Early Maxillary Orthopedics in Cleft Palate Patients: A Clinical Report

MELVIN SPIRA, M.D., D.D.S.
SONIA FINDLAY, D.D.S.
S. BARON HARDY, M.D., F.A.C.S.
FRANK J. GEROW, M.D.
Houston, Texas

The concept of maxillary orthopedics in cleft palate treatment is relatively new, and reflects a changing trend in the management of these deformities. Early dental arch defects and late malocclusions are frequent, although varying in degree, and generally have been accepted as unavoidable.

In the past, classical orthodontic treatment has been predicated on acceptance of the basic deformities, which involve not only the teeth but also the jaws, nose, and midface. Thus the orthodontic course has usually followed the familiar pattern of waiting until the permanent dentition has partially erupted, and of then utilizing a variety of appliances and techniques to move the teeth into a more functional and esthetic position. Nasal and midfacial deformities have usually been relegated to the surgeon and prosthodontist later for attempted correction.

Within the past two decades changing concepts have radically altered the approach to this problem. Harvold (*10*) and Kettle (*13*) refused to accept the collapse of the upper arch segments in complete cleft palate patients. After surgical repair and prior to the development of the fixed deformity, they utilized orthodontic appliances following eruption of the first permanent molars to move the arches to a more favorable position. Similarly, Pierce and associates (*19*), in 1955, stressed the advantages of orthodontic treatment instituted in cleft palate patients as early as the age of four. Using fixed coil spring appliances, the deformed segments were brought early into improved alignment, thus correcting the malocclusion and hopefully influencing the direction of growth potential of the involved bone.

Pruzansky (*21*, *22*) cited growth studies to substantiate the benefits of early orthodontic intervention following the eruption of the deciduous dentition, about the age of three. He described the rapidity of tooth and alveolar arch movement which takes place in these youngsters as

The authors are all affiliated with the Cora and Webb Mading Department of Surgery, Division of Plastic Surgery, Baylor College of Medicine.
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providing an incentive to initiate early orthodontics. Trussler and others (*27*) called attention to the effectiveness of early orthodontia in correcting arch malformations and in reducing associated hearing and speech problems.

Thus the stage was set for McNeil (*14, 15*) who, in 1954, after several years of investigation, described intraoral appliances introduced in infancy to achieve early correction of malaligned dental arches. By utilization of a prosthesis, which directs arch movement prior to surgical intervention, arch deformities are prevented or minimized before they develop. Burston's technique (*3*), though modified and refined, is similar in principle, and both methods take advantage of the rapid growth in this area in early infancy. The plates are designed to bring the lateral segments of the affected sides outward and forward. When necessary, extraoral compression is introduced to mold the premaxilla. Treatment is begun as soon after birth as possible, with the appliance frequently inserted before the infant is one week old. Harkins (*9*) successfully utilized a combined approach in bilateral cleft palates with an expanding maxillary prosthesis initially, followed with a spring device.

A final refinement in maxillary orthopedics has been the introduction of bone grafting to the alveolus and palate in cleft palate infants, combined with early anterior palate repair. Nordin (*17*), Johanson and Ohlsson (*12*), and Stellmach and Schrudde (*23, 26*) were among the early proponents of this method. They and others inserted cancellous bone from the iliac crest, tibia, or segments of rib into the defect following the alignment of the maxillary arches. This sophisticated approach, based in part on the premise that there are actual bone deficiencies existing in the cleft palates (*4*), unites the cleft and presumably promotes a more normal development with an assist from the active septal growth center on the uncleft side. Within the past decade a number of investigators (*1, 2, 5, 7, 8, 11, 16, 18, 24, 25*), working together and independently, have reported the results of early maxillary orthopedics and orthodontic intervention with and without bone grafting. The beneficial results presented have been due to a combination of efforts of plastic surgeons and orthodontists working together.

The scholarly opposition to this method of treatment by Pruzansky and Aduss (*20*) is recognized and has merited serious consideration. Their longitudinal study of cleft palate patients has shown alveolar arch collapse occurring only in 40% of all those treated by surgery alone without maxillary orthopedics.

Aware of the clinical advantages which appear to accrue with the introduction of a prosthesis in early infancy, we have followed a "middle of the road" course in our group of cleft palate patients. We have combined concepts previously presented with new innovations, arriving at a method of treatment suitable and practical for this group of deformities.

