Early Orthodontic Procedures For Cleft Lip And Palate Individuals

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In recent years orthodontists working with cleft lip and palate children have shown an increased awareness of the potential orthodontic problems inherent in the newborn. By reviewing the formation of the primary and secondary palates and by enumerating the recent developments in this unique field, these problems are better understood.

Of the recent investigators in this field, perhaps Burston[1] from the University of Liverpool has been most instrumental in forwarding the need for a more extensive interchange of ideas between the embryologist and the clinician. Citing extensively from the works of Streeter[2] at the Carnegie Institute in Washington, he presents the current thinking regarding the embryology of the cleft lip and palate.

This work has shown that the facial processes consist of mesodermal masses migrating forward between the ectodermal covering of the face and the roof of the oral cavity. Thus no ectodermal fusion is indicated, but only a smoothing out of the ectodermal folds. Upon fusion of the neural folds to form the brain, certain cells are extruded from the neural crest and migrate down the side of the head to form the cranial ganglia and the visceral arches. This usually takes place at about 24 to 26 days in utero.

In the area of the mandibular arch, a secondary caudal extension of the mesoderm occurs which pushes around beneath the brain towards the midline forming the maxillary processes. However, on either side of the face there are two residual areas where the ectodermal coverings of the face and the roof of the oral cavity anteriorly remain close together. These are the olfactory placodes of which the pear-shaped narrow part inferiorly eventually becomes the lip. Between the two ectodermal layers forming these areas there is only a very thin layer, a few cells thick, of the original mesoderm.

As the adjacent mesodermal extension from the mandibular arch (maxillary process) continues to grow, the contour of the face takes on the characteristic bulges of the facial processes and the olfactory placodes appear to sink in (Streeter, 1948). In normal development a part of each maxillary process passes between the upper main portions of the placodes thereby separating the two layers of ectoderm and forming a bar of tissue which is the primitive palate. The upper portions of the olfactory placodes continue on as a thin double membrane (bucco-nasal) to eventually become the nostrils. The primitive palate, from which the upper lip is derived, is formed at about five weeks and includes the premaxillary or incisive bone of the maxilla anterior to the nasopalatine canals or incisive foramen. A cleft can occur if either of the maxillary processes fails to extend beneath the olfactory placodes. They then split through the lip, dependent, of course, upon the degree of lack of mesodermal extension. Clefts may be either unilateral or bilateral, and may or may not involve the alveolar crest. When

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the cleft occurs before five weeks, it is usually caused by a breakdown of tissue and not a lack of fusion.

In the formation of the secondary palate the folds emerge at around eight weeks and initially lie vertically. When the mandible drops and they lie above the tongue, it is then that they truly fuse, the hard then the soft palate. A cleft can occur here due to a number of reasons: gross interference such as in the previous primary palate; the failure of the ectoderm to disintegrate so that the mesoderm cannot fuse; formation of cysts (Scott, 1955), or failure of the mandible to move inferiorly.

At birth then, a cleft in the oral cavity in one form or another is present. As clinicians the important thing is to alleviate a potentially serious skeletal dysplasia and minimize subsequent orthodontic intervention. Until about seven years ago most orthodontists would have waited at least a few years before beginning treatment. At that time C. Kerr McNeil[3] of the University of Glasgow published his thesis stating his belief that orthodontic treatment should start as soon after birth as possible, six weeks in the "mild cleft cases", earlier in the more severe ones. As early as 1950[4] he wrote that he felt it essential to start mechanical measures at an early age because the first growth acceleration of the jaws takes place from birth to seven months. In orthodontic and plastic surgery circles McNeil's thesis caused controversy about whether union of clefts could be obtained by nonsurgical procedures.

Another aspect of his approach, though less spectacular, is the preoperative correction of the defect of the maxillary arch and resultant satisfactory relationship between the arches. His appliance is acrylic and acts both as an obturator and orthodontic appliance. His technique is as follows.

Fig. 1

A composition impression is taken and a plaster model poured. The extent of the defect and the relations between the jaws are analyzed with embryonic and morphologic factors taken into consideration. Based on this analysis, the decision is made of what corrective procedures are indicated, i.e., whether lesser segments need moving forward or outward, or whether a midline correction of the major segment (in unilateral cases) is required. The model is cut at the appropriate places and the segments moved in the required direction; the model is then rebased, Fig. 1. The amount of orthodontic correction is a matter of clinical judgment but definitely should be related to rate of growth of the child. The first appliance can only be a feeding one if necessary with subsequent appliances made active

after the child is accustomed to it.

