

PRESURGICAL ORTHOPEDIC MANAGEMENT OF THE UNILATERAL CLEFT LIP AND PALATE NEWBORN PATIENT

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Presurgical orthopedic manipulation to facilitate cleft lip closure and/or approximate or normalize the segmental relationships of the clefted maxilla has been a prudent protocol for over 20 years; it has permitted the plastic surgeon to proceed with lip closure without the need for lip adhesions. Additionally, obturating the cleft improves suckling and feeding and helps in the provisional separation of the nasal and oral cavities. A few select cases are presented to illustrate the benefits of this noninvasive approach.
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KEY WORDS: premaxillary/maxillary (greater segment), presurgical orthopedic manipulation, obturation, extraoral fraction techniques, maintenance, normalized segmental relationships

Presurgical orthopedic alignment of the maxillary segments in the unilateral cleft lip and palate patient has been advocated to facilitate cleft lip repair and maintain and/or adjust the maxillary arch segments in an effort to enhance the facial segmental relationships before lip closure surgery. Our philosophy has been to carry out presurgical maxillary orthopedics in selected cases using a palatal obturator in conjunction with a traction force across the cleft lip, reducing the soft tissue cleft lip and maxillary bony segmental disparity with orthopedic manipulation, thereby approximating the tissue segments and providing tissue and apical base approximation as preparation for the definitive lip repair by approximately 3 months of age.

INDICATIONS FOR PRESURGICAL ORTHOPEDICS

In essence, the indications for presurgical orthopedic manipulation are when the bony and/or soft tissue disparity of the segments' position in relationship to each other need to be altered to facilitate cleft lip, palate, or periosteoplasty repair. By the use of presurgical orthopedic techniques, lip adhesions are avoided precluding their risks, expense, and potential for tissue damage. Practically speaking, whenever the surgeon might think a lip adhesion would be helpful, then presurgical maxillary orthopedics is appropriate instead. This represents a minority group relative to all unilateral clefts, but a rela-

tively difficult group. The Atlanta Cleft Lip and Palate Team has never done a lip adhesion.

Many variations in cleft anatomy exist. It is therefore appropriate to first accurately diagnose the specific anatomic deformity of the individual infant.

When the size of the cleft is small, labial traction is not necessary unless a gingivoperiosteoplasty is planned. The maxillary segments are evaluated with regard to facial asymmetry, their relationship to each other, and to the cranium. In most cases of unilateral cleft lip and palate, where presurgical orthopedics may be necessary, the premaxillary/maxillary or (greater maxillary segment) is procumbent and labially displaced relative to the cranium.

ORTHOPEDIC EVALUATION: THE ANATOMIC DEFORMITY

The type and completeness of the unilateral cleft is first noted. Next, the position of the greater and lesser maxillary segments are examined. The premaxillary/maxillary segment (greater segment) may be proclined, asymmetrically positioned, and/or canted and labially displaced. The lesser segment may be contracted medially or overly lateralized. The positions of the greater and lesser segments will help define the presurgical orthopedic goals. The size of the bony cleft, the maxillary arch deformity, and/or the disparity of the soft tissue lip segments will dictate the need for presurgical orthopedic manipulation and prognosticate the level of surgical difficulty. The level of feeding difficulty is also ascertained.

ORTHOPEDIC RULES OF THUMB

1. If the clefted maxillary arch is constricted, contracted, or collapsed, expand it. In this type of case, a split obturator with an expansion screw (positioned high in

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the cleft) may be used. This is rarely the case in the newborn, in whom the lateral arches are usually in good transverse position.

2. If the bony cleft and maxillary segments are overly disparate and the soft tissue cleft is wide, the surgeon's ability to close the lip is handicapped. In such cases, the craniofacial orthopedist will need to apply a force across the cleft lip to reduce the lip's segmental disparity, thereby approximating the tissue segments. It is important to be aware that an unopposed force, placed across the clefted lip, will likely collapse the bony maxillary platforms.
3. Thus, it is the authors' opinions that a palatal obturator should be in place before deploying labial traction to maintain proper positioning of the lateral arches. This will help preclude the medial bony collapse of the maxilla. Uncontrolled facial traction, such as that which occurs during lip adhesion without obturation, is likely to result in a constrictive deformity of the maxilla. Thus, the maxillary segments should be stabilized with an obturator before the application of labial traction forces.

