Dynamic Cleft Maxillary Orthopedics and Periosteoplasty: Benefit or Detriment?

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In 1990, Drs Millard and Latham published their initial experience with dynamic maxillary appliances (DMAs) and periosteoplasty for children with cleft lip and palate. The technique provided for alveolar alignment and consolidation, with elimination of oronasal fistulas. Opponents to this approach speculated about impairments to facial growth. To date no longitudinal studies have been published. Over the last 10 years, 35 unilateral and 10 bilateral complete clefts have been treated with this technique. All patients have been followed and documented clinically, orthodontically, and radiographically. Cephalometric analyses were performed on children after the age of 6 years. The children have excellent facial aesthetics with well-balanced lips and noses. Radiographs demonstrate bone within the repaired alveolar clefts. Articulated impressions show anterior and lateral crossbites in the unilateral patients that improve over time and appear to be correctable orthodontically. The bilateral patients have satisfactory occlusions and arch forms. Cephalometric analyses confirmed no evidence of skeletal crossbites or midfacial growth retardation. This is a work in progress that will continue as the children grow. Although definite and final conclusions would be premature, it can be stated that to date all patients are following consistent and favorable growth patterns. Our team is confident in proceeding with this technique.

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Clefting deformities of the lip and palate occur in approximately 1 in 800 births. They create significant physical and psychological challenges to patients, families, and physicians. The decisions made in the newborn period will be reflected for a lifetime.

In 1990 Drs Ralph Latham and Ralph Millard[1] published their initial experience with dynamic maxillary appliances (DMAs) and mucogingivoperiosteoplasty (periosteoplasty). Their proposed benefits included early alveolar arch alignment, elimination of the oronasal fistula, potential for bone growth across the repaired alveolus (possibly obviating the need for future bone grafting), improved nasal and facial balance, and soft-tissue repairs performed in a tension-free fashion on a stable bony platform.

Opponents to this approach postulate about the possible impairments to facial growth and the creation of the orthodontic cripple.[2,3]

To date there have been no published long-term studies to corroborate, elaborate, refute, or challenge this approach to cleft care.

Materials and Methods

From 1986 through 1997, 45 patients were treated in a standardized way. The 35 unilateral complete clefts and the 10 bilateral complete clefts each had passive removable obturators placed in their mouths at birth. These served as feeding aids as well as static appliances to hold the position of the cleft segments. At 6 weeks of age the static appliance was exchanged for the DMA (Fig 1), which during the ensuing 6 weeks brought the cleft maxillary segments into anatomic alignment (Fig 2). At 3 months of age the DMA was removed and a periosteoplasty was performed to fuse the aligned segments (Fig 3, along with lip and nose repair. When each patient was 1 year old, the hard and soft palate was closed using the Von Langenbach technique. Any small refinements to the lips and/or noses were performed prior to the patients' entering school.

All of the patients in the series were followed and documented by a team consisting of a plastic surgeon, an oral-maxillofacial surgeon, an orthodontist, and a prosthodontist. Each patient was