A bite block is then made of soft carding wax and transposed to the corrected working model; the child's bite is registered and the skull center line recorded in wax. A single acrylic appliance is made on the corrected model and, once inserted, the action of biting achieves the desired molding and stimulation of the maxillary processes.

Since the publication of this technique and treatment procedure, few men have attempted extensive work along this line, and fewer still have reported upon it.

Hotz and Graf-Pinthus,[5] working at the dental institute of the University of Zurich, report on obtaining relatively good results using this general procedure, especially in bringing forward underdeveloped segments and in correcting lateral deviations. (In personal discussion with Dr. Hotz, I have learned that they do essentially as does McNeil, but if there is a need for more than one appliance, additional ones are made from the original sectioned cast.) After this first preoperative phase and surgery, the orthodontic appliance is reinserted as soon as possible.

Burston[6] is employing essentially the same technique with slight modifications. At present there is a dental ward at the University Hospital in Liverpool specifically for newborn unoperated cleft children, wherein these infants are treated with orthodontic appliances prior to lip closure.

Harkins,[7] in Pennsylvania, showed keen interest in this approach also. In reference to the bilateral cases in particular, he felt that the various surgical repositioning procedures for the premaxilla depended upon pressure of the surgically united lip. Unfortunately, this may not work all of the time because the lip can be closed in one or two stages and sometimes the buccal segments collapse. Even if the vomer is resected and repositioned, the buccal segments are still displaced too far mesially. Thus the premise for presurgical orthodontic treatment is expansion of the buccal segments first, then vomer resection and retropositioning. Surgical closure of the alveolar process is performed when the retroposed premaxilla has been forced by lip pressure into the breach obtained by the expansion appliance. Some people consider his modifications of the original McNeil technique as radical for he wired his appliance directly through the alveolus, justifying any "small" damage against any future "collapse". Retention of the appliance is of minor concern; it is kept in place for around four weeks and then replaced.

Not everyone involved with cleft palate orthodontics believes, however, that initial t r e a t m e n t procedures mean orthodontics on the newborn. As recently as 1959 Glass,[8] in discussing the work of Burston and McNeil, states that early presurgical treatment procedures are carried out with more enthusiasm in some centers than in others. He feels that orthodontic treatment should be directed to the correction of the individual teeth to help esthetic harmony and normal function and to give arch stability. It can be started "as early as four to six years of age".

Subtelny,[9] in 1957, represented the general thinking in this country in regard to early orthodontic treatment in the cleft child, that of treatment with the deciduous dentition in place. He also stated that orthodontic repositioning of alveolar segments at this time served to create a normal foundation for the surgically reconstructed lip. Such procedure could be instrumental in preventing an overdevelopment of the lower lip.

Terwilliger[10] stated that early orthodontic therapy in cleft lip and palate

children is essential because the maxillary bones and their component parts can be moved and altered in young children with relative ease and thereby create a more functional dental arch. By early first phase treatment, he means around four years of age while Johnston[11] (1958) feels that early treatment indicates the presence of the deciduous dentition.

Rosenstein,[12] as recently as 1960, cited treatment procedures at the Cleft Lip and Palate Institute of Northwestern University where first phase treatment consists of placing a modified Arnold split-lingual appliance on children as young as three and four years of age.

Olin[13] shows extensive procedures in many cases where the dentition is present, both deciduous and permanent. However, Olin and his associates at the University of Iowa have done work on presurgical cleft cases.

In addition to a cleft problem that these children have, there is also the real possibility that an inherent orthodontic problem might exist, not necessarily related to the cleft. Nevertheless, it has been our experience that rarely is there a really serious problem of collapse in the buccal segments of the maxilla in cleft cases where the alveolar ridge is intact. It has generally been those cases that present with a Class III or Class IV Veau type cleft, the complete unilateral or complete bilateral cleft of the lip, jaw, and palate, that show collapse. We often find the classic collapse on the side of insult in the unilateral case and bilateral collapse of the buccal segments in the bilateral case. When the child becomes manageable and sufficient teeth are present we try to reduce the unilateral or bilateral crossbite. If, for any number of reasons, orthodontics is not attempted until the complete permanent dentition is in place and the condition of the crossbite is allowed to persist for a number of years it is very difficult to reduce, especially through a maze of cicatrices.