The devices used are atraumatically placed and secured and the labial traction forces which are deployed are gradual and progressive over 2 to 3 months beginning within days of birth. This gentle procedure promotes remodeling without sudden bony junctional results and in proper time for the cleft lip repair to be performed at about 3 months of age.

IMPRESSION TECHNIQUE

A 3-Step Process

A soft wax impression (Surgident Blue Soft Periphery Wax, Miles, South Bend, IN) of the deformed maxilla is taken by molding a wad of the soft wax into the shape of a teaspoon with a short, stout handle. The wax is

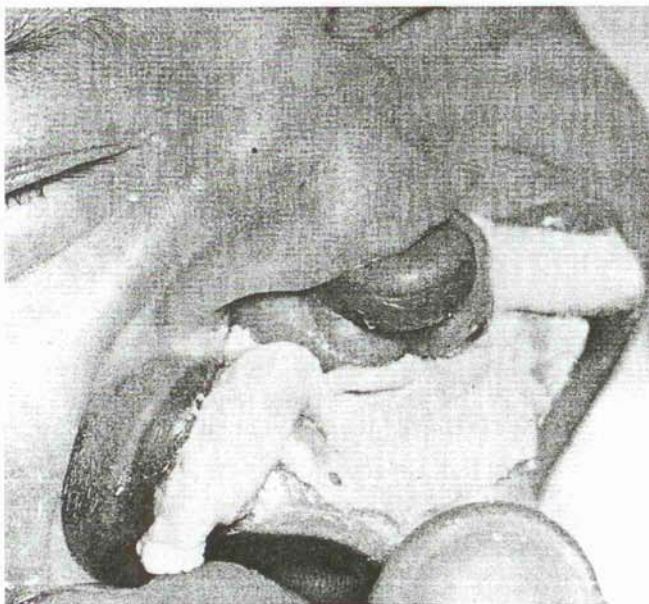


Fig 1. Alginate impression taken in custom tray.

warmed and shaped to a pliable consistency and inserted into the infant's mouth. The wax is pressed up into the cleft of the supine infant and molded over the entire maxilla including the premaxillary segment. It is removed and inspected and re-inserted for greater detail as necessary.

The wax impression is poured in a quick-setting stone. This cast is used to fabricate a preliminary custom acrylic tray. This acrylic tray is used to take a second impression of the edentulous neonatal maxilla. The second impression may be taken in dental compound impression (Kerr Manufacturing Company Impression Compound, Kerr USA, Romulus, MI) material. This material will not run and can be used safely in the dental office.

Precautions: It is important not to overheat the compound to avoid burning the mucosa and to not let it cool completely before removal because it can get stuck in the undercuts. A second stone cast is then poured, and a final acrylic custom tray is fabricated for the purpose of taking the final alginate wash impression (Fig 1). Note: The custom tray is perforated with 2.0 mm drill holes to permit the alginate impression material to push through the holes for retention during the final impression. The final custom tray should also be coated with an adhesive coating for additional retention (Hold[®] Spray-On Tray Adhesive, Teledyne Water Pik, Fort Collins, CO).

Depending on the medical experience of the dental physician, it may be advisable to take the final alginate wash impression in the recovery room of the children's hospital and/or in a clinic where the plastic surgeon will be available. Equipment to manage an unstable airway should always be available should the alginate material be aspirated. This situation has never occurred, however to avoid this problem use a minimal amount of the alginate material in the posterior part of the impression tray. A well-adapted tray is important. Using slightly warm water will quicken the set of the impression material. Distortion of the delicate impression must be avoided once it has been taken. This final impression is poured in dental stone.

Fabricating the Obturator

Using the final stone cast, the height of the alveolar ridge and posterior border of the obturator are outlined. Undercuts high in the nasal vault are relieved using clay or wax. A 2-mm undercut on the superior aspect of the lateral palatal shelves is left for retention. To prevent irritation of the vomer, the obturator is relieved by approximately 1 mm to 15 mm in this region. The acrylic of the obturator is not extended high in the nasal vault as this will obstruct nasal airflow. A separating medium is painted on the stone cast before applying acrylic. The acrylic is then cured under pressure (23 psi) for 15 minutes in warm water. The obturator is then removed, trimmed, polished, disinfected, rinsed and placed.

