Cleft Lip Repair, Its Orthodontic Significance

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I would like to present the cleft lip problem as it is seen by the surgeon from the operative point of view in the repair of the lip and also in regard to the results of his handiwork on the gross dentition. The surgeon who undertakes repair of the cleft lip must consider not only the aesthetic and functional results as regards the lip alone, but also the effect on the dental arches and the dentition. In general, the surgeon is capable of appreciating the latter in but a very general and gross way and is soon over his head in the deep waters of orthodontics. It is only fitting and proper that he look for help to those skilled in this field. While in the need of just such help several years ago, I had the great good fortune to meet Dr. Wendell Wylie. He elucidated several principles for me, which, I hope, will prove beneficial in the cooperation of the surgeon and orthodontist in the care of the cleft lip child. In the course of this essay I will attempt to review some of the basic principles involved and relate them to the evolution of cleft lip surgery and to the changes in the dental arches produced thereby. Much of this may prove to be repetitious for you, but it is important that I state the principles on which the general argument is built. According to Samuel Hemley in his book entitled *Fundamentals of Occlusion,* "the lips and cheeks (orbicularis oris and buccinator) combine to act as a powerful force on the dentition, the former pressing on the labial and the latter on the buccal surfaces of the teeth. The tongue is an expanding force on the dentition, pressing forward in the incisor region and laterally in the premolar and molar regions, especially during deglutition." We can therefore consider the dental arch to be subjected to two sets of forces, one tending to compress it (the lip) and one tending to expand it (the tongue).

The deformity which gives both of us the most trouble, however, is the complete cleft of the lip, associated with a complete cleft of the palate. It is in these cases with the more severe clefts that we have our greatest difficulties. Before we go into this aspect of the problem, it may be pertinent to ask how important it is, especially the problem of the severer clefts with which we are going to spend so much time. In the general population, approximately one birth in 650 is a cleft lip or cleft palate, or both. A large number of the more severely deformed clefts fail to survive the first year of life (about 25%), resulting in an overall cleft incidence in the general population of one in one thousand. About 25% of these are cleft lip only, about 25% cleft palate only, and 50% a combination of the two. The vast majority of this latter group falls into the category which interests us more keenly, that is, a complete cleft of the lip and palate and is therefore a significant problem.

It may be well for us to review the common clefts of the lip. In general, the clefts of the lips are described as being complete or incomplete, depending on whether the cleft extends through the floor of the nostril, and as unilateral or bilateral (Fig. 1). The in-

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cidence of these clefts is approximately as follows:

1. Cleft lip, incomplete—27%.
2. Cleft lip, complete—48% (43% complete cleft palate).
3. Cleft lip bilateral incomplete—7%.
4. Cleft lip bilateral complete—18% (17% have complete cleft of palate).

In like manner, it is well for us to review the more frequent types of cleft palate (Fig. 2). Their incidence is as follows:

1. Soft palate—21%.
2. Soft and hard palate—31%.
3. Entire palate and alveolar ridge—39%.
4. Bilateral cleft palate—7%.

With complete cleft of the palate and lip, either unilateral or bilateral, the normal conditions are changed in two respects. The normal compressive force of the lip is absent and the normal stability of the dental arch is lacking, both as a result of the loss of continuity of the alveolar ridge and also as a result of the loss of support of the palatal arch. The alveolar ridge, or ridges, is subjected to the expanding force of the tongue, which is not balanced by a compressive force of the lip.