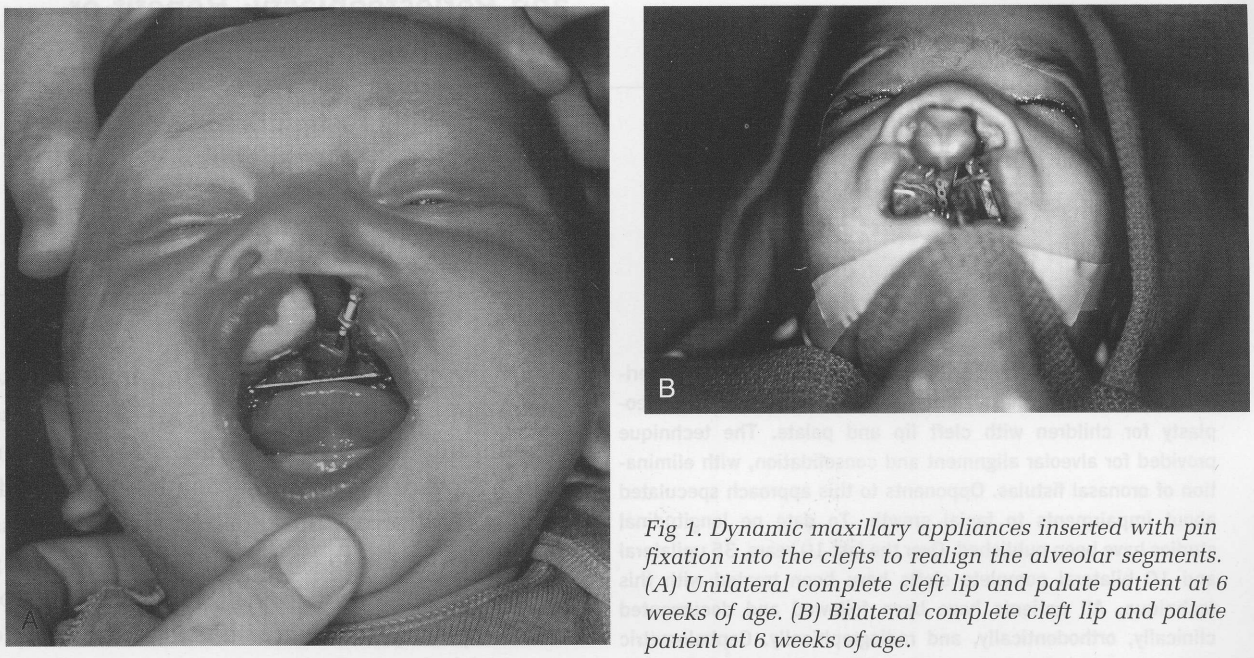


Fig 1. Dynamic maxillary appliances inserted with pin fixation into the clefts to realign the alveolar segments. (A) Unilateral complete cleft lip and palate patient at 6 weeks of age. (B) Bilateral complete cleft lip and palate patient at 6 weeks of age.

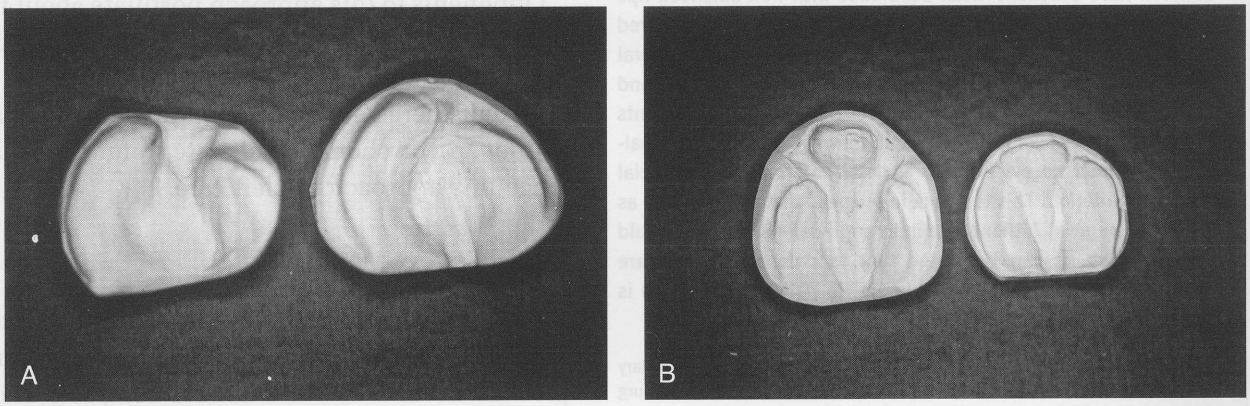


Fig 2. Plaster cast impressions demonstrating the dynamic maxillary appliance (DMA) action in aligning the cleft alveolar segments over a 6-week period. (A) Unilateral pre- and post-DMA cast showing alignment of the arch. (B) Bilateral pre- and post-DMA cast showing alignment of the dental arch and repositioning of the premaxilla.

