

# Varying Concepts in Bone Grafting of Alveolar Palatal Defects

NICHOLAS C. GEORGIADÉ, D.D.S., M.D.  
KENNETH L. PICKRELL, M.D.  
GALEN W. QUINN, D.D.S.

*Durham, North Carolina*

The increasing interest in and apparent success of techniques used by many of our European colleagues for using an autogenous bone graft for bridging the gap of clefts in the alveolar ridge with the resultant stabilization of the alveolar ridge and associated surrounding palatal bone stimulated us to adapt some of these procedures, both as primary and secondary osteoplasties. Approximately 10 years ago interest in closure of secondary alveolar clefts (including the palate) was reported by Nordin and Johanson (3) of Sweden and at about the same time by Schmidt (4) of Germany. Schrudde and Stellmach (5, 6) in 1958 reported on their experiences in the use of autogenous rib grafts in bridging defects anterior to the alveolar process. A concerted effort was made by these and other surgeons to utilize various types of flaps and sources of autogenous bone for reconstruction of both the alveolar arch and, as much as feasible, the bony palate in order to have the maxilla retain its proper relationship with the mandible during facial growth. (5-11).

In initiating a review of over 2,200 of our cleft lip and palate patients, it became clear to us that many of our results, particularly in the bilateral cleft and complete alveolar cleft group, were short of our desired goals from both functional as well as esthetic standpoints. In order to better understand the surgical possibilities for a more satisfactory attainment of our goals, we endeavored to review the various European schools of thought and we visited some of the maxillofacial centers of interest to discuss with them and see first hand their approach to the problem. The various clinics and clinicians we visited, over a two year period, were kind enough to show us many of their post-operative results both in primary and secondary cleft lip and palate patients. We discussed operative procedures, per se, and were able to examine the exceedingly fine collections of pre- and post-operative radiographs, study models, and appliances which were obtained pre-operatively as well as post-operatively following bone grafting of the alveolar cleft.

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The authors are affiliated with the Divisions of Plastic, Maxillofacial and Oral Surgery, and the Division of Orthodontics, Duke University School of Medicine, Durham, North Carolina.

In order to best describe our conclusions it seems appropriate first to point out that in this as in many other facets of our reconstructive surgery, the enthusiasm of the individual surgeon for a particular procedure needs to be considered. It became apparent to us very quickly that no one surgical procedure could be used for closure of all the various sizes of alveolar clefts both in the unilateral as well as the bilateral defect.

### **Types of Bone Implants**

**RIB BONE.** Autogenous rib grafts are obtained from the fifth to seventh ribs, right side, using an incision inferiorly and laterally to the areola in the anterior axillary line (Figures 1, 2a and 2b). If two stages of bone grafting are necessary, the same incision can be used for removal of an adjacent rib during the second stage a few months later.

Three techniques may be used in implanting rib bone in its new bed in the oral cavity. (a) An eccentrically placed H-shaped rib strut can be used which is wedged into the cleft with the more prominent portion of the bone placed on the labial aspect to elevate the slight depression usually found in patients with complete alveolar clefts. Bone chips may then be placed around the solid bony structure. (Figure 3a). (b) A solid piece of rib can be used following linear separation at the ends exposing the cancellous portion of bone. This is placed along the labial and palatal portions of the alveolar ridges with the solid portion in the cleft area (Figure 3b). (c) The rib can be broken into many small chips and packed into the cleft and into the mucoperiosteal pocket created by the flaps (Figure 3c).