Method

The patients in this neonatal predentition cleft palate group comprise 67 infants and include newborns through the age of 18 months or up to the age of first palate repair. At the initial examination, usually in the first week of life, a low fusing white modeling compound impression is made of the maxillae and a modified Kerr McNeil acrylic appliance processed. It is inserted and maintained on the palatine-alveolar surface by the mechanical action of the tongue and the buccal musculature during sucking motion assisted by an adhesive lubricant (Polygrip) or Vaseline. An extraoral string attached to the prosthesis and taped to the preauricular skin is used initially, but usually becomes extraneous as the infant accustoms himself to the appliance. The initial prosthesis (Figure 1) is of the passive type and serves to partially seal off the cleft, facilitating sucking and deglutition, and permits the mother to acquaint herself with the purpose and advantages of the treatment, promoting her early and continued cooperation.

In addition to the appliance, feeding is further facilitated by the use of the Nuk Sauger nipple (Figure 2). The nipple is placed into the mouth inverted with the aperture directed ventrally towards the tongue. Thus the fluid flows in a more normal direction away from the cleft defect. This maneuver brings the mandible and tongue into contact with the

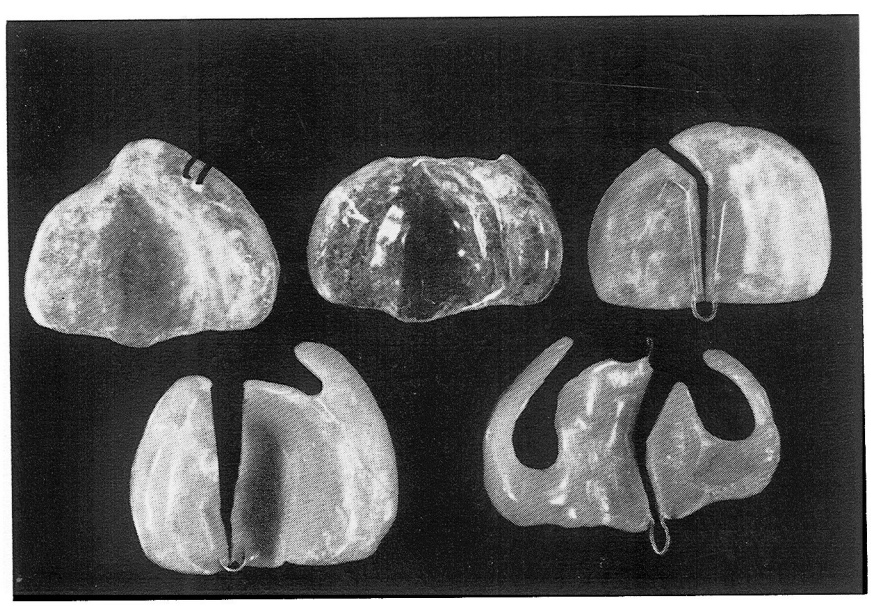

FIGURE 1. A variety of prostheses are employed. The initial appliance may be a simple plate (upper left) or may have an incorporated spring wire which is later activated by splitting the palate segment (upper right).

