one time was commonly associated with an inadequate expression of the skeletal growth of the upper face in cleft lip and palate individuals.[18] This stimulated study of these adults. Interpretations were drawn; principles began to evolve, and changing concepts of treatment were instituted relative to the infant and child with a cleft of the lip and/or palate. In the youngsters it became important to project into the future and to prevent the development of the age-old problems of the older individual with a repaired cleft of the palate. More importantly, it was gradually realized that with refinements in therapy many of the youngsters of today would not have to grow up with the problems frequently seen in yesteryears.

Without a doubt, it is important to further the development of proficiency in therapy at these early stages of life. What is accomplished at an early age may very well reflect itself in the emotional as well as the physical development of a cleft-palate individual throughout life. The importance becomes even more pronounced when one

realizes that the frequency of the problem is apparently on the increase. Recently, Fogh Andersen[19] reported a significant increase in the incidence of cleft lip and/or palate in Denmark. He stated that in contrast to the incidence of this problem as presented in 1939, approximately 1.3 out of 1000 births, he noted an increase to 1.64 out of 1000 births by 1957 and still not fully documented data for 1964 reveal another increase of incidence to approximately 1.84 out of 1000 births. Thus, it would seem that how well some phase of therapy is accomplished at an early age will affect more and more people at later ages.

At one time it had been concluded that a cleft palate child, operated on at an early age, would frequently exhibit a deformity of increasing severity with progressive growth. It was felt that the middle face would fall farther and farther behind the development of the lower jaw and the forehead leading to a disfigured facial profile. In fact, in many areas of the country it was reasoned that surgical correction of a cleft palate should be delayed until the child approached school age. By delaying surgery it was assumed that the effect of the palatal operation on the growth of the maxillary jaw would be minimized. Thereby the least possible retardation of upper facial growth would ensue, and the potential for a good facial appearance would be enhanced. This viewpoint seemed to assume that all surgical corrections of a cleft palate would have a retarding influence on the growth of the upper face. In more recent years and on the basis of continuously accumulated records, it has been pointed out that there are numerous cases of cleft palate which have been successfully corrected by surgery in which deleterious effects on facial growth are not visible.[20] Despite this, inequality in the growth of the jaws may occur in some, or at best, a few individuals. This may or may not be reflective of any therapeutic procedure. It may be the result of a genetic potential for continued growth of the mandible and a reduction or cessation in growth of the maxillary jaw (Figure 14). It may even be reflective of a minimal reduction in maxillary growth as a result of some therapeutic procedure. In a few instances, especially in some older cases, it may be related to a disturbance in growth of the maxillary jaw. In some of these individuals it may be foolhardy to think that orthodontic treatment will guarantee a full or even adequate development of the upper jaw. No matter whether orthodontic treatment was undertaken or not, at any age, problems may still develop at later stages of growth. These problems may in no way be related to the proficiency of orthodontic care, but to the pattern of facial growth. In the care of individuals with clefts of the lip and palate it is not unusual to observe a good facial appearance at a young age and to observe development into a less desirable facial appearance at a later age. This observation seems to be correlated with changes in the potential relationships between the maxillary and the mandibular jaws. Be-

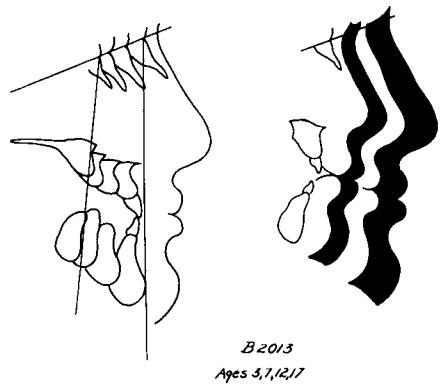

Fig. 14 Superimposed tracings of serial cephalometric headplates obtained from Dr. B. H. Broadbent at Western Reserve University. In this noncleft subject an increase in mandibular prognathism and facial profile concavity is evident.

cause of continued mandibular growth that is subsequent to the completion of maxillary growth, the chin may assume a more forward position than that of the maxillary jaw. If there is some underdevelopment of the maxillary jaw, and there is continued mandibular growth, then there may be difficulty in keeping the maxillary incisors labial to the mandibular incisors. In these cases the mandible with its dentition may eventually exceed the position of the maxillary teeth, anteroposteriorly, even after extractions in the mandibular bicuspid regions. With some reduction in full maxillary growth the upper jaw may not grow adequately in the vertical dimension as well as in the anteroposterior dimension, adding insult to injury. With inadequate vertical dimension the mandible may overclose in an upward and forward direction to achieve full dental occlusion. The result would be an exaggerated forward positioning of the mandibular chin and the mandibular dentition (Figure 15). Today these cases seem to be fewer in number in comparison to yesteryears; however, few though these cases may be, they exist. In these instances the orthodontist may have to depend on prosthetic adjuncts as a final step to orthodontic therapy. Prosthetic aid may be necessary to increase the vertical dimension of the maxillary region and to prosthetically place the maxillary incisors in a more anterior position.

Fig. 15 Serial cephalometric tracings of an individual with a repaired unilateral cleft of the lip and palate. The mandible has been growing downward and forward while the maxilla expresses inadequate forward growth and some inadequacy in vertical growth. Despite extractions in the mandibular arch it was impossible to keep the maxillary incisors labial to the mandibular incisors. Records made in 1954, 1960, 1963 and 1965.

In conclusion, it can be stated that care for the individual with a cleft of a palate extends from birth into adulthood. Actually, it continues throughout the lifetime of the individual. Reconstructing the oral cavity and maintaining the health and integrity of the oral cavity are important to speech and facial appearance. The orthodontist is capable of playing a vital role in the rehabilitation of a cleft-palate individual through his knowledge of the anatomy and physiology of the oral cavity, supplemented with a knowledge of growth changes and what they mean to cosmesis and speech. Our levels of clinical success have improved tremendously over the years and our focus of attention has shifted from the gross aspects of clinical correction to the search for refinements in clinical correction. Clinicians no longer seem to be overly concerned with the "hows" and "whethers"; how and whether it should be treated orthodontically. The focus of attention seems to be rapidly progressing toward how ideal a result can be hoped for. Unquestionably, the more ideal the improvement, the more the psychoemotional problems stemming from the anatomic defects can be avoided at any age.

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