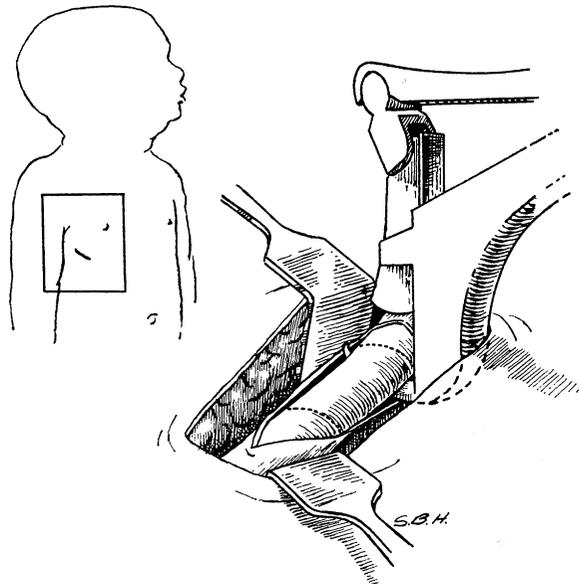
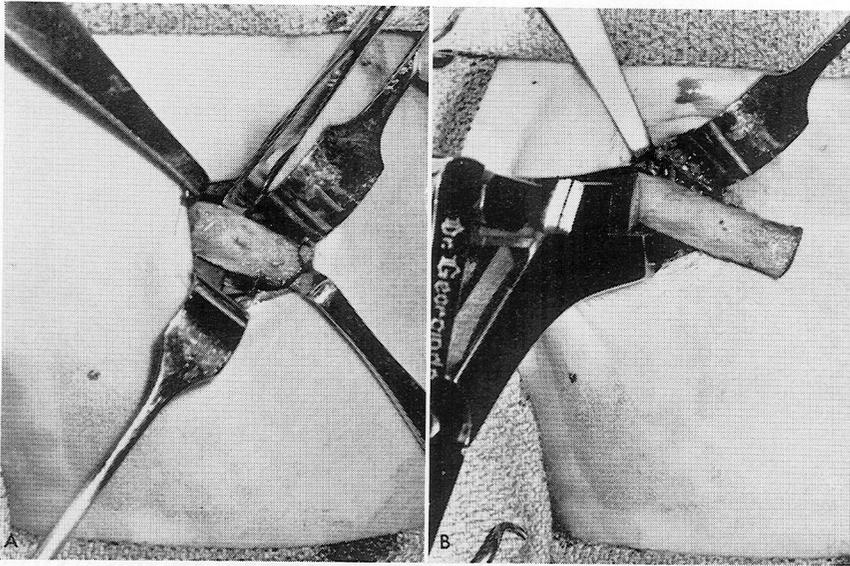


FIGURE 1. Area of incision in right anterior axillary line. Schuchardt rib cutter illustrated. Periosteum is approximated following removal of bone.



FIGURES 2A and 2B. Technique for exposing and excising rib graft.

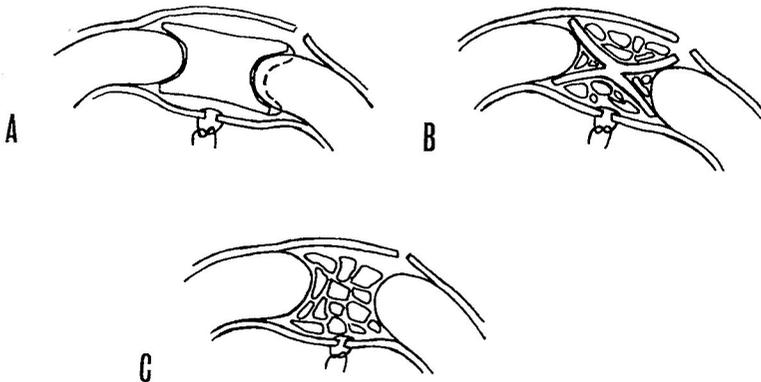


FIGURE 3. A. Illustration of rib graft inserted between exposed alveolar cleft edges with extension of bone graft to labial and palatal areas. B. Linear separation of rib ends and inserted into cleft with apposition of cancellous portions to the bony surfaces of the alveoli.

**ILIAC BONE.** The use of cancellous bone from this area appears to us to be preferable in children because of the large supply of cancellous bone available inferior to the crest (Figure 4). There is probably more rapid calcification with new bone formation when this type of bone is used. A large dental amalgam plugger has been found to be most useful in packing the cancellous bone into position.