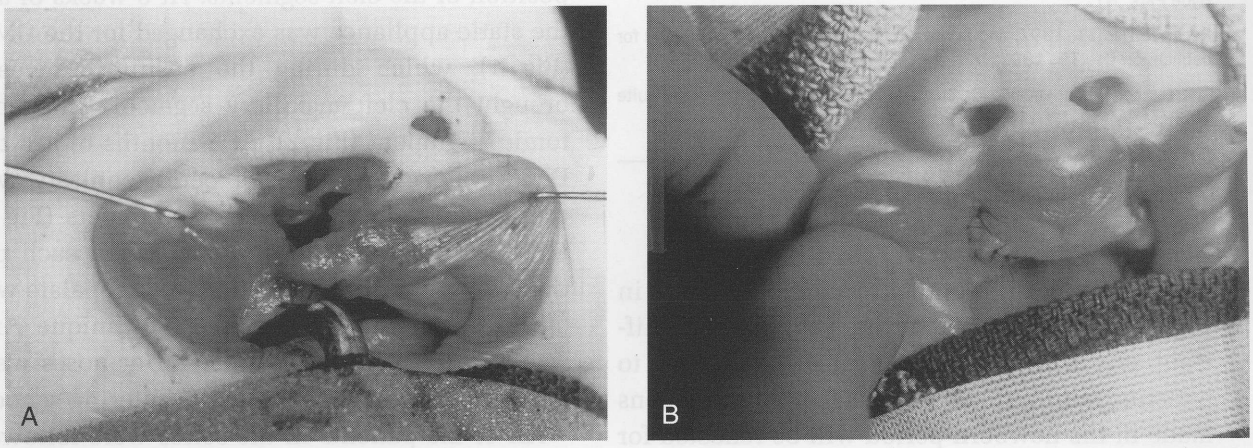


Fig 3. Mucogingivoperiosteoplasties performed to fuse the aligned dental arches and to eliminate the oronasal fistulas. Surgery was performed at 3 months of age at the time of lip and nose repair. (A) Unilateral periosteoplasty. (B) Bilateral periosteoplasty.

Fig 4. Four-year follow-up photographs demonstrating balanced faces with favorable scars from repairs performed without tension on stable bony platforms. (A) Unilateral complete cleft treated with dynamic maxillary appliance (DMA) and periosteoplasty. (B) Bilateral complete cleft treated with DMA and periosteoplasty.