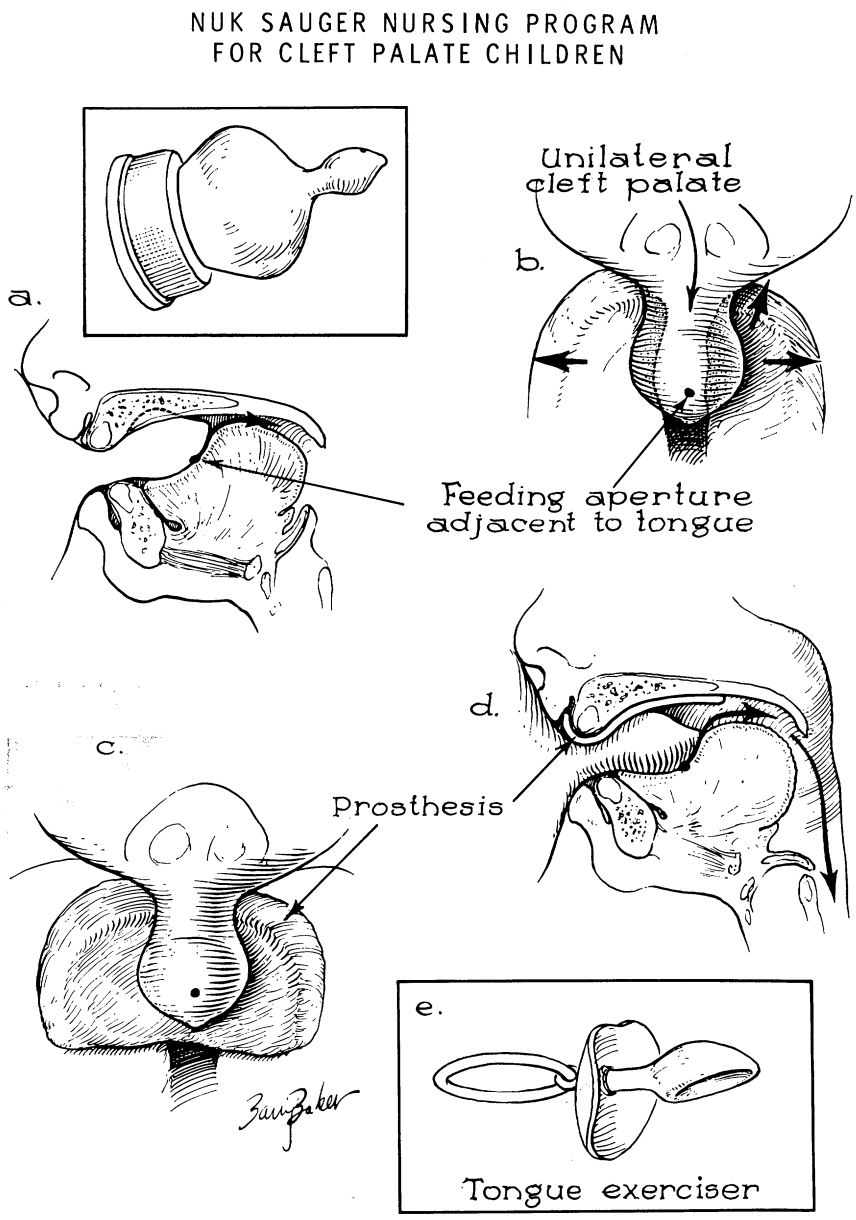

FIGURE 2. The use of the Nuk Sauger nipple and tongue exerciser.

baglet (bulb convexity), creating a forward thrust during sucking. This may provide an additional stimulus to anterior growth of the maxilla.

The active effect of the prosthesis on the alveolar segments is achieved by the addition of a posterior spring wire, with the appliance then split longitudinally away from the line of the cleft (Figure 1). When expansion

of the anterior segments of the alveolar arch is desired, the posterior spring is activated by opening the split prosthesis less than a millimeter at a time, creating a lateral pressure.

The expansion effect of the prosthesis can be increased by the utilization of a Nuk Sauger tongue exerciser. Intermittent coordinated action by the tongue and adjacent musculature serve to exert pressure against the midsection of the prosthesis, spreading the latter and transmitting this laterally directed force against the alveolar segment.

The orthodontist and the surgeon examine the patient weekly for the first one to two months of treatment. The visits are then at monthly intervals. The goal during this period of treatment is to assist natural growth factors through active expansion and to develop and maintain good arch form.

The treatment plan outlined is flexible and if there is any persistent tendency to collapse, it must be altered. Sometimes the addition of acrylic in selected areas on the medial cleft side of the palate surface of the prosthesis with a diametrical relief as indicated will further promote expansion when necessary. Occasionally a prosthesis is not as effective as is planned. In these cases dental casts are constructed, the maxillary segments are repositioned to a more normal arch form on these casts, and an acrylic appliance made from the models in the improved desired position.

The infant keeps the appliance in continuously; it is removed only for cleaning following feeding.

During the period of lip repair, which usually is performed in the second to third month of life, the prosthesis is trimmed accordingly and may be left in place postoperatively.

