

Maxillary Orthopedics and Anterior Palate Repair with Bone Grafting

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This is a two-part presentation designed to present a proper program for the treatment of complete clefts of the palate for the first two years. In many of these patients, except for the routine orthodontia with which everyone is associated, this may be their total surgical care.

Part I. Maxillary Orthopedics

Surgeons responsible for the total care of the patient with cleft palate have observed the problem of early collapse of the cleft segments followed by maxillary retrusion and poor facial development, and have felt the need for early orthodontic procedures to prevent and correct these deformities. Maxillary orthopedics in the newborn and orthodontic procedures in the four-year-old child, when properly coordinated, are now becoming part of the routine care of these patients. The practice of maxillary orthopedics in infants is still in the formative stage, but from early and encouraging results it seems that progress has been made. However, it should be realized that the following procedures are not necessarily the last word on the subject but should be viewed as a new effort to rehabilitate the cleft patient as soon as possible.

For the past two and a half years, we have been engaged in this work of maxillary orthopedics and bone grafting (1). The term maxillary orthopedics has been recently coined to denote the shifting of the maxillary segments of the infant palatal clefts by the insertion of acrylic plates to control or change the relationship of maxillary segments to each other and to the mandibular arch. Always, the aim is to create or maintain a harmonious maxillary arch, resulting in a proper relationship to the mandible.

If the condition present at birth requires no alteration, the segments are then maintained in proper position by the plate until they can be held by a bone graft. When the segments are in malocclusion with the mandibular arch, correction is started by the insertion of a plate using the motor force of the gumming and sucking of the infant to initiate the change while the motor force of the repaired lip is used to complete the shifting of the maxillary components. The plate simply serves to guide and mold the seg-

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ments. This sucking and gumming force can be increased by creating a groove in the maxillary appliance which relates to the mandible, as carried out by Burston (2, 3). However, this groove has rarely been used in our patients.

There is one interesting additional benefit in the use of the maxillary appliance. These babies all take the bottle easier and once a plate has been inserted, the baby often will not feed without it.

The following is the routine used in our office. All patients are seen at intervals of one to two weeks. However, a new baby seen for the first time must return twice a week until treatment is well established.

TECHNIQUE

First Office Visit. The patient is usually seen in the office at one to two weeks of age or whenever the mother and baby are able to travel. The type of arch deformity and its relationship to the mandible is noted. The width of the cleft is measured and photographs and impressions are made. In all of the planning for these babies, it is important for the maxillary arch to be properly related with the mandibular arch.

Using special trays (Figure 1) with large holes for easy fixation, an impression is taken with warm Kalginate.¹ Experience has shown that the impression material is prevented from oozing into the pharynx by use of a red wax dam across the posterior margin of the impression tray, a little projection of wax to fit into the cleft, and the holes in the tray. The baby is placed in a supine position with the head slightly extended, and a trial insertion of the tray is made to be sure that it will be of adequate size and shape for the arch. The Kalginate is mixed in a rubber bowl with warm water in a proportion of one to one. While this is being done the tray is held under warm water so that the impression material can set as quickly as possible. The tray is never filled above the level of its margins and the major portion of the Kalginate material is kept to the front of the tray. If the loaded tray is held under running lukewarm water the surface of the Kalginate assumes a very smooth texture for an accurate impression.

The tongue is held down with a tongue blade and the tray inserted into the mouth as quickly as possible. The tray is passed into the mouth against the tongue to the back of the hard palate and then pushed upward and forward. As the tray is pushed against the palate, the baby is raised to a sitting position holding the head slightly forward (Figure 2). This prevents gagging and lessens the danger of obstruction. It is quite important to have a suction operating with a tonsil tip. Palpation of the impression material by the assistant will reveal when it is set and ready for removal. Premature removal of the impression material will result in fragmentation with danger of respiratory obstruction. The impression is then examined to be sure that it is satisfactory regarding both detail and vertical length.

The impression can be poured into stone or wrapped in a moist medium and sealed with wax paper before being placed in the refrigerator.