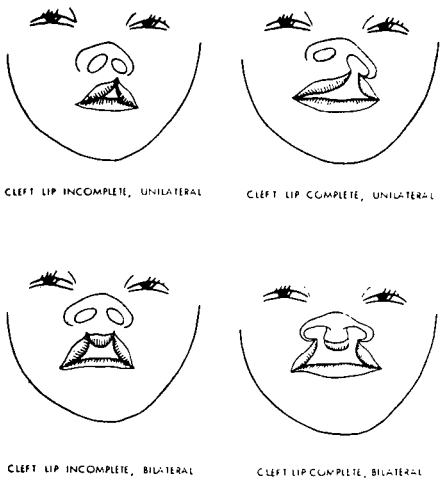


Fig. 1

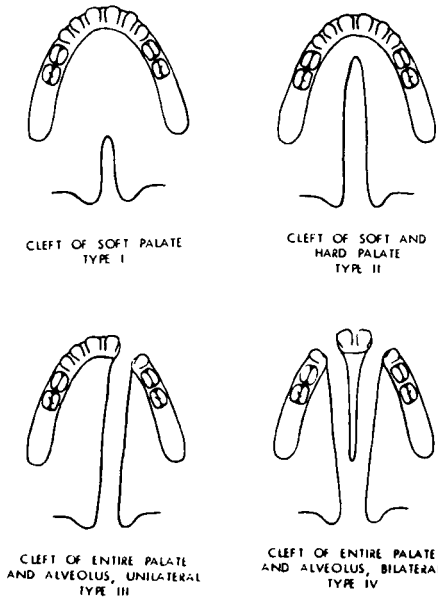


Fig. 2

As a result of unopposed action of the tongue there is some lateral expansion of the alveolar ridges, especially in their anterior segments. The tongue probably explores this cleft and produces a flaring-out of the anterior extremities of the alveolar ridges at the margins of the cleft. In this unilateral cleft lip the palatal bone at one side is attached to the nasal septum, giving it added stability. The alveolar ridge on the cleft side is the one with the lesser power of resistance to movement.

Because such deviations from the normal pattern of the alveolar ridges may result from the unopposed action of the tongue, one might come to the conclusion that all our troubles would be over when we repaired the lip and thus balance the opposing forces. Balance is the key word, and it is a lot harder to get it than pronounce it. When we close the lip we, in effect, bring into play an orthodontic device which can produce overcorrection with medial displacement of the alveolar ridge or ridges and

result in collapse of the dental arch. This is especially true when cleft lip repair is carried out before the midfacial bones are well ossified and able to resist pressure. There is another kind of pressure brought to bear here, and that is exerted by the patients—to have the lip closed as early as possible. I have been in the practice of deferring lip surgery until three months of age, not only because the infant is considerably larger at that time than he is at birth, making surgery more exact, but also with the idea in mind of securing more stability of the alveolar arch from ossification of the midfacial bones. The operation is carried out under endotracheal anesthesia and dental study models are taken immediately before surgery. The sutures are removed on the fourth postoperative day and the child is discharged from the hospital a few days later. At age eighteen to twenty-four months, palatal surgery is carried out, again under endotracheal anesthesia, and again dental study models are made.

Figure three shows the dental study models of a unilateral complete cleft lip and a complete cleft of the palate just prior to lip repair on the left and twenty months later on the right. The lingual deviation of the alveolar segment on the cleft side is evident.

A similar deformity is shown in figure four, a complete cleft lip and cleft palate prior to lip repair on the left and sixteen months following the repair on the right. In this case, the lip has molded the premaxilla into a more normal position, and although the deformity is not great, there is a lingual malposition of the alveolar ridge on the cleft side.

Here (Fig. 5) is a bilateral cleft lip and cleft palate, on the left just prior to lip repair, and on the right five months following repair. The premaxilla is trapped anteriorly and the dental arch has lost its keystone. Some surgeons recommend manual posterior displacement of the premaxilla at the time of lip closure, but this is not without serious consequences to the septum and base of the brain.

Figure six is a bilateral cleft lip and cleft palate prior to lip repair at age three months on the left, and twenty-one months after lip repair on the right. Here again the premaxilla is trapped anteriorly and presents a problem.

At this point, one might justifiably ask what kind of lip surgery is being carried out and why can't we effect its repair in such a manner that it will be full and loose, and thus avoid this compression of the dental arch. In order to answer this question satisfactorily, I believe it would be well to review the development of cleft lip surgery so that you may appreciate the problems confronting a plastic surgeon. It is interesting to note that in the development of surgical procedures to attain a normally functioning and aesthetically pleasing lip, a rather loose full lip has been obtained.