In previous methods of treatment, when the maxillary alveolar segments were in good alignment, serious consideration was given to bone grafting the anterior portion of the arches as other authors have described. We, however, have discontinued this procedure after a period of disenchantment because of late collapse. We have maintained the prosthesis as a space maintainer and obturator through the time of palatoplasty (ages 18–21 months) and/or through the period of eruption of the deciduous dentition.

In bilateral clefts the prosthesis is modified to maintain and/or promote expansion of the two lateral maxillary segments while repositioning the premaxilla (Figure 3). Where the latter is projected labially, shortly after birth an extraoral light pressure band over the protruding structure, attached by tape to the tragus, assists in bringing this segment back to a more favorable position. We have found no need for surgical repositioning of the premaxilla. The prosthesis is constructed with a double spring, split on each side, to allow and encourage lateral expansion. Subsequently the plate is modified to inhibit anterior development of the prolabium and late collapse of the arch segments in back of the premaxilla.

In all cases, measurement of arch position and movement are made

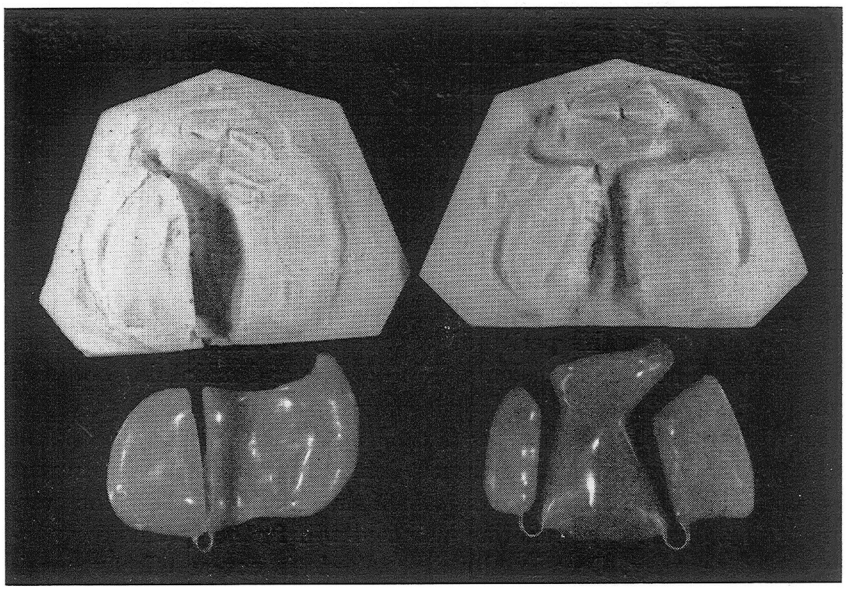

FIGURE 3. Typical appliances employed with unilateral and bilateral cleft palates. Note that the split in the prosthesis is away from the cleft.

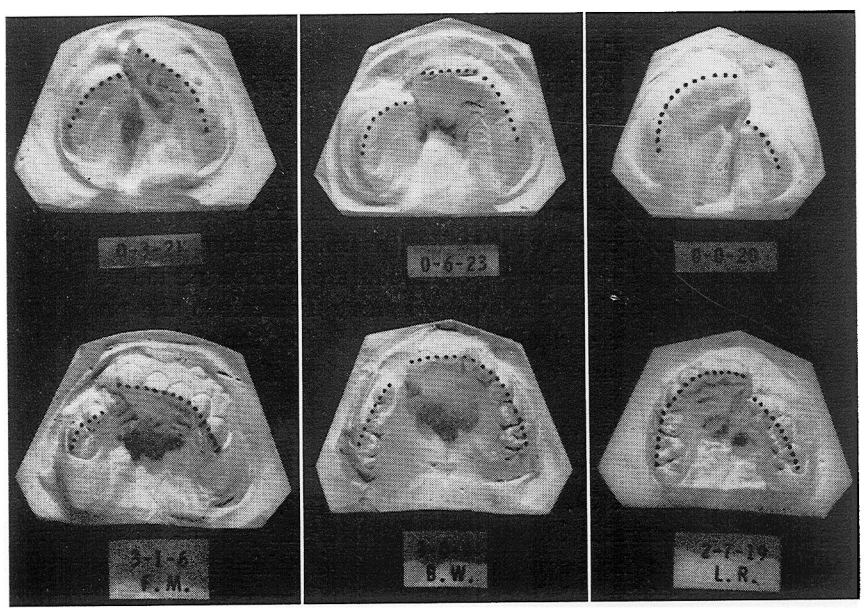

FIGURE 4. Typical examples of unilateral cleft palate patients treated with prosthetic appliances through the eruption of the deciduous dentition. The ages in years-months-days are shown for each patient.