There is the possibility too of reverse crossbite where the maxillary components completely enclose the mandibular arch. This may occur in cases where rather than a lack of tissue because of the cleft, there is primarily a lateral displacement; it occurs also in micrognathia. We have seen them occasionally but this type is the exception, rather than the rule.

This paper is a preliminary report of our treatment of these children, prior to, at the time of, and subsequent to lip and palate surgery. To date the sample consists of 16 infants and one child four years of age. Three of these cases are seen privately, one at Children's Memorial Hospital, and the remainder at the Cleft Lip and Palate Institute of Northwestern. There are nine complete unilateral clefts and eight complete bilateral. There are eleven males and six females.

Because the prosthodontist is more familiar with the handling of a new type thermoplastic acrylic a number of these cases have been started under his supervision, using this material. Although the acrylic must be cured for a number of hours, it has the unique property of plasticity when heated slightly above room temperature, and the ability to return to the original cured form upon cooling. Thus, in the McNeil technique, when the cast is separated and reoriented in the desired position, and the acrylic cured to this position the same acrylic plate may then be heated, made plastic and inserted into the mouth around undercuts and into the cleft area, Fig. 2.

In discussing briefly the eight prosthetic cases, seven are unilateral complete, for we feel that this type case lends itself more readily to cast sectioning and the thermoplastic material.

Fig. 2 McNeal-type thermoplastic appliance in place. Note the "wings".

Initially, we thought all of these cases might need expansion of some sort; this is not necessarily so. Five have required expansion and appliances have been placed. The remaining three had not required expansion, although passive acrylic holding plates have been placed in two. All of these cases had the lip closed prior to the insertion of the appliance.

We have tried a somewhat different approach orthodontically, using the cold cure acrylics with various types of expansion screws and, where necessary, sectioning the casts, Fig. 3.

Of the nine orthodontic cases, eight are bilateral complete, and one unilateral complete. Because this paper is a preliminary report, no extensive statistics are available; however, discussion of the clinical aspect of these cases is vital.

Three of the nine, one of which is the unilateral complete, have not required expansion. In the other two, we are awaiting the eruption of the deciduous molars for the placement of a lingual holding arch. Some of the others merit comment:

J. S.: In this case the lip had been closed in two stages about a year prior to the placement of an orthodontic expansion appliance. The expansion screw is also the spring tension variety, and the child is using his second appliance now, Fig. 4. When maximum expansion has been obtained, the appliance is removed in its expanded position and placed on the original model which has been sectioned to accommodate it. The void between the cast sections is filled with wax, and a new appliance of cold acrylic is made from this original cast.

F. M.: For this infant the expansion appliance was placed prior to the clos-

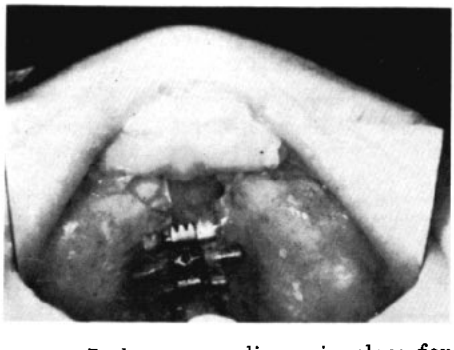

Fig. 3 Jackscrew appliance in place for bilateral expansion.

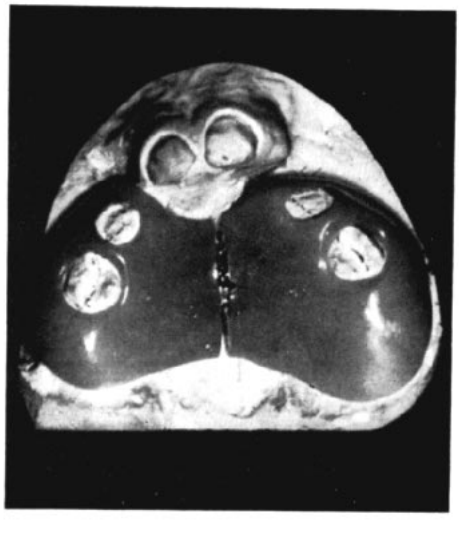

Fig. 4 Jackscrew appliance on cast.