In figure seven we see drawings depicting the development of lip surgery. The earliest lip surgery may be described as primitive. This type of lip repair which is carried out in a straight line through a soft tissue with a free border such as the lip, results in a notching of the lip as the scar contracts. The scarline is obvious, the lip is flat or even depressed, and the cupid's bow is absent.

In 1836 Husson utilized curved lines instead of straight lines. The greatest stress is taken up by the widest point in the curves, giving a relative fullness or pout to the inferior free border of the lip. In addition, the approximation of curved lines produces a longer line of closure than the opposition of straight ones, thus overcorrecting the length of the lip in anticipation of its eventual

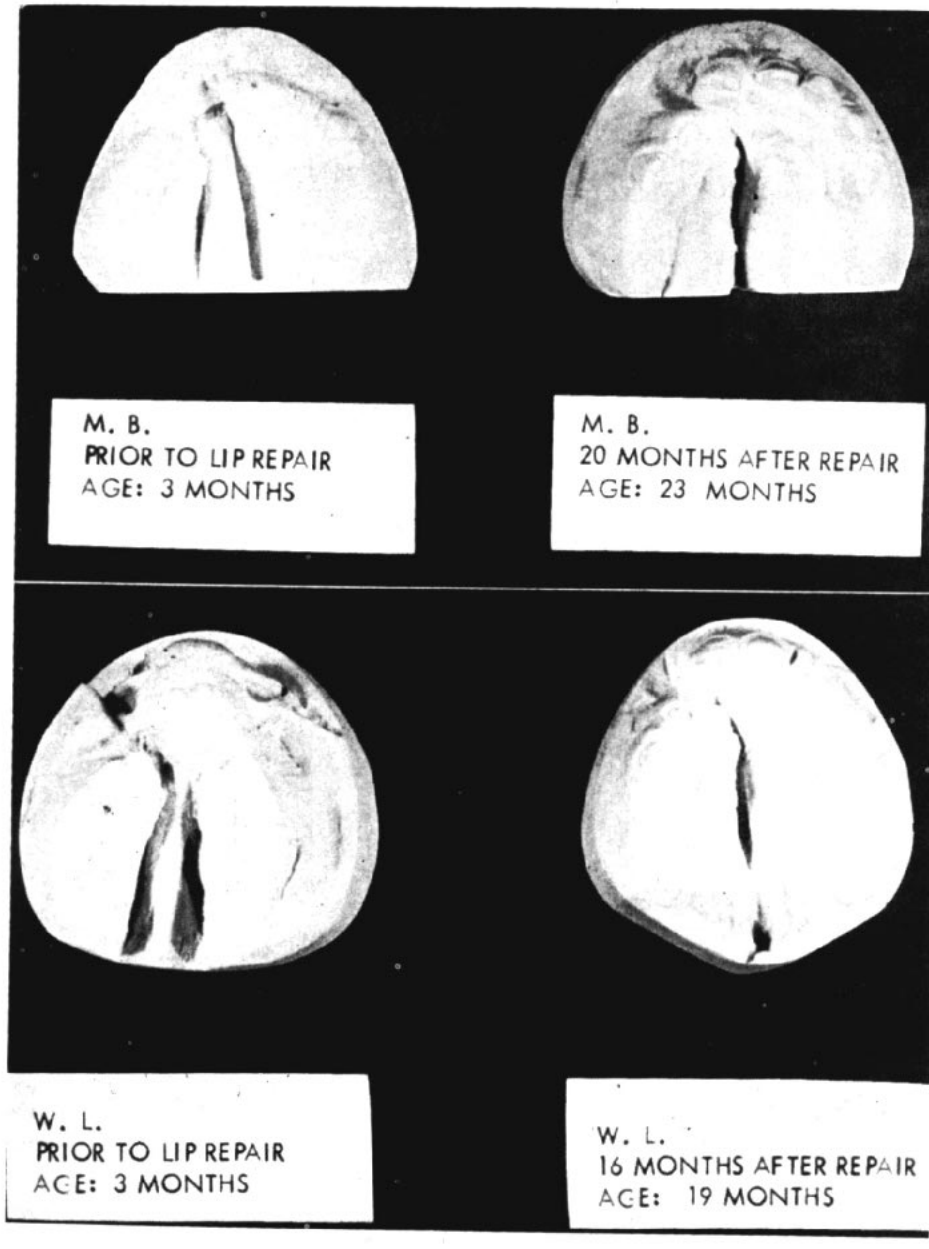


Fig. 3 Above.
Fig. 4 Below.