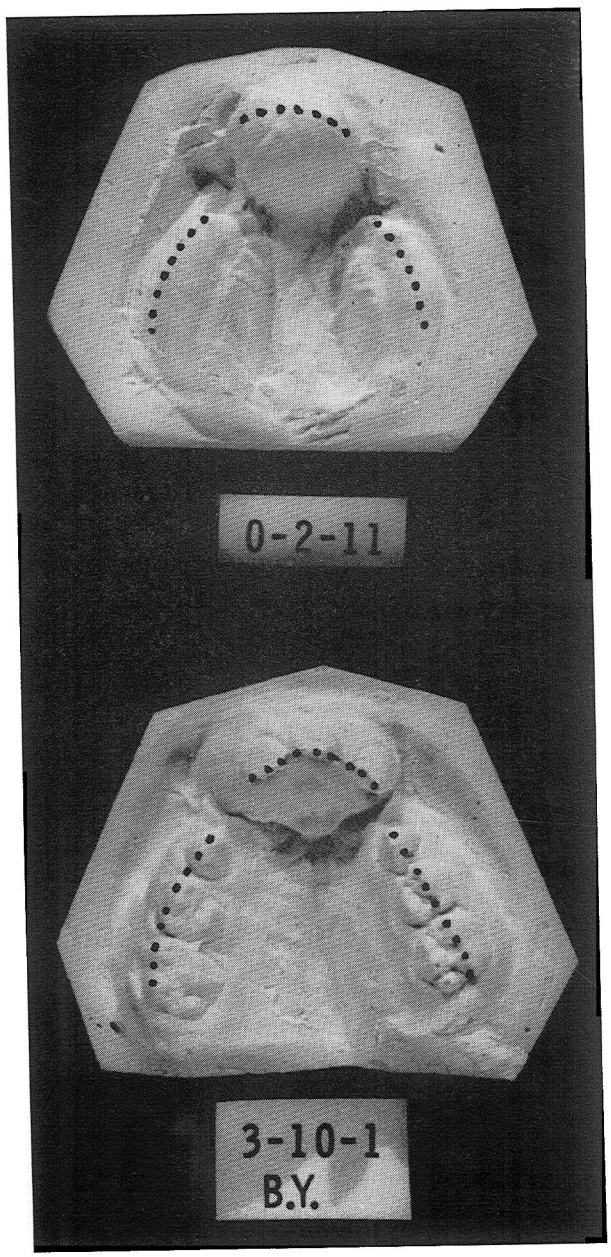

FIGURE 5. Bilateral cleft palate treated by continual wearing of a series of expansion prostheses.

monthly and correlated with overall maxillofacial growth. The appliances are changed as needed at the discretion of the orthodontic member of the team. Serial cephalometric radiographs have been secured in a few cases, but on most we take intraoral radiographs only to determine the local

