An Intraoral Appliance for Management of the Protrusive Premaxilla in Bilateral Cleft Lip

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Management of the protruding premaxilla and prolabium in bilateral cleft lip and palate can be a confounding problem. This report introduces an intraoral traction appliance that has been successfully used to move the premaxilla and prolabium to a more favorable position for surgical repair of the bilateral cleft lip. The appliance consists of a palatal baseplate for anchorage and a latex rubber traction strip looped over the prolabium to retract the premaxillary segment. The results in five cases are presented and compared to two cases where no presurgical management was performed and lip repair had been delayed for medical reasons. Advantages and disadvantages of the appliance are discussed.

KEY WORDS: protruding premaxilla, protruding prolabium, bilateral cleft lip and palate, intraoral traction appliance

Management of the protruding premaxilla and prolabium in bilateral cleft lip and palate can be a confounding problem. In many instances, the premaxillary segment is so protrusive and the prolabial soft tissue so small that any attempt at surgical correction of the cleft lip would produce excessive tension and wound breakdown or a poor cosmetic result.

Clinicians have proposed a variety of techniques to deal with this problem. Among these have been extraoral traction (Cronin and Penoff, 1971; Hellquist, 1971; Rutrick et al, 1984; Vargervik, 1983), oral pinning and traction (Georgiade et al, 1968; Georgiade, 1970, 1971; Georgiade and Latham, 1974, 1975; Latham et al, 1976), premaxillary surgical setback (Cronin and Penoff, 1971) and premaxillary excision (Cosman, 1984). At our Center, we have encountered several technical as well as philosophical problems with these techniques.

We found the “bonnet technique” for extraoral traction to be cumbersome and uncomfortable for the child, especially during the hot summer months. In addition, parents often complained of its conspicuousness and the tendency for the traction band to shift from its ideal position (across the premaxilla and prolabium) with normal infant head movements. In those cases where the premaxilla deviated laterally, it was also difficult to move the premaxilla toward the midline.

Oral pinning and traction has not been favored by our Center because of the possible interference with maxillary growth and the developing tooth-buds. Further, the long-term effects of this procedure on facial growth have not been documented. Guidelines for surgical setback of the premaxilla have been suggested (Friede and Pruzansky, 1972; Aduss et al, 1974), but interference with midface growth (Friede and Pruzansky, 1985) is a concern. Excision of the
premaxilla is a drastic procedure. It has been performed in selected cases with reasonably good results (Motohashi and Pruzansky, 1981); however, it can still produce serious problems in the dentition, dental arch development, facial esthetics, closure of oronasal fistulas, and definitive dental habilitation.

The purpose of this report is to introduce an intraoral traction appliance which has been successfully used at our Center to move the protruding premaxilla and prolabium to a favorable position for surgical correction of the bilateral cleft lip deformity.

**METHOD**

The decision to refer the newborn infant with a bilateral cleft lip and palate for prosthetic management is made by the surgeon. If he feels he can do a better lip repair following repositioning the premaxilla, he refers the infant to the prosthodontist as soon after birth as possible. Early referral is very important, since the older the infant, the more difficult it is to keep him from removing the appliance with his hands.

The surgeon's decision to refer for premaxillary repositioning is based on his training and experience, the availability of tissue in the prolabium and lip, and the degree of premaxillary protrusion (Friede and Pruzansky, 1972; Aduss et al, 1974).

At the initial prosthetic visit, an intraoral cast is made of the maxilla. On this cast, a palate baseplate of autopolymerizing acrylic resin is fabricated (Fig. 1A). An area of relief is created between the midline anterior aspect of the baseplate and the palatal aspect of the premaxilla to permit the backward movement of the premaxilla. The distance from the middle of the polished surface of the baseplate around the prolabium and back to the baseplate is measured and a latex rubber strip 5.0 mm less than that length is attached to the baseplate with cyanoacrylate. The areas of cyanoacrylate attachment are sealed with acrylic resin (Fig. 1B). The width of the rubber strip should nearly cover the prolabium. This yields a force of approximately 5.0 ounces. In our first two cases, we noted that this force was clinically satisfactory. However, the appropriate force may vary from patient to patient, and this has to be determined for each individual.

The baseplate is then relined in the mouth with resilient denture liner to engage the anatomical undercuts of the palatal cleft for retention. Denture adhesive is also used to further enhance retention and anchorage of the palatal baseplate. The rubber strip is looped over the prolabium to produce backward traction on the premaxilla.

The strip must be checked as excessive force can cause soft tissue irritation or pressure necrosis on the prolabium or unseat the palatal prosthesis. Inadequate force will not produce the desired posterior movement of the premaxilla (Fig. 2).