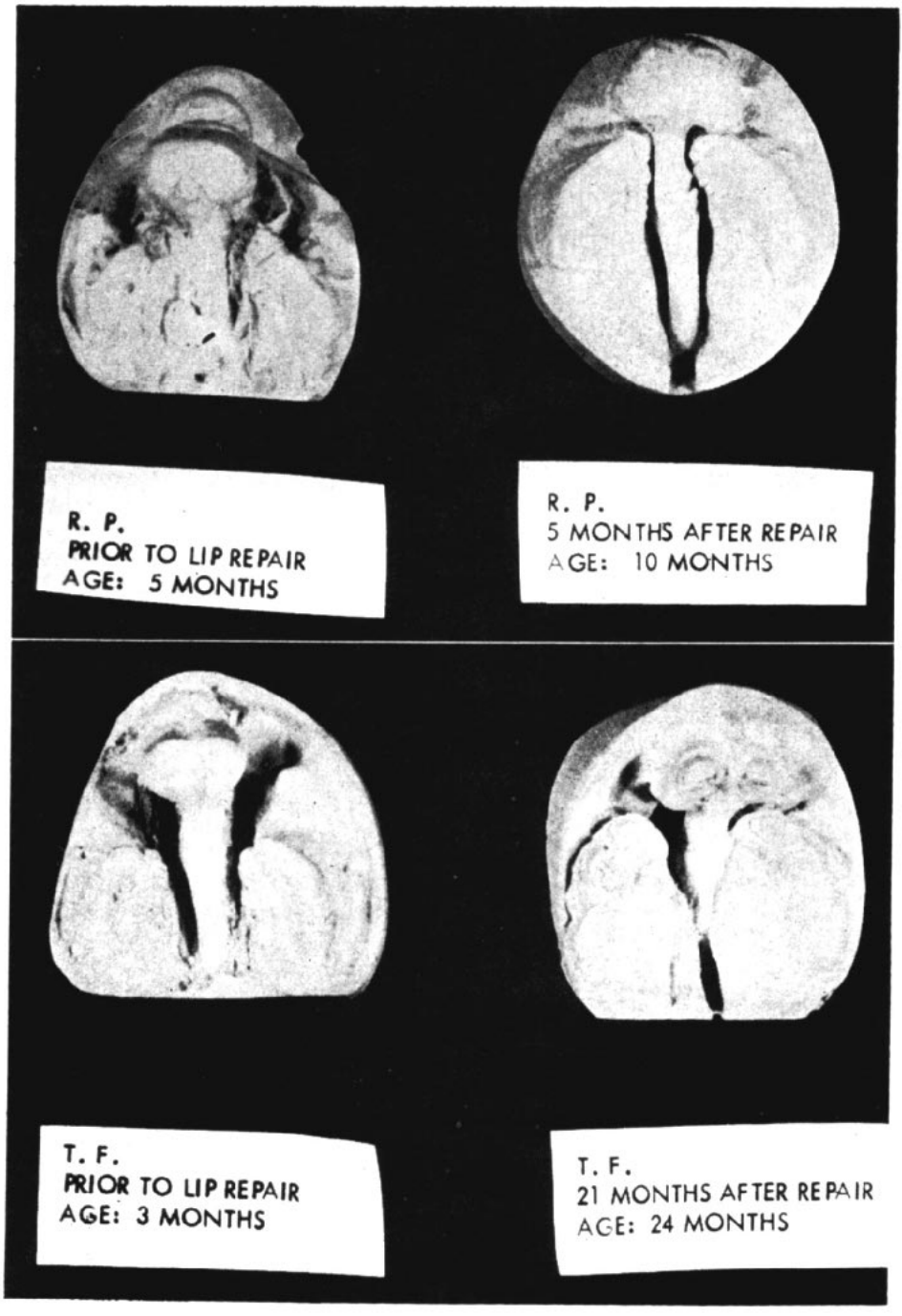


Fig. 5 Above.
Fig. 6 Below.

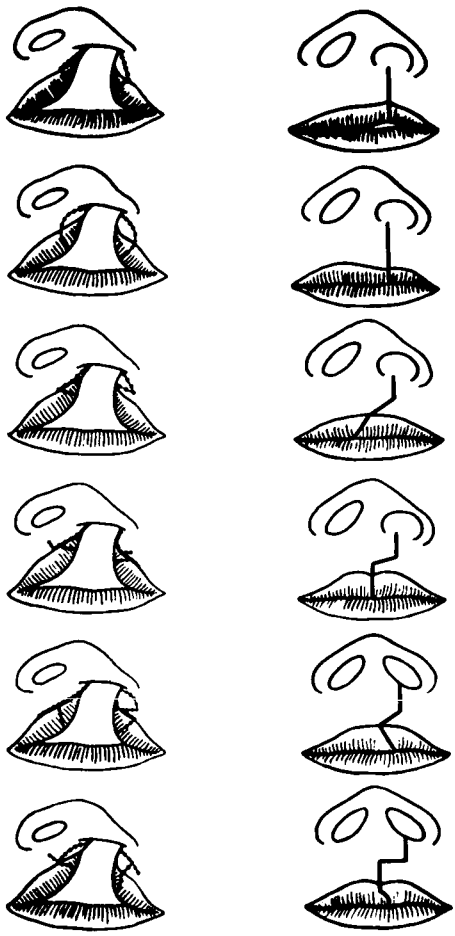


Fig. 7

contracture along the suture lines.

In 1884 Mirault swung a triangular flap across the suture line at the free border of the lip. With this maneuver, not only is the notching from the scar contracture greatly reduced, but also some fullness or pout is added to the lower part of the lip. This bending of the sutureline effectually camouflages it.

In 1892 Hagedorn utilized rectangular flaps across the sutureline at the free border of the lip. This eliminated notching from scar contracture, gave the best camouflage to the sutureline, markedly increased the fullness or pout at the free border of the lip, and restored the cupid's bow.

In 1930 Blair and Brown carried the Mirault operation to the ultimate of its possibilities by their perfection of technique. Their handling of the nasal defect is still the accepted approach to this problem today.

In 1949 Le Mesurier utilized the curved incision of Husson and the rectangular flap of Hagedorn in an ingenious combination. The sutureline is broken, not just bent, thus effectively diverting the observer's eye and eliminating the possibility of notching secondary to scar contracture. A generous pout or fullness of the lower lip is provided by both the rectangular flap (carrying about twice as much tissue as a triangular flap) and by the curved incisions. The cupid's bow is restored more effectively than in any other operation.

Using this technique, however, did not prevent a collapse of the dental arches; it appears that the expanding force of the tongue is no match for even the most loosely repaired lip and that a collapse of the dental arch can be expected in a significant number of cases. I do not have statistically significant figures of the incidence of crossbite in cleft lip and palate cases following lip surgery but previous to palatal surgery. In a review of a 104 postoperative cleft palate cases which we carried out a few years ago, we found two-thirds of the cases with unilateral complete cleft lip and cleft palate had a crossbite deformity as did three-fourths of the bilateral cleft lip and complete cleft palate cases.