A dental student comes to our office later in the afternoon and pours the

¹ Kalginate, Lee Smith Company, Chicago, Illinois.

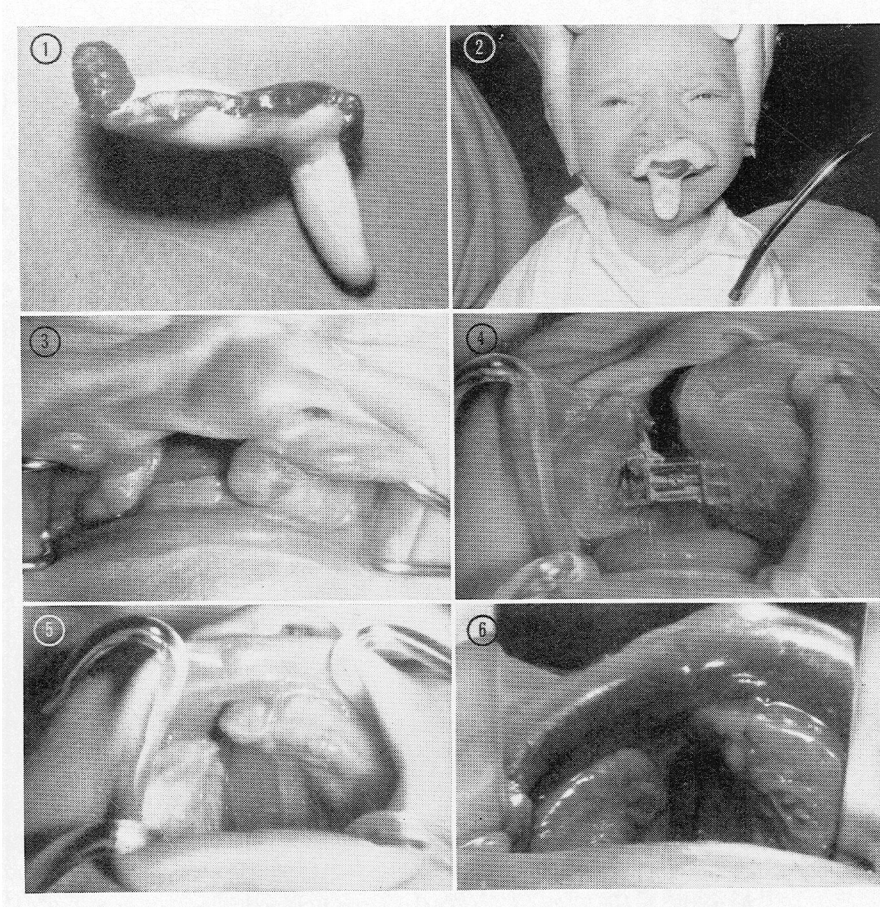


FIGURE 1. Infant acrylic tray with red wax on the margin.

FIGURE 2. Impression tray in place with the baby in sitting position.

FIGURE 3. Baby D.G. Occlusion at birth.

FIGURE 4. Baby D.G. Plate with screw in open position.

FIGURE 5. Baby D.G. Arch two weeks after lip repair.

FIGURE 6. Baby K.B. An 8 mm cleft five months after lip repair.

impression into stone. A proper plate is planned on the stone model based on the clinical appearance of the arch and its mandibular relationship. The dental student then prepares the plate with an expansion screw.

Experience has shown that a static plate should not be used for more than a few months because of the danger of restricting the growth of the maxilla. If the upper and lower arch relationship is satisfactory at the initial visit, the mother is instructed to turn the screw in the plate every five to seven days, which will produce .25 mm increase in the appliance. This amount is considered adequate for average growth of the maxilla. When expansion of the segments are required, the screw is turned every other day.

Second Office Visit. The patient returns in one to three days (unless they

are from out of the city in which case we try to have the plate completed the day of the initial visit). The plate is then inserted and checked for a proper fit, taking care that it does not extend too high into the sulcus or too far posteriorly onto the soft palate area. The mother is instructed regarding the removal and cleaning of the plate, which should be done once or twice daily. She is also shown how often to advance the screw. If the plate fits satisfactorily, it is coated with Poly-grip and inserted in the baby's mouth.