Placement of the Obturator

The obturator is placed and examined in situ. If it is overextended posteriorly, it can be trimmed away. Flexion of the atypically inserted posterior palatal muscles can

cause displacement of the obturator, especially during screaming. Modifications can be performed to prevent dislodgment.

An obturator safety line (See Fig 2) is used initially until the parents become comfortable with removing the device with their fingers. Drill a hole through the obturator approximately at the point at which a cuspid tooth would be present and thread dental floss through this hole. The floss is attached to the cheek with a small piece of tape. The parents then use the dental floss to pull the obturator from the mouth. If an apnea monitor is being used, it should be continued as directed by the managing physician.

Retention of the obturator can be enhanced by using 2 or 3 small dabs of denture adhesive paste on the obturator's palatal surface.

The benefits of the obturator are multiple. The obturator improves suckling and increases the efficiency of feeding. It is also used as an incline or guide plane to control the orthopedic remodeling during the use of labial traction forces.

Use of the Obturator to Control Segmental Remodeling During Extraoral Tractioning

After a 3- to 5-day stabilization period, the obturator may now be used as an orthopedic device. To do so, the obturator is relieved or selectively ground to permit the bony segments to be remodeled in the direction desired. Tape (Fig 3) or an elastic traction bonnet (Fig 4) is placed across the clefted lip. The acrylic ahead of the bone, which is being reduced is trimmed away and the obturator repolished as required. Elastic traction is used to mold the bone/lip segments to their more normal and desired positions.

After the construction of the obturator and its intraoral placement, an orthopedic decision should be made regarding treatment goals. If a given segment, commonly the greater segment or premaxillary/maxillary segment, is displaced (as in overexpanded) labially or facially, the acrylic of the obturator can be relieved beneath this segment so that the maxilla may be remodeled inwardly and the procumbency reduced. Extraoral traction will cause the greater segment and lesser segment to be brought closer together. Orthopedic segmental repositioning can be controlled by how the surgeon relieves the obturator. When the moving segment touches the relieved obturator, the remodeling should cease. Further remodeling of the segments may be accomplished by further selective grinding away of the acrylic to permit further segmental repositioning.

If the patient is seen before any traction forces have

been applied, the lateral segments are likely to be found reasonably well-positioned and may need only maintenance obturation before closure of the lip.

Optimally, the obturator should be kept in place until lip closure, during the repair, and it can also be used after the lip has been closed. If left in, it is best not taken out for 3 weeks. Unfortunately, if the obturator's use is discontinued, the soft tissue lip tethering may encourage collapse of the segments resulting in a constricted maxilla. Ideally, the obturator is continued until palate repair at about 6 months of age. (This may not be feasible if growth and change result in an ill fit in the meantime). Fig 5 to illustrate the technique discussed above.

A variety of extra oral traction techniques have been utilized. A simple adhesive bandage (Fig 3) may be placed across the lip, but our preference is to use hypoallergenic paper tape (Fig 5). A baby bonnet with Velcro side panels sewn on, and an elastic band for premaxillary traction may also be used (Fig 4). These traction devices and the mechanical principals involved are the same for bilaterally clefted newborns and unilateral cases. Caution should be exercised to use very light forces and not to overly retrude the premaxillary/maxillary segment, but rather conceive of the traction device as a restraining mechanism used to preclude its further untethered forward and lateral growth. Thus, during the first 3 months of life, before lip closure, the face will mature, while the extra oral traction device tethers or restrains the forward development of the premaxillary/maxillary complex, allowing the disparate maxillary segments to become approximated. It is easy to overreduce a procumbent premaxilla, and thus, a minimal force of only 5 to 10 g should be sufficient to restrain forward growth, permitting the face to mature so that the surgeon can proceed with lip closure at about 3 months of age without undue strain or the need for lip adhesions.

Tissue Precaution

Alternating taping and the elastic traction bonnet will help keep the facial tissue from becoming too irritated by the adhesive tape.

Cleaning

The parents are instructed to clean the obturator once or twice a day, wiping off the denture adhesive, cleaning it with a toothbrush, applying adhesive and replacing it immediately. If food has gone up into the nasal vault, the vault may be rinsed with a rubber syringe using sterile water.