Figure eight shows diagrammatically how this crossbite is produced. The alveolar ridge is situated at the inferior extension of the maxilla and is subjected to a medial force of the lip, which is greater than the lateral force of the tongue. One palatal segment is in con-

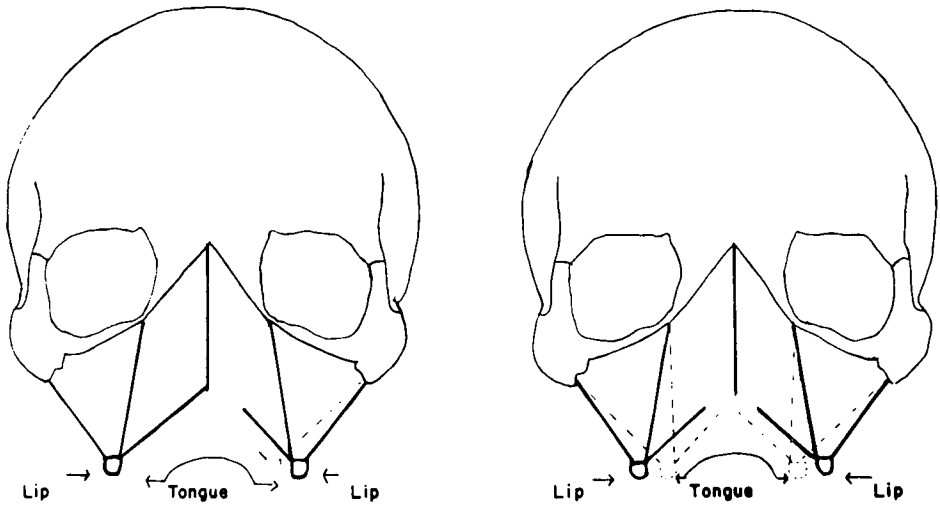


Fig. 8

tinuity with the nasal septum. This serves as a flying buttress which stabilizes the alveolar segment on the side opposite the cleft. The alveolar ridge on the cleft side is unable to withstand the compressive force of the lip and drifts medially, as represented by the lighter broken lines.

In a bilateral cleft lip and palate neither palatal bone is attached to the nasal septum, so both alveolar ridges may drift medially as a result of the compressive forces of the lip. It is, of course, to be remembered that the maxilla extends anteriorly in a rather shelf-like projection which is able to withstand these forces even less well than the posterior alveolar components.

Since we have now considered in detail the compressive force of the lip, it might be well for us to examine the ways in which its force can be resisted. In order to prevent collapse of the dental arch it is necessary that the arch be supported in compression. It is necessary that this support be provided at the time of lip surgery at which time no teeth are in evidence. In order to meet this challenge, we devised an expandable bar of stainless steel consisting of a screw and a threaded cylinder into which it can be introduced. The ends are broad for weightbearing, save for short extensions, which are necessary for retention of the device.

These palatal bars (Fig. 9) are made in convenient sizes of stainless steel by a skilled machinist. Seven-eighths of an inch to one inch in length is the size which we have found to be required most often. In introducing this device bur holes are drilled into the palatal bones on opposite sides of the cleft, using the right angle handpiece. The retention pin is inserted into the drilled hole and a suture, which has previously been wrapped around the cylinder, is pulled. With fixation of the screw, the cylinder turns much as a top spins, and its retention point is directed into the appropriate position. A wire is passed through holes in each end of the device to prevent collapse or aspiration, and is carried out through the nostril and taped to the cheek.