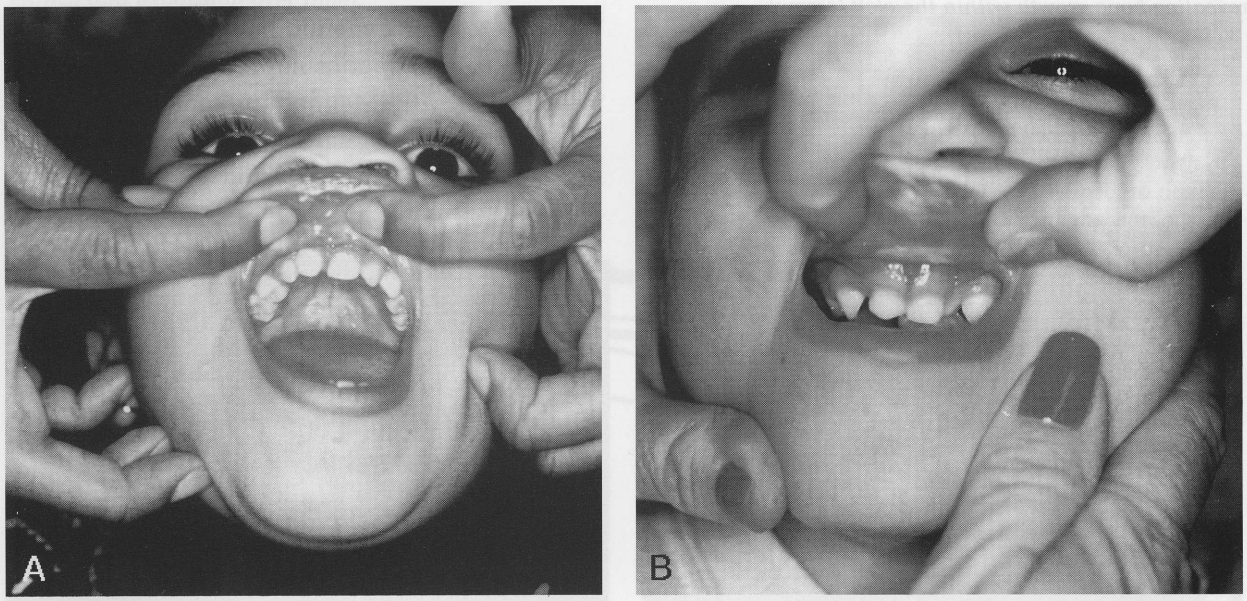


Fig 5. Cleft patients at age 7. Note the balanced dental arches and elimination of the oronasal fistulas. (A) Unilateral complete cleft. (B) Bilateral complete cleft.

followed serially with photographs, assessing facial esthetics; radiographs, looking for bone growth across the cleft site; and with articulated impressions and occlusograms. Cephalometric analyses were performed on the children age 6 years and older to evaluate further dental-facial growth.

Results

All of the children had very acceptable facial aesthetics. The lips and noses were well balanced with favorable scars (Fig 4). The oronasal fistulas have been closed successfully (Fig 5). Radiographs clearly demonstrate bone development in the area of the repaired cleft, although the density has varied (Fig 6). In many patients, tooth eruption has occurred.

Articulations revealed early anterior and lateral crossbites in the unilateral patients. The serial occlusograms demonstrated that these improve over time, and appear to be correctable orthodontically (Fig 7). The bilateral patients maintain satisfactory occlusions and balanced arches (Fig 8).

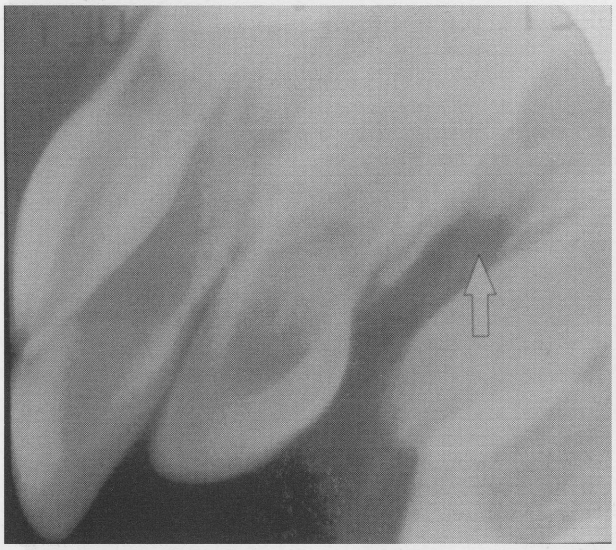


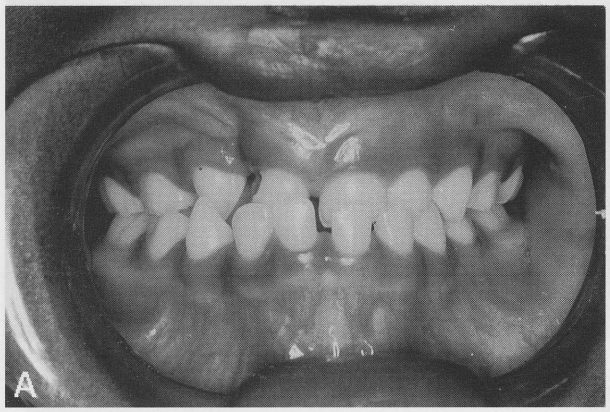
Fig 6. Radiograph of a repaired alveolus at age 7, revealing bone growth within the cleft (arrow).