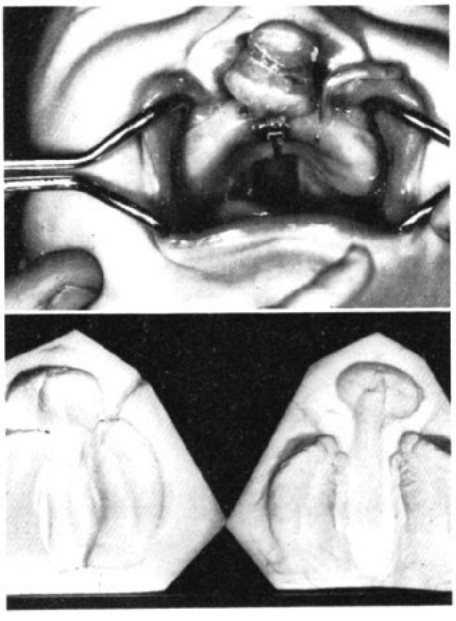

Fig. 5 Jackscrew appliance with single "wing".

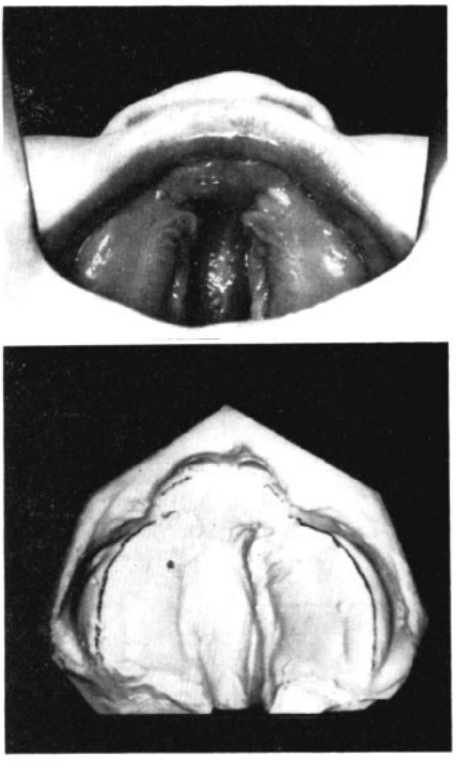

Fig. 6 Left, after expansion therapy of right.

Fig. 7 After lip closure.

ing of the lip, Fig. 5. Note not only the expansion obtained bilaterally, but also the very evident growth of the septum, Fig. 6. Figure 7 shows the lip and palate after lip closure. Burston and McNeil feel that in the cleft case either or both the maxillae are without the influence of the septum and growth is subsequently altered, even postpartum, leaving the maxilla distally placed. Some[14,15] feel that sectioning the septum in bilateral cases is then needed to stabilize the premaxilla securely and esthetically to the lateral segments.

B. E.: In this case the lip was also closed prior to the placement of an orthodontic expansion appliance. The original appliance carried modified acrylic "wings" as McNeil originally designed, until we found that these acted as convenient levers for the child to displace the appliance, either with his hands or shoulders. The "wings" were therefore eliminated from subsequent appliances. The original appliance also used the conventional Glen-Ross type jackscrew, Fig. 3, but the spring tension type was used in succeeding ones which were made from the original sectioned cast. Another pertinent factor besides lateral expansion is that of the size of the premaxilla itself. If, after expansion of the lateral segments, the premaxilla cannot be moved distally sufficiently, even after vomer resection, it can be trimmed slightly on its lateral aspects.

M. N.: This youngster depicts the ideal type upon which to attempt some form of expansion. The lip has not yet been closed, and the baby has been followed closely since birth, Fig. 8. The lateral segments were in such close approximation immediately after birth that a con-

Fig. 8 Patient at birth.

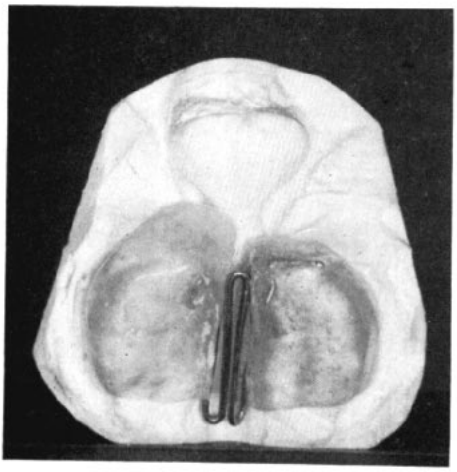

Fig. 9

ventional screw on a split acrylic palate could not be used. The original appliance therefore consisted of a curved, recurved "coffer type" spring, which was used long enough to create sufficient expansion for placement of a spring tension type appliance, Fig. 9. The child is now using his third appliance and, since there is approximately enough lateral dimension for the placement of the premaxilla, lip closure and possible septum resection is planned in the immediate future.