The extensions for retention of this

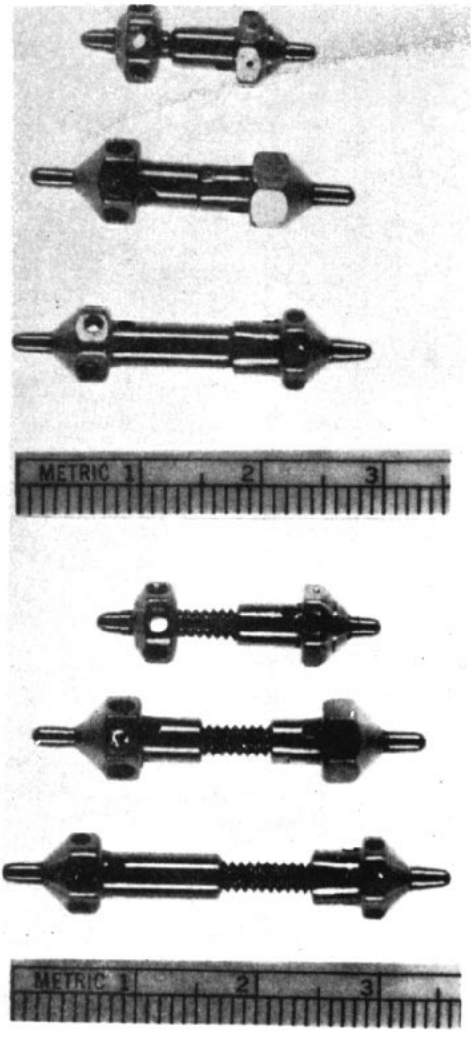
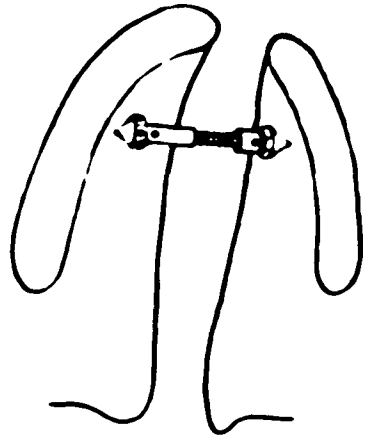


Fig. 9



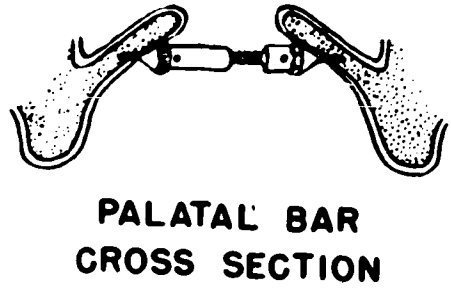


Fig. 10

device extend through the palatal bone but not into the alveolar ridge and do not interefere with the dentition (Fig. 10).

An example of the clinical use of this device is shown in figure eleven. The bar was inserted into the palatal arch at age three months, at the time of closure of the cleft lip. The flaring of the alveolar processes on either side of the cleft is apparent. To the right it is seen with the bar in place six weeks later. The alveolar processes are seen to be on their way to a more normal contour as a result of the molding process of the lip. The dental arch has not collapsed, however. After being in position for about four months the palatal bar was removed and in the lower left, we see the contour of the alveolar arches about one month after its removal. In the lower right we see the last model made on this child at age ten months, showing a fair arch. With this bar in place and a retention wire through the nostril taped to the cheek, this child had no difficulty in eating, but gained weight normally. There was no evidence of infection about the bar, nor did the