ILLUSTRATIVE CASE REPORTS

Arch of Greater Width than Mandible.

- A. Baby D.G. was born in January, 1963, with a 13 mm cleft (Figure 3). A so-called bypass plate was inserted (Figure 4) designed with the screw in the open position so that as the screw was turned, the maxillary segments are moved toward each other. This program was carried out with the mother turning the screw every other day for a period of three months. The cleft had been reduced to 8.5 mm and the lip was repaired on April 11, 1963 (Figure 5). The plate was left in place with the premaxillary segment on the noncleft side exposed to the pressure of the repaired lip. Three weeks after the lip repair, the cleft had been reduced to 5 mm, and the arch was quite symmetrical and in a better relationship with the mandible.
- B. Baby K.B. was born June 1, 1960. There was an 8 mm alveolar cleft at the time of the lip repair. At six months of age, she still had an 8 mm cleft (Figure 6) and a loose fitting appliance was inserted with outriggers taped to the cheek. The so-called "loose fitting" appliance relies on suction to pull the maxillary segments into proper position using the plate as the guiding mechanism. Continued use for eight weeks reduced the size of the cleft to 4 mm (Figure 7).

On February 11, 1961, an anterior palate repair was done using vomer and lip mucosal flaps for closure. A wedge graft from the sixth rib was inserted between the ends of the alveolar segments in the cleft (Figure 8). Use of the plate was then discontinued. X-ray films taken at one month following the graft (Figure 9) revealed the bone to be unattached as a foreign body. However, at four months films showed the bone graft to be completely fused and with normal appearance (Figure 10). At three years of age the arch and occlusion were proper and the x-ray films showed persistence of the bone graft with good bony stabilization of the alveolar cleft (Figures 11 and 12). X-ray films 27 months post grafting revealed the permanent central incisor growing into the bone graft. The lip at two and a half years is shown in Figure 13.

Protruding Premaxilla in the Unilateral Cleft

- A. Baby C.B. was born with a 9 mm cleft with the premaxillary segment on the normal side in a markedly protruding position (Figure 14). At 12 days a bypass plate (Figure 15) was inserted which did not cover the premaxillary segment. An elastic band attached to a cloth headcap was then used to bring

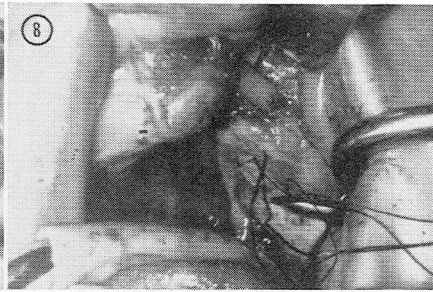
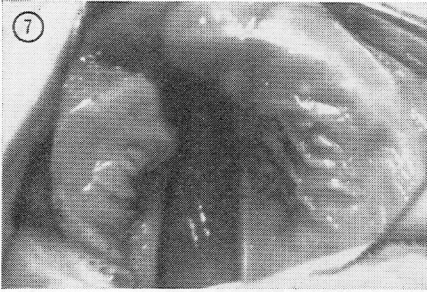


FIGURE 7. Baby K.B. Cleft reduced to 4 mm in the three weeks with loose fitting plate.

FIGURE 8. Baby K.B. Bone Graft between alveolar processes.



FIGURE 9. Baby K.B. X-ray film of graft, one month post-operative.

FIGURE 10. Baby K.B. X-ray film of graft, four months post-operative.

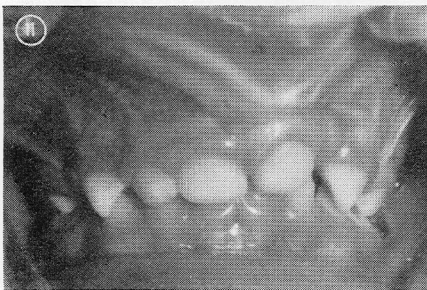


FIGURE 11. Baby K.B. Occlusion at three years.