In cases with collapsed palatal shelves it is necessary to expand the maxillary segments to permit posterior movement of the premaxilla. This can be accomplished by sectioning the palatal appliance anteroposteriorly and incorporating a spring to move the maxillary segments laterally to the desired degree of expansion. This can be accomplished prior to premaxillary retraction or simultaneously. If the premaxilla is deviated to one side, the traction band may be adapted so that the force will pull the premaxilla to a more

**FIGURE 1** A, Acrylic resin baseplate on dental cast. B, Latex rubber strip attached to baseplate.
central position. This will enhance maxillary dental arch form and esthetics once the lip has been repaired.

The appliance is worn continuously and is cleaned after feeding. The parents are carefully instructed in the placement, removal, and cleaning of the appliance. As the premaxilla is retracted, the patient is seen every 7 to 14 days for any necessary adjustment or replacement of the rubber strip, refitting of the baseplate, or relief of the anterior portion of the baseplate. The patient is also seen monthly by the surgeon to determine when adequate premaxillary retraction has occurred to permit successful lip closure.

**FINDINGS**

Five patients were treated with this appliance. Results were evaluated by using measurements made from dental casts and existing serial cephalometric radiographs. Dental cast measurements compared five treated cases to one untreated case. Radiographic measurements compared four treated cases to two untreated cases.

Linear measurements of the perpendicular distance from point alpha (α), the most anterior point in the premaxilla to the anterior limit of the maxillary palatal shelves (M-M') were compared on dental casts obtained pre- and post-prosthetic intervention (just prior to surgery). These values were compared with those obtained from one case (1096C) in which lip surgery was delayed for medical reasons. In this case, dental casts were made at the initial visit and just prior to surgical repair of the bilateral cleft lip.

In all of the prosthetically managed cases, the distance to M-M' decreased. The linear decrease ranged from 1.0 to 3.5 mm. In the non-managed case this distance increased by 4.0 mm (Figs. 3 and 4).

The results were also evaluated roentgenocephalometrically, utilizing the technique described by Pruzansky and Lis (1958). The lateral radiographs were obtained as part of the Center’s protocol for all patients. No additional radiation exposure was necessary for this study. The angle sella-nasion-alpha (S-N-α) formed by the anterior cranial base plane and the most anterior aspect of the premaxilla (Friede and Pruzansky, 1972) was measured to determine the degree of posterior movement of the premaxilla. The radiographs that were analyzed were obtained at the patient’s initial visit and just prior to lip repair. Measurements from these films were compared with two cases in which surgery was delayed.

![FIGURE 3 Graph of changes in M-M'⊥α in the control and prosthetically managed cases.](image-url)
Distance From Palatal Shelves to α

<table>
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<th>Patient</th>
<th>Age</th>
<th>Distance</th>
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<tbody>
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<td>+4mm</td>
</tr>
<tr>
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<tr>
<td>Prosthesis</td>
<td>0-4</td>
<td>14</td>
<td>-1mm</td>
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</tbody>
</table>

Figure 4 Distance from M-M'⊥α in control and prosthetically managed cases.

- The S-N-α angle increased in two non-managed cases (C). For the prosthetically treated cases (P), this angle decrease ranged from 0.5 to 9.5 degrees, (Figure 5 and 6). Downward movement of the premaxilla was also observed in all of these cases.
- In all of the prosthetically treated cases, the surgeons subjectively reported that the premaxilla had moved to a more favorable position for lip repair.

**DISCUSSION**

This appliance was developed to retract the protruding premaxilla to a favorable position for the surgeon to achieve a more functional and cosmetic surgical repair of the bilateral cleft lip deformity (Fig. 7). It is applied at the surgeon’s request and worn only as long as the surgeon feels it is necessary.

In all cases, the appliance has been worn successfully by the patient. All parents reported no problems placing, removing, or cleaning it. The application of a low-grade, constant retraction force is necessary to move the premaxilla backward and at the same time prevent soft tissue necrosis of the prolabium or dislodging of the palatal plate because of excessive force.

The following problems have been encountered with this appliance: (1) In some cases of incomplete cleft lip it may be difficult to loop the latex strip around the prolabium. (2) Because of the small amount of force that can be applied, adequate movement of the premaxilla may take months, although this period has been highly variable among our cases. However, surgeons feel that this time delay permits further growth of the soft tissues adjacent to the cleft and this facilitates surgical repair. Since some treatment is being provided, parental anxiety is reduced.
Regarding the presence of an open cleft for an extended period. (3) The latex strip loses its elasticity after 7 to 14 days and requires adjustment or replacement almost weekly. Studies are currently underway to find an alternative elastic material. In spite of these problems, this appliance has been effective in retracting the protrusive premaxilla to a more favorable position for lip repair.

REFERENCES


Figure 6 Changes in S-N-α angle in control and prosthetically managed cases.

<table>
<thead>
<tr>
<th>AGE</th>
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<td>100°</td>
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<tr>
<td>0-1</td>
<td>103°</td>
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Table 1 Changes in S-N-α angle in control and prosthetically managed cases.