**TIBIAL BONE.** This technique has been demonstrated by Johanson and Ohlsson (1) in young infants (in the pre-weight bearing stage) and utilizes a medial, slightly curved incision with excellent exposure of the

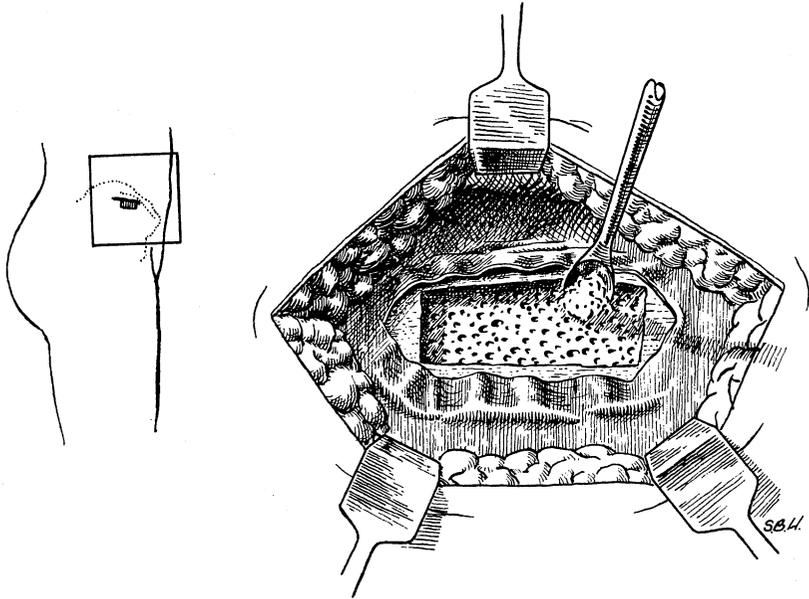


FIGURE 4. Area of iliac bone usually used for obtaining cancellous bone. Note incision is not made on the iliac crest but approximately 2 cms inferior. A large curette can be used for the removal of the cancellous bone following removal of the thin cortical plate of bone.

tibial shafts (Figure 5). A large supply of cancellous bone is available. Post-operative x-ray films taken routinely of the areas failed to reveal any abnormalities in the bony areas from which the grafts were taken. Cosmetically the post-operative incision appeared to be quite acceptable particularly in the male child.

#### *Types of Tissue Flaps Used with Bone Grafts*

**LOCAL FLAPS.** Local flaps from either bilateral or unilateral clefts of the alveolar ridge are obtained from the labial alveolar ridge areas and rotated in hinge-like fashion based either medially or laterally toward the palate exposing the bony segments of the alveolar clefts. The labial defect is then closed with any of a number of labial flaps which can be rotated from the medial or lateral aspect into the defect over the overlying bone implant. The flaps are closed generally with 4-0 nylon suture material on a small CE-2 type needle (Figures 6 and 7).

**DISTANT FLAPS.** Distant flaps (one stage vomer) are used for wider clefts of the alveolar ridge. This type of flap, used by Schrudde and Stellmach (5-8), is easily elevated and transferred in one stage directly anteriorly to meet an oncoming flap from the labial surface to cover the bone implant. The denuded vomer can be covered with a small palatal pack for 24 to 48 hours to minimize loosening if necessary. Bilateral