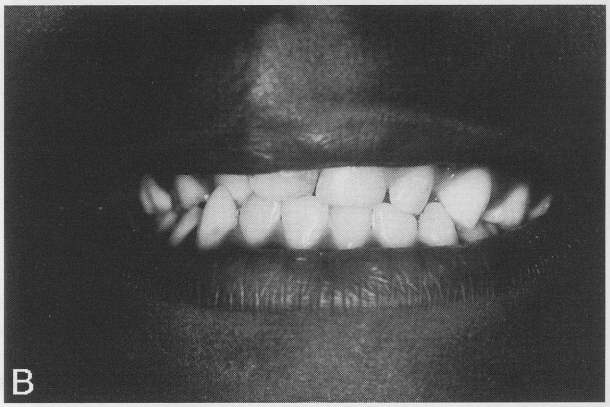
Cephalometric analyses of the children age 6 years and older demonstrate normal facial skeletal growth in all directions. The maxillae show no sign of growth retardation in comparison to noncleft standards (Fig 9). The maxillae are also positioned vertically and horizontally within a normal relationship to the mandible with respect to noncleft standards (Fig 10). Projections of the treatment plans show that with orthodontic correction, their analyses fall with in normal ranges.

All of the younger patients are following the patterns of their older counterparts.

Discussion

The debate over dynamic maxillary orthopedics and mucogingivoperiosteoplasty centers around midfacial growth. Staunch opponents to this approach claim that retardation will occur unless full facial growth has occurred prior to manipu-





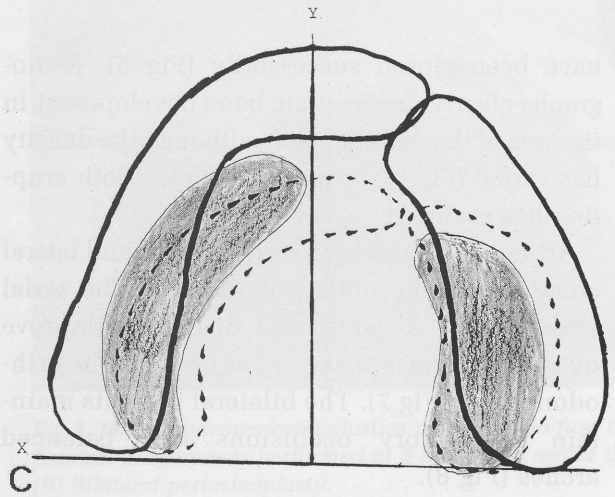


Fig 7. Unilateral complete cleft lip and palate treated with dynamic maxillary appliance (DMA) and periosteoplasty. (A) At age 5 years there is evidence of an anterior and lateral crossbite. (B) At age 9 years, prior to any orthodonture, this same patient shows improvement in the occlusion with growth alone over time. (C) Serial occlusogram demonstrates the pre- and post-DMA position of the maxillary arches and the position at age 8 years (shaded segments = original cleft position; dotted lines = post-DMA repositioning; solid bold lines = growth over time with expansion in all directions).