FIGURE 12. Baby K.B. X-ray film of graft, 27 months post-operative.

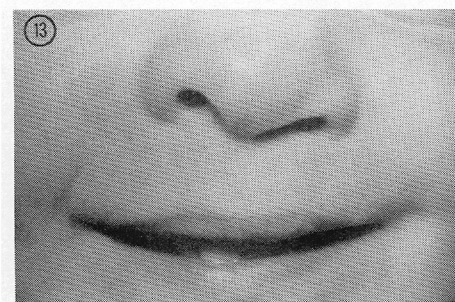


FIGURE 13. Baby K.B. Lip at two and one-half years.

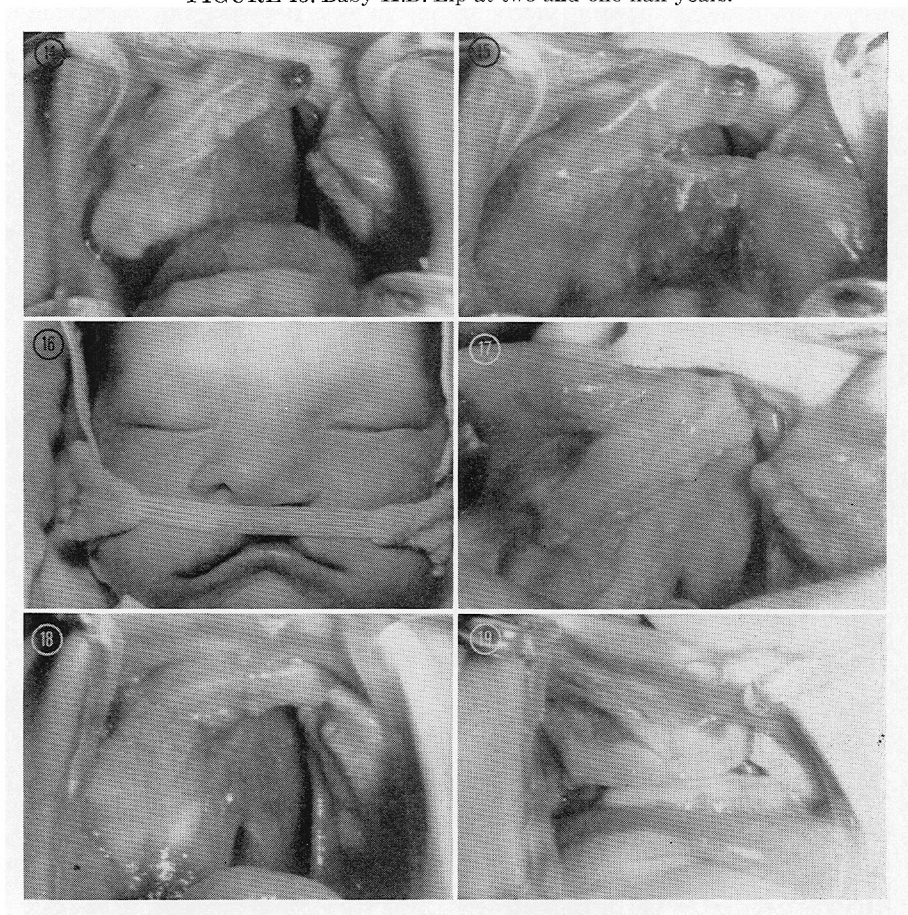


FIGURE 14. Baby C.B. Protruding premaxilla with a 9 mm cleft.

FIGURE 15. Baby C.B. Bypass plate with premaxilla uncovered. Note that the plate covers all the cleft segment.

FIGURE 16. Baby C.B. Elastic band pressure against the protruding premaxilla.

FIGURE 17. Baby C.B. Cleft reduced to 4 mm in width with two months of elastic pressure.

FIGURE 18. Baby C.B. Arch five weeks post-operative lip repair.