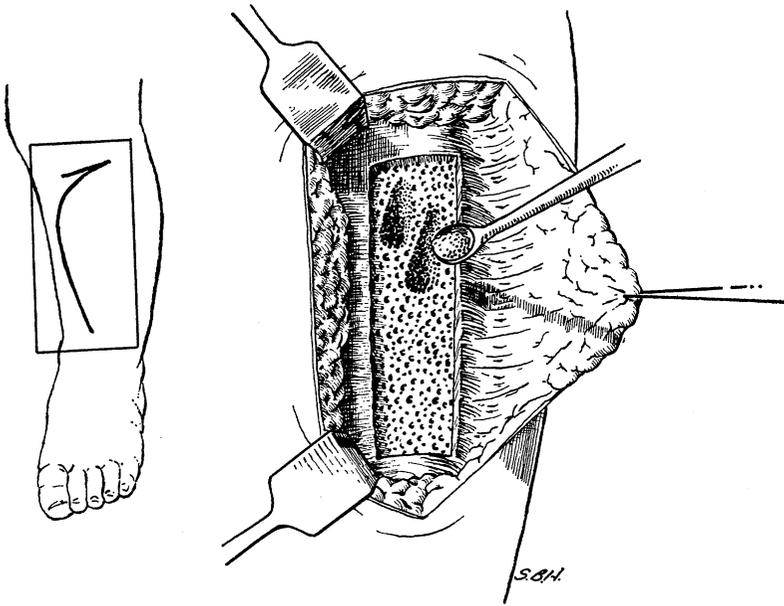


FIGURE 5. Donor site for obtaining cancellous bone from the proximal tibial area utilizing a medial curved incision which is then retracted exposing the tibial shaft. A cortical segment is removed and desired quantity of cancellous bone and bone marrow is taken and then packed into the alveolar cleft and palatal cleft. (After Johanson)

vomer flaps utilized in bilateral clefts are formed in two stages at intervals of two or three months. Elevation of two vomer flaps with denudation of both sides of the vomer bone in one stage may jeopardize the blood supply of the vomer (Figure 8).

**LOCAL VOMER FLAPS.** The local vomer flap (two stages) is used in conjunction with local alveolar flaps during the initial repair of the lip when the infant has regained his or her birth weight and then an additional one pound. (Approximately 10 pounds in weight is the usual desired weight.) The mucosal flaps are rotated and used to close the nasal floor along the cleft. A longitudinal vomer flap is developed and transferred in a hinge-like manner to the lateral palatal cleft and inserted into a pocket under the muco-periosteum. This raw surface on the exposed vomer flap is rapidly filled with granulation tissue which becomes epithelialized in approximately four weeks. The second stage repair of the alveolar cleft is performed approximately three months later. At the same time, most of the surgeons we visited "take down" the lip and prepare the alveolar ridge area for bone grafting. The bone utilized in this technique is autogenous bone either from the iliac crest (in children), or from the tibia in the non-walking infants (age 3 to 9 months), or from the right rib cage in the sixth and seventh rib areas. The previously transferred vomer flap is undermined carefully and cancellous bone is packed into the defect