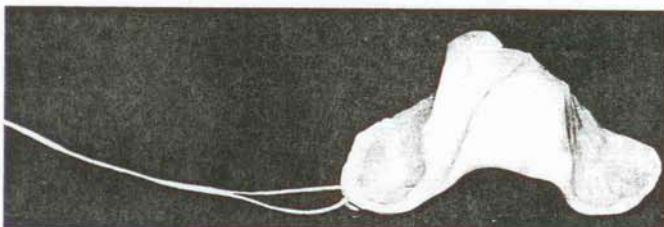


Fig 2. Selectively ground away acrylic obturator contoured to permit the symmetrical orthopedic repositioning of the premaxilla (Note: Dental floss safety line).

DISCUSSION

Shaw and Semb,¹ in summarizing the current approaches to orthodontic management of cleft lip and palate, found neonatal orthopedics commonly advocated to reduce excessive alveolar cleft width and approximate lip margins before lip repair in complete unilateral clefts. The rationale for this procedure is that surgical repair of the lip is rendered more easily, leaving less scar tissue that may interfere with later facial growth. Huddart² evaluated the effect of presurgical orthopedics in patients with unilateral cleft lip and palate. Patients undergoing presurgical treatment were compared to patients with untreated



Fig 3. Contoured adhesive bandage is used to restrain/approximate the disparate tissue segments (Note: the use of hypo-allergic tape is preferable).



Fig 4. Elastic traction is placed across the cleft lip and attached to the Velcro (Velcro USA, Inc, Manchester, NH) side panels as needed to control the direction of segmental remodeling. The obturator is in place, and a safety line is taped to the face.

unilateral clefts. The palatal cleft was reduced by up to 50% at the same time that lesser segment rotation improved and the lip and alveolar clefts narrowed. It was believed that narrowing of the palatal cleft was secondary to changes in the slope of the palatal shelf as it became more horizontal during treatment. Huddart advocated treatment whenever possible in unilateral cases.

It has been our experience that there is extreme variation in the unilateral cleft deformity. Accurate diagnosis of these anatomic variations forms the mainstay of treatment decision making. In our cases, maxillary orthopedics as described in our article has been quite satisfactory. It is possible to appropriately reduce the premaxilla, if only very gentle forces are used. There are, however, a number of children who develop an anterior crossbite, and it is impossible to know whether this may in part reflect a possible bony deflection secondary to the labial traction forces applied in early infancy. There is no way to determine what is related also to the surgical repair forces, and so on. Certainly it is best not to over reduce the premaxillary segment originally. And it is easier to manage later some degree of residual procumbency than anterior crossbite. Berkowitz³ believed that in complete unilateral clefts, the noncleft segment's premaxillary portion was rotated outwardly, distorting the nose. Serial growth records by Berkowitz did not support cleft lesser segment retrusion in the majority of complete unilateral clefts.³ However, Millard and Latham^{4,5} reasoned that in complete unilateral clefts, when the lesser segment was displaced lingually, it should be brought buccally. In these situations, they suggest primary management of the unilateral cleft may be accomplished using a Latham device. While such a situation is rare in the newborn and more likely seen later, especially after an unopposed external force (such as a lip adhesion without an arch obturator), it can be nicely and atraumatically handled by a split obturator with a central lateralizing jack screw. We do not prefer Millard and Latham's^{4,5} regimen.