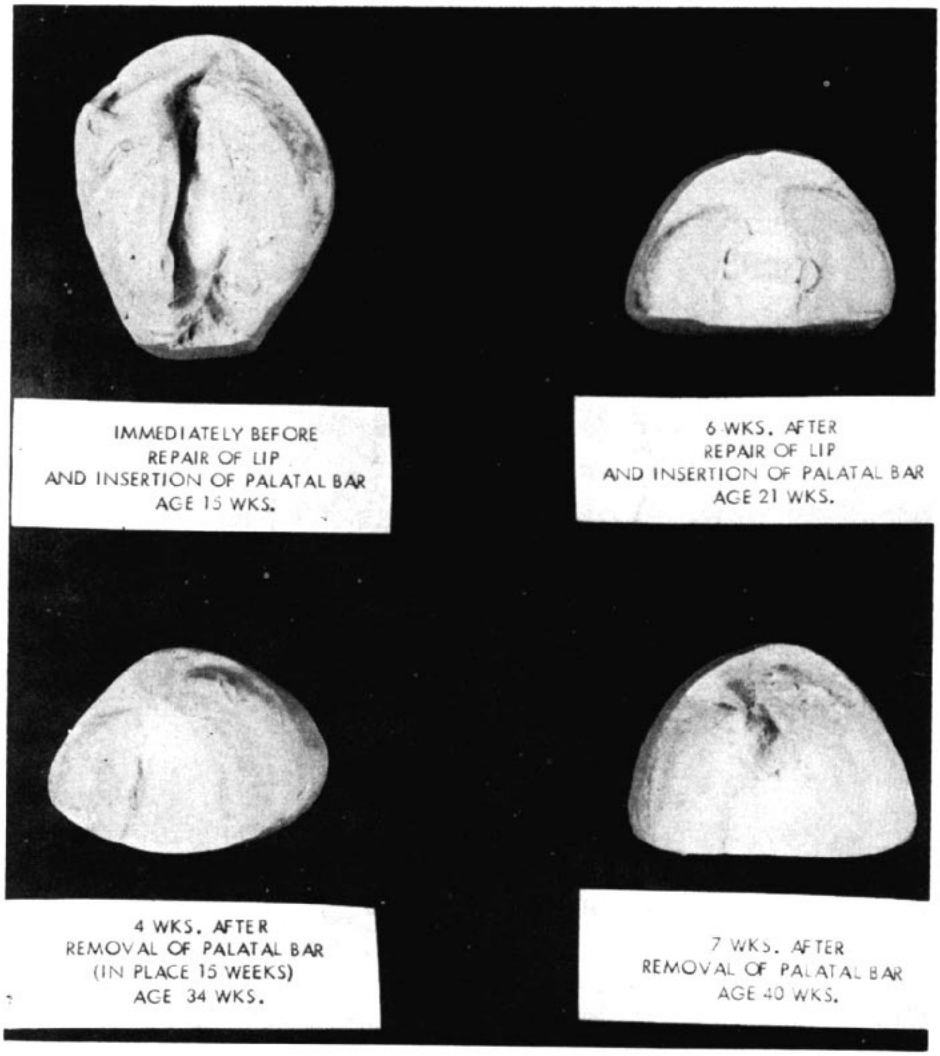


Fig. 11

child run a fever at any time. A few days after removal of the device there was no evidence of the site of its insertion. We have used this bar in but a few cases and it will require a long period of study to determine how long it should be left in place and just how satisfactory it is in preventing collapse of the dental arch. It may be that once satisfactory ossification of the maxilla has taken place the bar can be removed without fear of collapse.

In summary, an attempt has been made to review the gross forces at work on the alveolar segments of a patient with a cleft lip and cleft palate deformity. The possibility of reducing the compressive effect of the lip has been investigated along with the evolution of lip surgery. The possibility of supporting the alveolar ridges in compression, at least through the early period of ossification by the use of a palatal bar has been mentioned. Since the palatal

bar appears theoretically advantageous in supporting the alveolar segments in compression and has produced no obvious injury and no complications, we will continue to investigate its possibilities. Since this study was initiated about a year ago, we have just a few cases followed but for a very short period of time. This essay is in the nature of a preliminary report and is by no means to be considered as an unlimited advocation of the general use of this device. Although the malocclusions produced by early unsupported closure of the lip may be readily corrected by appropriate orthodontic therapy at a later date, there are significant numbers of such patients whom the orthodontist cannot reach. If this palatal bar proves successful, we sincerely hope it will lessen to some degree the very great need for orthodontic therapy which all these patients have. Dental study models and careful follow-up examinations will be made to evaluate the effect of this device and the results will be reported to you at a later date. Whether this proves to be a successful approach to this problem or not is less important than the development of a close cooperative effort on the part of the orthodontist and plastic surgeon to prevent or reduce deformities in the cleft lip and palate patient.

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This work was carried out in close cooperation with Dr. Wendell L. Wylie, without whose encouragement, advice and guidance it would not have been initiated.