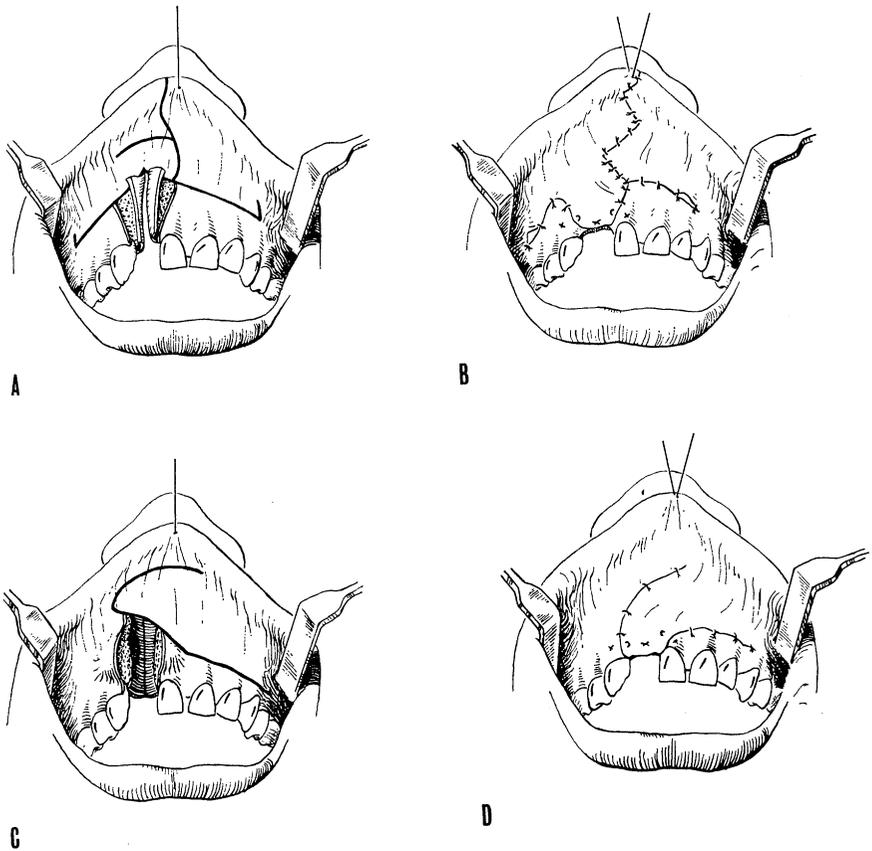


FIGURE 6. Palatal flaps are developed initially and turned in and approximated with 4-0 nylon sutures for prolonged stability. Care must be taken to close any nasal-oral opening. Medial or lateral flaps are then developed and advanced to cover bone graft. (After Schuchardt and Pfeifer)

following exposure of the denuded bone edges including both the labial as well as the palatal aspects of the cleft. Local and labial flaps are then used as described previously along with repair of the cleft lip (Figure 9).

It appears to us that expansion of the alveolar arches may be necessary prior to some types of alveolar cleft repair in order to obtain the best possible arch form. The prosthetic appliances as designed and utilized by Johanson and Ohlsson (1, 2) in their orthodontic management of their patients appeared to us to be particularly successful. The management can be begun three weeks post bone graft. Appliances used in all other clinics which were visited stressed the importance of post-operative insertion of appliances.

### Summary and Conclusions

Repair of the alveolar cleft appears to be useful if any degree of stability is to be expected in the alveolar arch. Studies elsewhere have shown

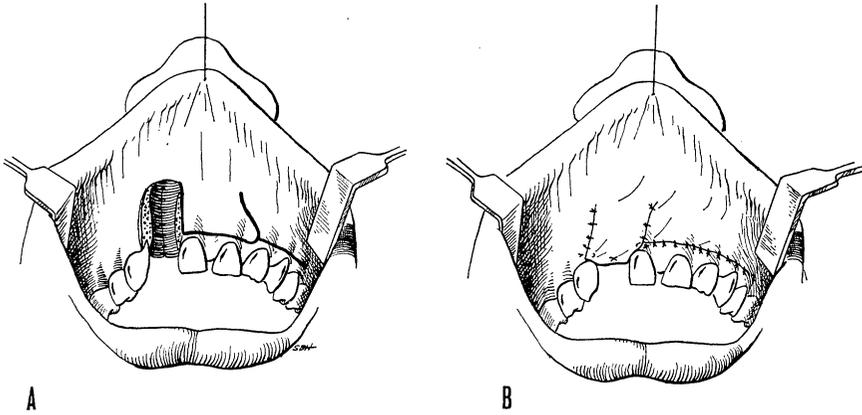


FIGURE 7. Local medial flap rotated over exposed bone and subsequent bone graft.

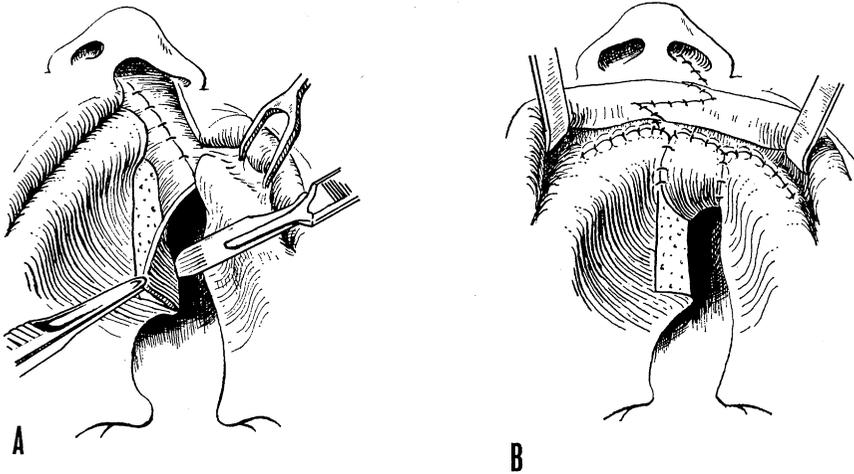


FIGURE 8. A longitudinal vomer flap developed and turned on itself following closure and creation of a nasal floor is used as illustrated for the wide alveolar clefts. (After Stellmach)