FIGURE 19. Baby C.B. Occlusion at two months post-operative lip repair.

backward pressure against the protruding segment (Figure 16). Continued use for a period of two months reduced the size of the cleft to 4 mm (Figure 17). The lip was repaired, using a modified Tennison technique. The arch at five weeks post-operative lip repair (Figure 18) was symmetrical, with the alveolar processes almost in contact. The occlusion one month later is shown in Figure 19.

Collapse of Cleft Segment

- A. Baby D.B. had a cleft of the anterior one-fourth of the hard palate (including the alveolus) with a collapse of the cleft maxillary segment behind the premaxillary segment (Figure 20). Because of a misunderstanding by the mother, there was a four-month delay before treatment was started. An acrylic appliance was inserted with an expansion screw designed to move the maxillary segment laterally (Figure 21). The mother advanced the screw every other day for a period of two months; a partial correction was achieved before the lip repair was carried out. At the time of the lip repair, an incision was made through the mucoperiosteum at the posterior margin of the cleft and a pocket created down the midline of the hard palate to the posterior margin. Using an osteotome, the cleft segment was then divided from the noncleft segment and a new plate inserted (Figure 22) in surgery. The forces of the lip repair could now be used to help move the maxillary segment laterally while the premaxillary segment rotated into better position. Other than

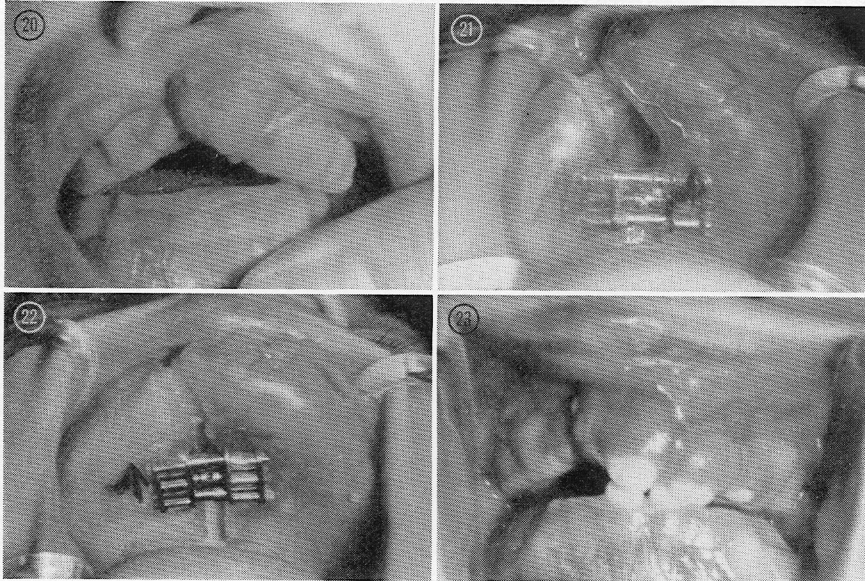


FIGURE 20. Baby D.B. Cleft of the primary palate with collapse.

FIGURE 21. Baby D.B. Acrylic appliance with expansion screws.

FIGURE 22. Baby D.B. Second acrylic appliance with expansion screws inserted in surgery.

FIGURE 23. Baby D.B. Occlusion at one year of age.

a slight overbite, the arch and occlusion were in good relationship at the age of one year, five months post-operative lip repair, (Figure 23).

The Bilateral Cleft

- A. Baby G.S. was born in September, 1961. He presented a protruding premaxilla (Figure 24) with the lateral maxillary segments in good relationship as far as the mandible was concerned. A plate was inserted at about two weeks to hold the lateral segments, while elastic pressure was brought to bear against the protruding premaxilla for a period of six and a half weeks (Figure 25). During this time, the premaxilla moved back sufficiently (Figure 26) to permit a two-stage closure of the lip without undue tension. The plate with an expansion screw was continued after the lip repair to prevent col-