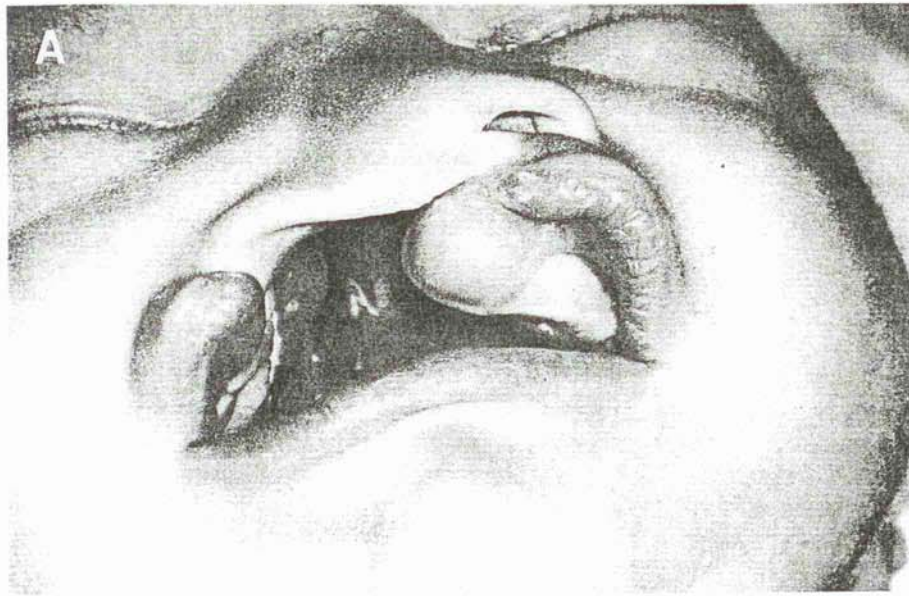
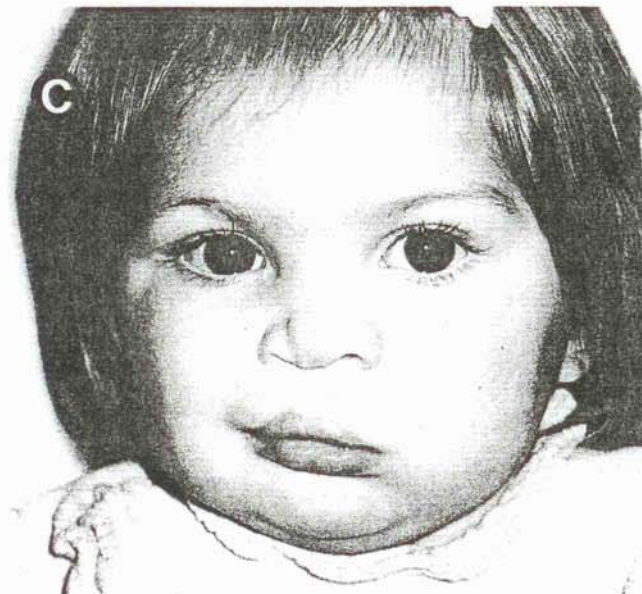
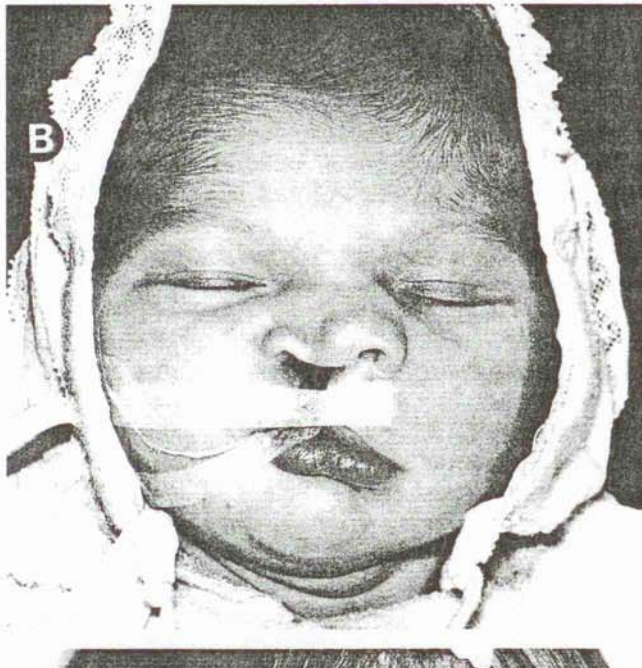


Fig 5. (A) Unilateral cleft lip and palate with broad disparity requiring presurgical orthopedic approximation. (B) Facial traction with paper tape (Note: The obturator is already in place intraorally). (C) Surgical lip closure following obturation and facial tractioning.



SUMMARY

Presurgical orthopedic management of the unilateral cleft lip and palate patient is indicated in children with wide clefts or in cases where a gingivoperiosteoplasty may be desired. Herein, we described a technique for neonatal orthopedic management of the unilateral cleft based on an accurate anatomic description of the cleft deformity and the specific needs of the infant, including feeding. Our program of presurgical management of patients with bilateral cleft lip and palate has been previously reported.⁶ Candidates for presurgical orthopedic management present with severe tissue disparities such that a surgical closure without tension may be difficult to achieve. With proper presurgical orthopedic management, the tissues can be brought into better alignment, permitting a one-stage repair under optimal and symmetric tissue positions. The technique avoids lip adhesions and permits an excellent one-stage lip repair to be performed.

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