that there is usually an accompanying hypoplasia of the alveolar ridge and that approximation of the bony alveolus is not desirable in many cases since it will only accentuate the deformity and alveolar collapse. The replacement of the missing segment of the alveolar arch with a bone graft appears to have considerable merit.

Following an evaluation of this problem made possible through the generosity of many European clinicians we feel that repair of cleft lip can be performed at any time when medically feasible. At the same time if oriented study models, cephalometric studies, etc., indicate that the time is propitious for closure of the alveolar cleft this can also be performed at that time (however, a 2 to 3 hour procedure may be contra-

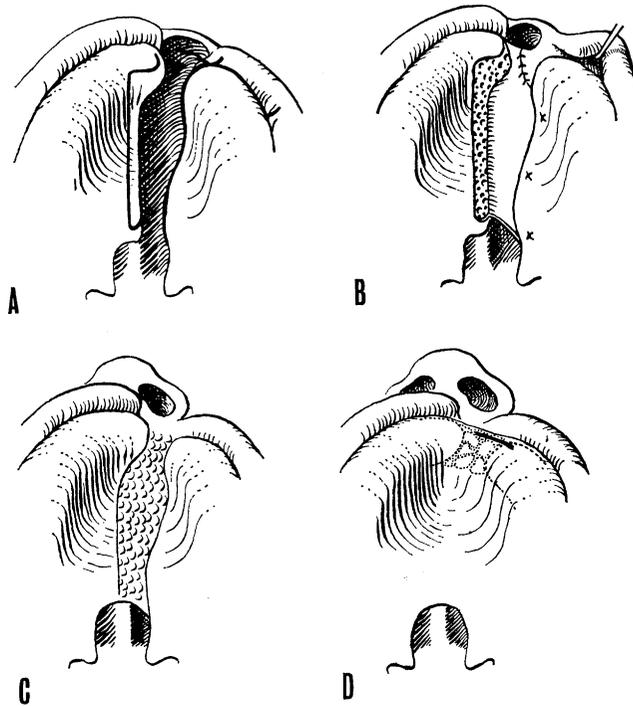


FIGURE 9. A, B. Technique of development of vomer flap and creation of a nasal floor are shown. C. Following transfer of vomer flap to lateral palatal area granulation and epithelialization will occur over a four week period. D. Three months following transfer of vomer flap a labial incision can be created under new epithelial surface exposing not only the alveolar cleft but also the palatal-vomer cleft, and cancellous bone is then packed into this defect. (After Johanson)

indicated in the very small infants). If a long vomer flap is not indicated, a local vomer flap with transposition can be performed easily at the time of the lip repair with bone grafting then to be carried out at age 4 to 5 months. If one desires, repair of the cleft lip can be put off until the patient is approximately four months of age and at that time a long vomer flap or local flap technique with bone grafting and repair of the lip can be performed in one stage. Since most of the alveolar clefts are hypoplastic, bone grafting should be performed prior to any collapse of the arches. The use of prothetic appliances pre- and post-operatively should be included in the armamentarium of cleft palate management along with orthodontic evaluation from the initiation of treatment.

Our general conclusions at this time, with 42 cleft palate patients in various stages of pre- and post-operative bone graft (29 post bone grafting and 13 undergoing orthodontic evaluation and treatment), lead us to believe that these procedures either singly or in combination will become a part of the overall management of patients both as primary and secondary procedures. We will watch with interest this group of children

as they attain maturity before finalizing our thoughts with special emphasis in our present and future endeavors in the prevention of alveolar collapse and, where necessary, pre-operative expansion of the maxillary arches prior to bone grafting.

*Duke University Medical Center  
Durham, North Carolina*

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