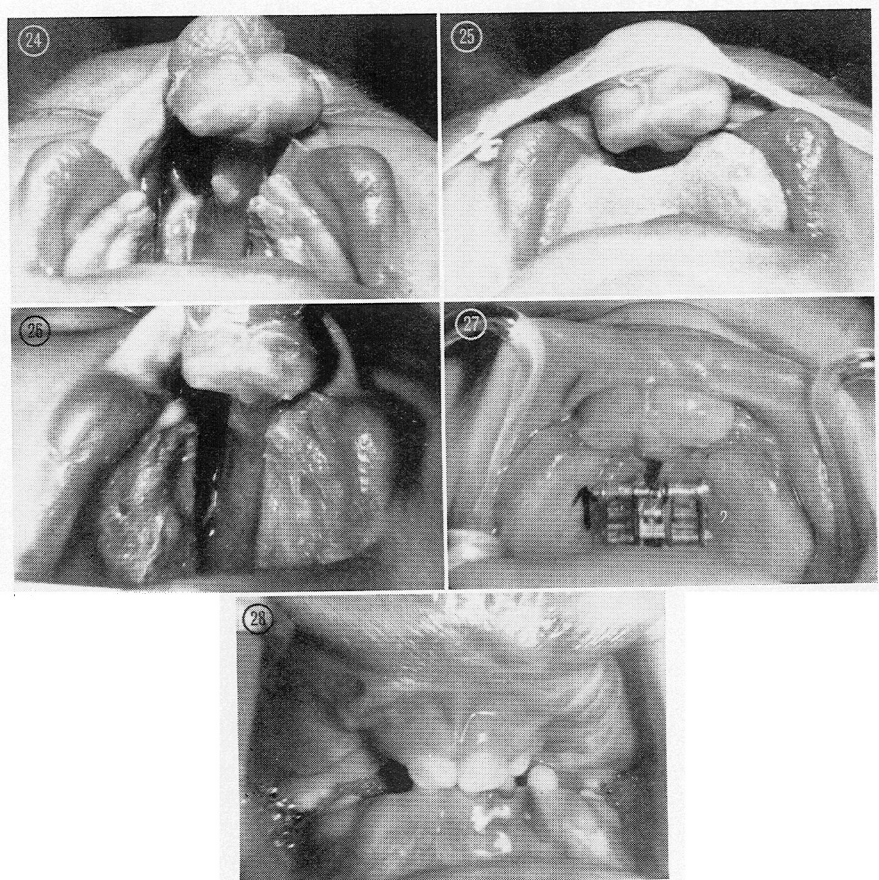


FIGURE 24. Baby G.S. Bilateral cleft with protruding premaxilla

FIGURE 25. Baby G.S. Elastic pressure against premaxilla with a plate to hold the lateral segments of the maxilla.

FIGURE 26. Baby G.S. Premaxilla immediately before lip repair.

FIGURE 27. Baby G.S. Revised appliance for continued expansion.

FIGURE 28. Baby G.S. Occlusion at 21 months of age, 10 months after bilateral bone grafts.

lapse of the maxillary segments and to keep up with the growth of the mandible (Figure 27). At 10 months of age, a bilateral on-lay bone graft was carried out without an anterior plate repair, and using split ribs to fix the premaxillary segment. The anterior plate repair was performed at 17 months, at which time use of the plate was discontinued. Figure 28 shows the occlusion at 21 months of age, 10 months post bone grafting.

Part II. Maxillary Bone Grafts

We are now bone grafting all of our complete unilateral and bilateral clefts at the time when the relationship of the upper arch with the mandible is as close to correct as possible. In the infant, this has been carried out as early as four months, with the average graft being done at a period of about eight to 12 months of age. These grafts have been placed before, during, and after the anterior palate repair.

Scott (4, 5) of Ireland has shown that the forward growth of the maxilla occurs primarily along the septal-maxillary junction. Fixation of the cleft to the normal maxillary segment should provide for a proper and orderly growth of the middle third of the face and prevent some of the retrusion that has taken place in the past. The purpose of the bone graft is threefold: a) to fix the cleft maxillary segment to the normal side; b) to provide support for the teeth in the region of the bony cleft; and c) to build out the flat contour often seen on the cleft side of the maxilla.