A. L.: This four year old was included to help us determine whether there is an appreciable difference in the rate, as well as amount of expansion, in those clefts where both the lip and palate have been closed previously. Because teeth were present, a modified form of the Arnold split-lingual appliance was placed for initial expansion, Fig. 10. A conventional jackscrew split acrylic appliance was then placed, Fig. 11, and finally two spring tension appliances. In the case of the removable appliances retention was enhanced by the addition of clasps around the canines and molars. Sufficient expansion has now been accomplished to consider surgical stabilization of the premaxilla without any need for septum resection. This particular case confirmed our thoughts on expansion, namely: expansion will not necessarily open up a previously closed cleft, and secondly, it is appreciably easier to expand lateral segments without having to fight palatal scar tissue.

We are just now beginning to feel confident in our approach which has

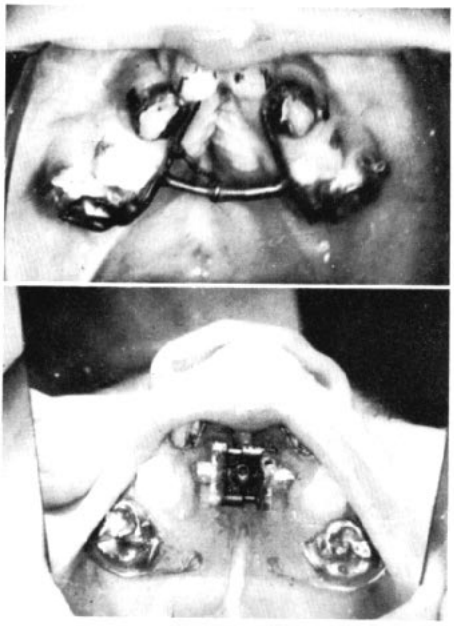

Fig. 10 Above

Fig. 11 Below

been modified from the original techniques of Burston and McNeil. We no longer use the acrylic "wings" to aid retention; retention, although a problem, is not insurmountable. Whenever possible, we insist on having the baby intubated for an alginate impression, by virtue of its accuracy, rather than routinely taking compound impressions.

We also feel that we are not compounding the problems in attaining adequate velopharyngeal valving. By virtue of expanding so that the axis of rotation is at the distal of the displaced segment, or somewhere anterior to it, the lateral dimension posteriorly need not be increased adversely.

Summary

A preliminary report has been given relative to early orthodontic treatment procedures in complete unilateral and bilateral cleft palate individuals. In the past both orthodontist and prosthodontist have been plagued by the unwarranted collapse of arches, or arch segments, in these cases. It is out of desire to reduce or alleviate the severity of these problems later in life that our procedures are undertaken at this time. To further delineate this evaluation from the theoretical, it became essential to assess similar cases wherein these procedures were, or were not, performed.

Despite heroic attempts to alleviate crossbites, collapsed arches, mutilated dentitions, and bizarre esthetics by these early treatment procedures, we may still have these problems in much the same degree in the older child.

Enlarged samples, biometric evaluation, but most important, a free exchange of information are required for a more extensive evaluation of the success of this approach.

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Discussion

B. L. Swoiskin

The essence of Dr. Rosenstein's paper is a technique modifying McNeil's device for obturating the cleft palate and manipulating the palatal segments prior to and following lip surgery in the complete unilateral and bilateral cleft lip and palate.

The principal arguments advanced in favor of this procedure may be summarized as follows:

(1) It facilitates lip repair by approximating palatal segments in advance of surgery.

(2) It facilitates the feeding of the newborn infant.

(3) It prevents the collapse of the palatal segments and the resulting crossbites common to complete lip-palate clefts.

The argument in favor of facilitating lip repair through presurgical manipulation is subject to debate. Many surgeons tell us that they gain no real advantage in the case of unilateral clefts and find that the preliminaries of orthodontic-prosthetic treatment in the newborn are unnecessarily time-consuming and costly. Our pediatricians emphasize that any gadgeting which makes the child look different from other children is an undesirable psychological complication in the acceptance of the infant by his parents. For these reasons our medical colleagues feel the disadvantages of the McNeil procedure far outweigh any gains made by presurgical manipulation.