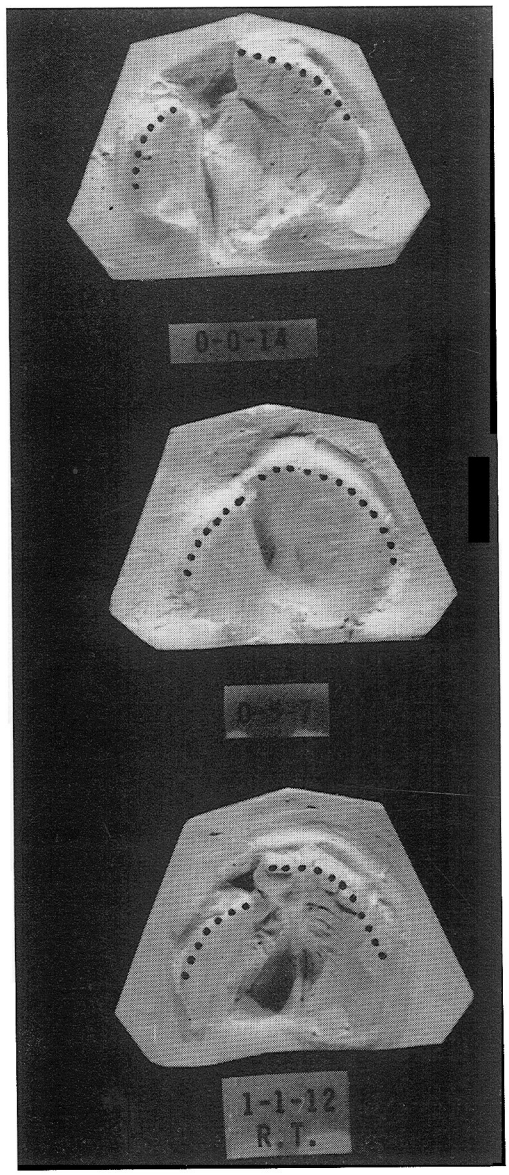

FIGURE 6. Patient discontinued the use of an appliance at six months of age. A degree of arch collapse occurred over the following six months.

bony growth, presence of teeth, and state of eruption at the alveolar cleft site. As the deciduous teeth erupt, the labial flanges are relieved to permit eruption of the incisors (Figure 1). Usually arch alignment is satisfactory at this stage. If further expansion is needed, a new appliance with a screw expander will encourage this after deciduous dentition has fully erupted.

The treatment plan outlined above is carried through the immediate

postoperative period of palate surgery, that is, to the 24th month. Ideally, at this age, lip and palate clefts have been closed, the arch alignment is satisfactory, and speech progress is well under way. A representative selection of patient's pre- and post-treatment casts is seen in Figures 4 and 5. The prosthesis must be worn through the period of eruption of the deciduous dentition, otherwise regression will occur (Figure 6). Minor degrees of collapse are easily corrected if they occur early and before the deciduous teeth have developed.

The effect on oral tissues of early orthopedic treatment in neonates has been of concern to us and others. The possibility of harm has been considered. Grossly, a prosthesis usually appears well tolerated with some thickening of the mucosa. Fisher and associates (*6*) could not corroborate histologically the clinical impression of thicker soft tissue along or around the cleft defect. In some, a thinning of this mucosa was found, suggesting that clinical observations could be accounted for on the basis of increased periosteal activity. These authors could ascribe no harmful affect to the prolonged wearing of a prosthesis.

Summary

A conservative maxillary orthopedic approach for cleft palate infants has been described. A series of prostheses are used early to help close the defect, to permit a more normal feeding pattern and, in combination with the Nuk Sauger device, to promote and maintain good dental arch form. Five cases are presented. It is hoped that the long term overall results will contribute to the improvement in function and esthetic appearance in these patients.

reprints: *Dr. Melvin Spira*
Division of Plastic Surgery
Baylor College of Medicine
1200 Moursund Avenue
Houston, Texas 77025

References

1. Brauer, R. O., T. D. Cronin, and E. Reaves, Early maxillary orthopedics, orthodontia and alveolar bone grafting in complete clefts of the palate. *Plastic reconstr. Surg., 29,* 625–641, 1962.
2. Brauer, R. O., and T. D. Cronin, Maxillary orthopedics and anterior palate repair with bone grafting. *Cleft Palate J., 1,* 31–42, 1964.
3. Burston, W. R., The pre-surgical orthopedic correction of maxillary deformity in clefts of both primary and secondary palate. *Trans. Internat. Soc. plastic Surgeons,* Second Congress, 1959, pp. 28–36. Edited by A. B. Wallace. Edinburgh: E. & S. Livingstone Ltd., 1960.
4. Coupe, T. B., and J. D. Subtelny, Cleft palate—deficiency or displacement of tissue. *Plastic reconstr. Surg., 26,* 600–612, 1960.
5. Crikelair, G. F., A. F. Bom, J. Luban, and M. Moss, Early orthodontic movement of cleft maxillary segments prior to cleft lip repair. *Plastic reconstr. Surg., 30,* 426–440, 1962.
6. Fisher, J. H., F. R. Shiere, M. D. Berkman, E. F. Cataldo, and H. R. Fogels, Oral tissue changes in infants with cleft palate. *Cleft Palate J., 4,* 316–326, 1967.