SOURCE OF THE BONE. We have used the fifth, sixth, or seventh ribs of the lateral rib cage in the midaxillary region. These grafts have been inserted as a wedge or on-lay graft, or a combination of the two. However, in every case, bone chips are also used to fill in the dead spaces.

WEDGE GRAFTS. These have all been done at the time of an anterior palate repair. The technique for this procedure is shown in Figures 29, 30, and 31. Figure 29 presents the incisions required to outline a vomer and lip mucosal flap. Figure 30 shows the vomer flap which is swung across and sutured beneath the muco-periosteum on the lateral side. The closure of

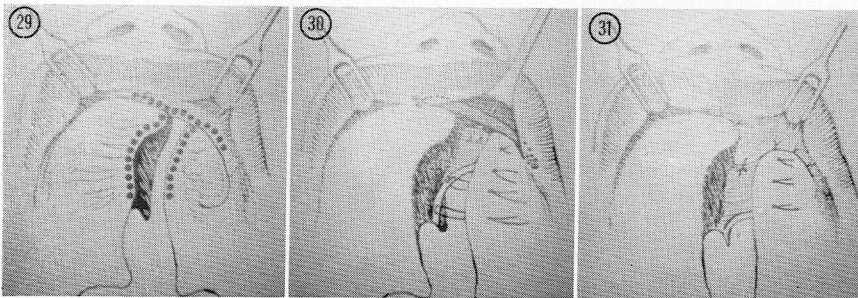


FIGURE 29. Incisions for vomer and lip mucosal flaps in anterior palate repair.

FIGURE 30. Vomer flap is sutured beneath muco-periosteal tissue on cleft side and to lip scar in sulcus. On-lay bone graft is in place.

FIGURE 31. Vomer flap sutured in place. Lip mucosal flap sutured over bone graft to vomer flap.

the alveolar and lip sulcus area is a special case and it is advisable to keep the incision more or less on the same level as the free edge of the hard palate. The flap from the alveolus on the medial side is actually a continuation of the vomer flap. On the lateral side a small flap is elevated from the alveolar area of the cleft and sutured not only to the flap from the medial side but also to the lip mucosal tissues. The deep closure in the sulcus and alveolar region is usually in the shape of an upside down T.

The incision is carried in the sulcus on either side of the cleft as in Figure 29, and the mucosa on the undersurface of the lip is undermined. This lip mucosal flap serves to cover all but the deep surface of the bone graft when sutured to the vomer flap behind the alveolar processes. Figure 31 shows this mucosal flap sutured over the graft to the vomer flap. The plate is reinserted with a small iodoform wick to cover the raw surface vomer flap. Figure 32 shows the closure when viewed from the sulcus and Figure 33 shows a wedge and on-lay graft in place.

Recently we have used a combination of wedge and on-lay grafts with the chips placed around the wedge graft. This will provide a maximum amount of bone in the cleft area.

The use of the vomer flap to cover the bone graft as suggested by Stellmach (6) would appear to preclude the use of this tissue for anterior palate closure and would therefore limit the amount of pushback of the palate.

ON-LAY GRAFTS. The on-lay graft is technically easier to do than the wedge graft and most of the grafts we have done have been of the on-lay type. These grafts vary in length from one and a half inches to three inches, and in one case, a graft was used to cover the area from premolar to premolar. In 22 of the patients, the grafts have been done after the anterior palate repair; in 12, they have been done at the time of the anterior palate repair; and in three patients, the grafts were done before the palate repair.

The surgical approach is quite simple. An incision is made in the sulcus (Figure 34) leaving about 3 mm of mucosa as a mucosal flap attached to the alveolus. A vertical incision is made to parallel the alveolar processes and is extended into the deep tissue before turning obliquely to the bone. This is necessary to provide a maximum amount of tissue attached to the alveoli. The muco-periosteum is elevated, creating a pocket on either side of the cleft. Where a palate repair has already been carried out, by careful sharp dissection between the alveoli, the operator can dissect in a plane between the nasal and oral surfaces backward into the cleft for a distance of 1 to 2 cm. Into this pocket, one may pack chips with an on-lay and/or wedge graft covering the area (Figure 35).