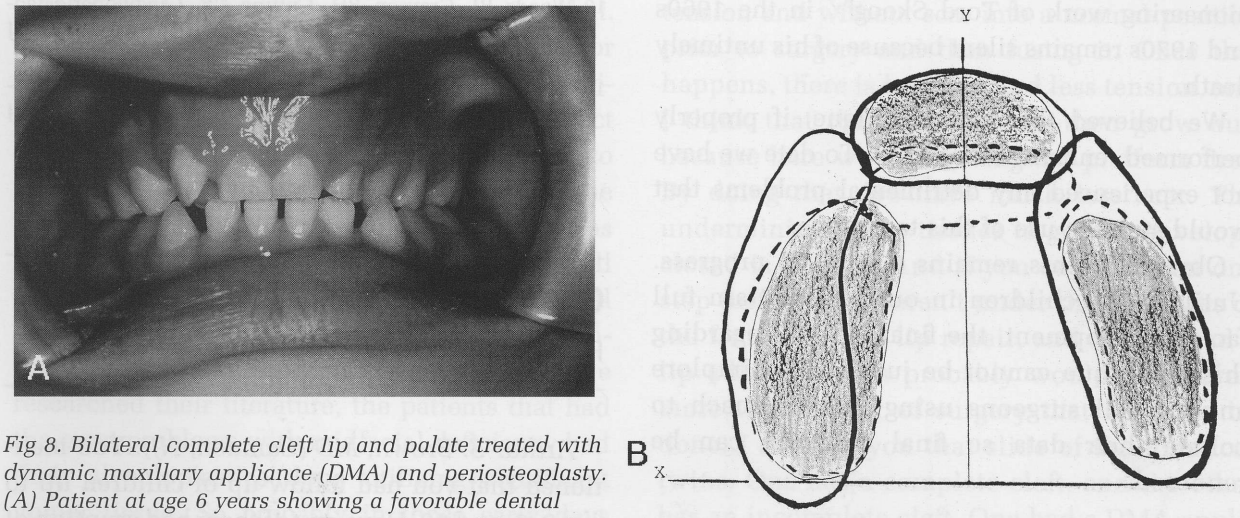


Fig 8. Bilateral complete cleft lip and palate treated with dynamic maxillary appliance (DMA) and periosteoplasty. (A) Patient at age 6 years showing a favorable dental arch prior to any orthodontic manipulation. (B) Serial occlusogram demonstrates pre- and post-DMA position of the maxillary arches and the position at age 7 years (shaded segments = original cleft position; dotted lines = post-DMA repositioning of the three segments; bold lines = growth and expansion over time).

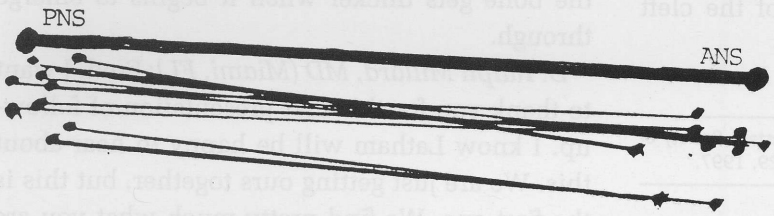


Fig 9. Cephalometric analyses of both unilateral and bilateral cleft patients age 6 years and older demonstrate the normal growth of the maxilla with respect to noncleft standards utilizing measured lengths from the posterior nasal spine (PNS; back of hard palate) to the anterior nasal spine (ANS). The bold line represents average normal maxillary length. The lines beneath are the individual age-adjusted maxillary lengths.

lation.[2,4] Others accept the concept of cleft maxillary orthopedics, but still implicate periosteoplasty, and reserve closure of the alveolus until adolescence.[3,5] Yet still others refute this entirely and call for early arch alignment and closure of the alveolus.[1,6–10] The problem in defining a clear-cut solution is the variables of technique and prospective long-term follow-up. Latham, working at Duke University, developed the Georgiade-Latham device for active repositioning of the cleft alveolar segments.[8,11] More than 20 years have passed without long-term follow-up.

Some critics cited vomer damage with periosteoplasty as the reason for midfacial growth problems. Millard and Latham[1] developed a periosteoplasty technique that did not infringe on vomerine growth centers. Their long-term data have yet to be collated and published, further adding to the controversy of the technique. The

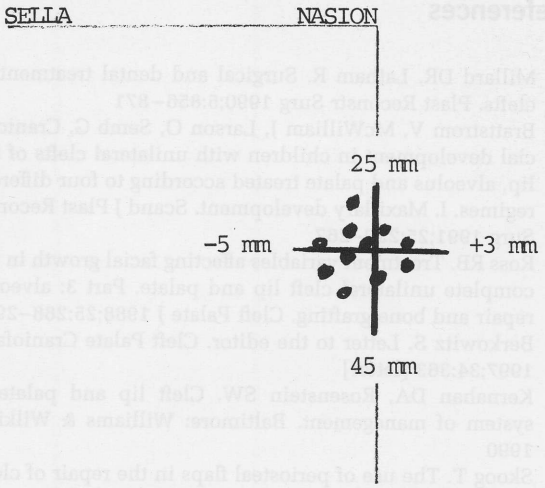


Fig 10. Cephalometric analyses of patients age 6 years and older demonstrating the normal position of the maxilla in both the horizontal and vertical dimensions with respect to noncleft standards. The normal horizontal positional range of the maxilla is from −5 to +3 mm from the nasion vertical. The normal vertical positional range of the maxilla is from 25 to 45 mm from the nasion.

pioneering work of Tord Skoog[6,7] in the 1960s and 1970s remains silent because of his untimely death.