7. GEORGIADE, N., Early utilization of prosthetic appliances in cleft palate patients. *Plastic reconstr. Surg., 34,* 617–623, 1964.
8. GEORGIADE, N., K. L. PICKRELL, and G. QUINN, Varying concepts in bone grafting alveolar palatal defects. *Cleft Palate J., 1,* 43–51, 1964.
9. HARKINS, C. S., Retropositioning of the premaxilla with the aid of an expansion prosthesis. *Plastic reconstr. Surg., 22,* 67–74, 1958.
10. HARVOLD, E., Principles of orthodontic treatment of the upper jaw in cases of palate with total cleft on one side. *Norske Tannlaegeforen, Tid. 25,* 395, 1949.
11. HORTON, C. E., H. H. CRAWFORD, J. E. ADAMSON, S. BUXTON, R. COOPER, and J. KANTIS, The prevention of maxillary collapse in congenital cleft lip and palate cases. *Cleft Palate J., 1,* 25–30, 1964.
12. JOHANSON, B., and A. OHLSSON, Die Osteoplastik bei Spat Behandlung der Lippen-Kiefer-Gaumenspalten. *Arch. Klin. Chir., 295,* 876–880, 1960.
13. KETTLE, M. A., The orthodontic treatment of dental deformities due to cleft lip and palate. *Dent. Pract., 5,* 70–81, 1954.
14. MCNEIL, C. K., Congenital and oral deformities. *Brit. dent. J., 101,* 191–198, 1956.
15. MCNEIL, C. K., *Oral and Facial Deformity,* pp. 14–25. London: Pitman and Sons, 1954.
16. MONROE, C. W., B. H. GRIFFITH, S. W. ROSENSTEIN, and B. N. JACOBSON, The correction and preservation of arch form in complete clefts of the palate and alveolar ridge. *Plastic reconstr. Surg., 41,* 108–112, 1968.
17. NORDIN, KARL-ERIK, Bone grafting to alveolar process clefts following orthodontic treatment of secondary cleft palate deformity. *Trans. Internat. Soc. plastic Surgeons,* First Congress, 1955, pp. 228–232. Edited by Tord Skoog and Robert Ivy. Baltimore: Williams & Wilkins Co., 1957.
18. NYLÉN, B., Surgery of the alveolar cleft. *Plastic reconstr. Surg., 37,* 42–46, 1966.
19. PIERCE, G. W., K. F. TERWILLIGER, V. PENNISI, JR., and F. H. KLABUNDE, Early orthodontic treatment in cleft palate children. *Plastic reconstr. Surg., 16,* 3–15, 1955.
20. PRUZANSKY, S., and H. ADUSS, Arch form and the deciduous dentition in complete unilateral clefts. *Cleft Palate J., 1,* 411–418, 1964.
21. PRUZANSKY, S., Description, classification and analysis of unoperated clefts of lip and palate. *Amer. J. Orthod., 39,* 590–611, 1953.
22. PRUZANSKY, S., The role of the orthodontist in a cleft palate team. *Plastic reconstr. Surg., 14,* 10–29, 1954.
23. SCHRUDDE, J., and R. K. STELLMACH, Die Primare Osteoplastik—Der Defekte des Kiefer Bogens bei Lippen-Kiefer-Gaumenspalten. *Am. Saugling; Variaufige Mitteilung Zentrabl. Chir., 83,* 849–859, 1958.
24. SHIERE, F. R., and J. H. FISHER, Neonatal orthopedic correction for cleft lip and palate patients; a preliminary report. *Cleft Palate J., 1,* 17–24, 1964.
25. SKOOG, T., Management of bilateral cleft of primary palate-bone grafting. *Plastic reconstr. Surg., 35,* 140–147, 1965.
26. STELLMACH, R. K., and J. SCHRUDDE, Funktionelle Orthopedische Gesichtspunkte bei der Osteoplastik der Defekte des Kieferbogens bei Lippen-Kiefer-Gaumenspalten. *Fortschr. Kieferorthop., 20,* 372, 1959.
27. TRUSSLER, H. M., T. B. BAUER, and J. M. TONDRA, Cleft lip-cleft palate problem. *Plastic reconstr. Surg., 16,* 174–188, 1955.