Figure 36 shows an x-ray film of chips in the alveolar cleft plus an on-lay graft. Where it is not possible to work into the bony cleft because of a fistula or because the palate has not yet been repaired, the graft is used as an on-lay with chips around the ends of the cleft.

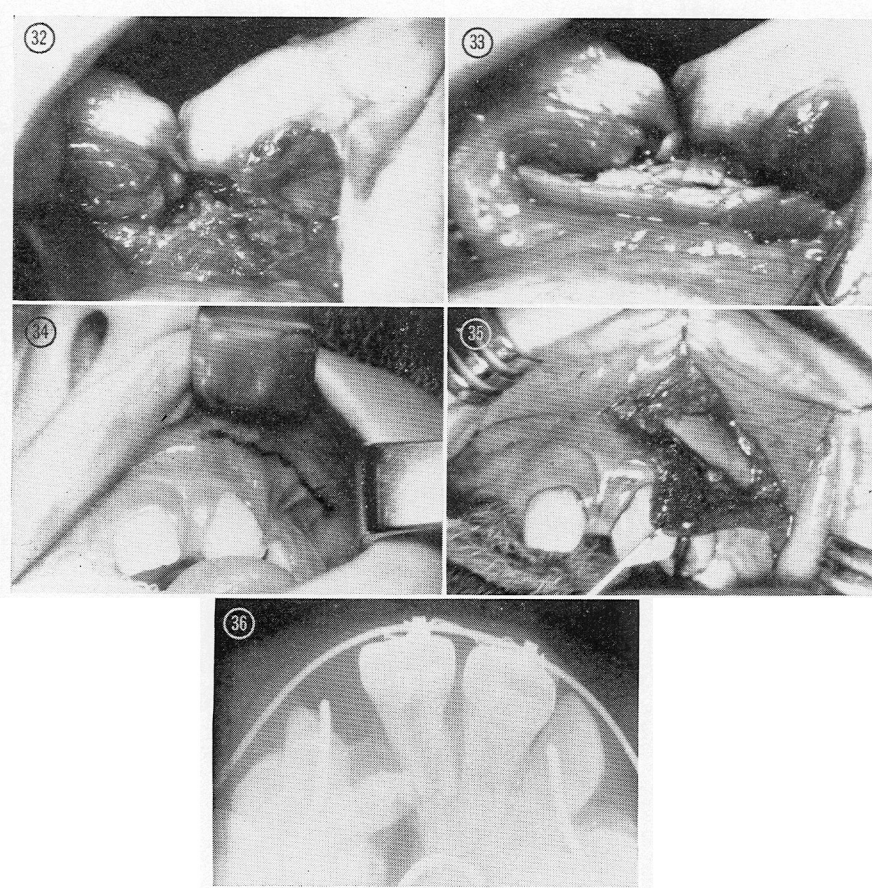


FIGURE 32. Closure of alveolar cleft and sulcus areas. Alveolar bone exposed.

FIGURE 33. Wedge and on-lay bone graft for baby C.B.

FIGURE 34. Incision outlined in sulcus.

FIGURE 35. Bone graft in place with an adequate mucosal flap attached to the alveolus.

FIGURE 36. X-ray films of a bone graft at 15 months post-operative.

Summary

Maxillary orthopedics is a technique which recently has developed considerable interest in this country. It is a program planned to control the movements of the maxillary segments in the unilateral and bilateral clefts of the palate by the insertion of an acrylic appliance. This will create or maintain a harmonious upper arch with a proper relationship to the mandible. After a suitable period of time, the segments are fixed by either a wedge or an on-lay split rib bone graft. Several patients are presented along with the techniques of the procedures employed. Much of this work can be carried out in the office on out-patients, using an ortho-

dentist or dental technician or both in an advisory capacity to help with the mechanical aspects of the problem.

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