Also, we must emphasize that not all complete unilateral or bilateral clefts are alike in the geometry of their palatal segments. It is our impression that the advocates of the McNeil philosophy have not taken proper account of the variant pathomorphology and pathophysiology displayed by this population.

Does the McNeil appliance facilitate feeding in the newborn? Our English colleagues tell us it does. Our own pediatricians, having modified the nipples and nursing procedures in accord with the individual needs of the patient, tell us that our babies feed quite well and gain weight on a par with normal babies despite the lack of obturation. Although accurate documentation of facilitation of feeding is possible, no one has gathered the evidence. In our judgment the burden of proof rests with the proponents of the McNeil school. As of this date we have not seen the evidence in favor of this procedure.

Now, we come to the most crucial argument of all, and this relates to the prevention of the collapse of the arches and the resultant crossbite seen in many complete unilateral and bilateral cleft palates. It is only natural that attempts have and will always be made to correct the congenital defect of cleft lip and palate as early as possible, with return of normal anatomy and function, and hence prevent complications later in life.

But, orthodontists have learned the lesson of patience; of giving nature a chance, of establishing normal environmental forces and allowing natural growth processes to be influenced by the changing dynamics of that new environment.

Regrettably, these concepts have not been understood by the McNeil school; indeed they have not bothered to observe the recorded natural history of postnatal development of the dental arches in cleft palate.

For example, I would point out that while approximation of palatal segments always follows lip repair, it is not the same in all cases. Three variants have been described:

1. Approximation with overlap.
2. Approximation and formation of

a butt joint in the alveolar process maintaining arch form.

3. Approximation without contact of alveolar segments.

At the moment we defy anyone looking at the newborn to predict the precise pattern the palatal segments will follow as a result of lip surgery.

Is collapse of the arches really a bad thing as the McNeil advocates imply? We submit our concepts for an entirely contrary point of view, namely, that collapse of the segments is desirable and should not be inhibited.

To understand our point of view I must ask you to forget arch form and occlusion for just a moment.

The item of highest priority for the patient with a cleft palate is normal speech. This overshadows everything else for it is our most human characteristic. Next is facial cosmetics and good occlusion is somewhere lower on the list. Of course, all of these items are physiologically interrelated but they can be separated.

Successful velopharyngeal valving through surgical repair is dependent on a number of biological factors independent of the surgeon's skill. One of these factors relates to the width of the cleft at the region of the tuberosities—the site of most frequent surgical breakdown; another factor is the width of the pharynx.

Subtelny has shown that the width of the pharynx is greater in clefts than in normals. Pruzansky compared the laminagraphs obtained by Subtelny with the casts on the same patients and found a direct correlation between the width of the tuberosities, the width of the clefts and the width of the pharynx. In simple terms, the wider apart the palatal shelves, the wider the width of the pharynx and the less assurance of successful repair.

It follows, therefore, that any procedure that inhibits approximation of the palatal segments indeed prevents early and successful repair of the velopharyngeal mechanisms so essential to normal speech. Besides, I would draw to your attention that the collapse observed is minimal in the posterior portion of the arch, most pronounced anteriorly.

In our experience following conservative surgical repair of the palate, expansion of the segments and establishment of normal arch form is possible by simple fixed appliances involving less expenditure of time and money than that entailed in the use of the McNeil technique.

Expansion can only be achieved once the anterior segment has been rotated to permit the unlocking of the smaller and impacted palatal shelf. This is not a complicated procedure and we have completed both steps in as little as two to three months in the preschool child.

Finally, I should like to note that until recently my knowledge of the McNeil technique was limited to what I could read in the journals. However, last May I visited several European centers. Therefore, what I report to you today reflects not only the perspective I have gained at home but also from the discussions abroad.

Those experiences lead me to conclude as follows:

1. The McNeil technique deserves duplication here provided it is regarded as an experimental technique performed for academic reasons only. This implies that every effort should be made to document the mechanisms of the change induced. Such documentation should include at least periodic casts and cephalometric films. Without such records no real knowledge will ensue.

2. Finally, it is our carefully con-

sidered judgment that the techniques described herein offer no real improvement upon the routine practices now employed at the Cleft Palate Center, University of Illinois.

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