We believed that this technique, if properly performed, enhances cleft care. To date we have not experienced any detrimental problems that would stop the use of this technique.

Obviously, this remains a work in progress. Until all the children in our series attain full facial development, the final verdict regarding this technique cannot be judged. We implore any and all surgeons using this approach to collate their data so final opinions can be rendered.

Conclusion

Dynamic maxillary repositioning of the cleft alveolar segments followed by periosteoplasty, in our hands, has proved to be a valuable technique in advancing cleft care. The patients and their families feel the physical and psychological benefits of early and complete closure of the cleft deformity.

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Open Discussion

Frederick N. Lukash, MD

Arthur S. Brown, MD (Camden, NJ): You mentioned that you had follow-up of children up to age 8, 9, and 10. Have any of them had eruption of the lateral incisor or the canine through your periosteoplasty area?

Dr Lukash: Yes. I have eruption in many of these kids, and we are in the process of moving them with expansion to orthodontically correct them. Actually, when the tooth begins to come down, it stimulates more bone in the area, and the bone gets thicker when it begins to emerge through.

D. Ralph Millard, MD (Miami, FL): Fred, I want to thank you for this first presentation of follow-up. I know Latham will be happy to hear about this. We are just getting ours together, but this is the first one. We find pretty much what you are saying, and we are very encouraged. Mainly we want to thank you for your good work and your careful follow-up.

Dr Lukash: Thank you for getting me involved in this.

Craig D. Hall, MD (Hackensack, NJ): Rick and I had an opportunity to discuss this a little bit. Bardach's literature on beagles shows that any surgery, palatal or lip, leads to growth distortions of the maxilla. Clinical studies on unoperated adults who have had clefts demonstrate that surgery alone leads to growth distortions of the maxilla. This periosteoplasty that is being proposed as a childhood operation increases the amount of surgery on the maxilla. So just by its presence alone, it should have an effect. If you are not necessarily eliminating a bone graft at a later date, you are raising the likelihood of maxillary deficiencies. So what is the urgency of doing it within the infant period?

Dr Lukash: There are two answers to that. Number one, in 1986 Ross did a major, major study with about 1,500 patients out of six institutions where they looked at every single aspect of cleft surgery on growth—from lip to palate to alveoloplasty to vomer setbacks, whatever. The only thing they incriminated in facial growth was the alveoloplasty. They basically accepted all other treatments as being okay with normal facial growth parameters. So this article totally incriminated what I was about to do. However, as we researched their literature, the patients that had the most problems with midfacial deficiency had their alveoloplasties done utilizing significant vomer tissue. So probably in those early days they were affecting the growth center. I think that what is happening here is much akin to what McCarthy and Monasterio and others are doing with distraction osteosynthesis. What we are doing early on is moving all these tissues without tension and without scar into a normal position prior to surgery and then fusing it. Once that happens, there is less scar and less tension, and I think that these tissues can then grow out, because here we are moving the platform first. By doing that, we have much less scar. The undermining of the tissues to get the envelope closed is minute. And if you carry it even one step further and weren't under the pressures of the family to do a lip repair, and did instead a lip adhesion, you probably would limit even more the amount of surgery that needs to be done. I showed you that slide of the identical twins. One has a complete cleft, and the other has an incomplete cleft. One had a DMA appliance and a periosteoplasty, and one just had a lip repair. Their faces are growing out at the exact same rate. Whatever midfacial problems they have are identical despite very different treatment plans.