ORTHODONTICS

INNOVATIONS

NASOALVEOLAR MOLDING WITH MODIFIED ORTHOPEDIC PLATE AT THE CLEFT CENTRE OF CHILDRENS HOSPITAL & INSTITUTE OF CHILD HEALTH, LAHORE

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ABSTRACT

Objective was to introduce a modified appliance and treatment protocol for presurgical nasoalveolar molding in a new born baby presenting with unilateral cleft of the lip and palate.

This treatment comprises use of an orthopedic plate with acrylic nasal stent, in combination with adhesive steri-strip. The plate is adjusted every week for alveolar molding. For nasal molding, soft acrylic is added incrementally to the acrylic nasal stent in order to lift the alar dome cartilage and to mold the depressed and concave lower lateral cartilage on the affected side. Activation was done on weekly basis till the age of three months.

The plate prevented cleft widening effect of the tongue and utilized the functional movements of the orofacial musculature to guide and relocate the major segment medially to its normal position. Reduction of 4.5mm was attained in the anterior region of the cleft gap by this device. The shape of cartilaginous septum, alar tip and medial and lateral crus were molded to resemble the near normal shape of these structures.

The technique helps to improve alveolar position, nasal septum alignment, nasal symmetry and nasal tip projection prior to lip repair. This device minimizes lip scar and results in aesthetic outcome of the patient.

Key words: Unilateral cleft, Nasoalveolar molding, Modified orthopedic plate, Acrylic nasal stent.

INTRODUCTION

The unilateral cleft lip and palate is associated with defect in nasal cartilage morphology and asymmetry of alar base and columella 1. The lower lateral car-tilage is often depressed and concave. These defects have a great impact on aesthetic outcome of the babies.

Presurgical infant orthopedics has been employed since the 1950s as an adjunctive neonatal therapy for the correction of cleft lip and palate. Some of the problems that the traditional approach failed to address include the deformity of nasal cartilage in unilateral cleft patients.

Grayson BH, Cutting CBI introduced presurgical nasoalveolar orthopedic molding in primary correction of nose, lip and alveolus of infants born with unilateral cleft palate by adding a nasal stent in acrylic to the labial vestibular flange of the conventional intraoral molding plate (nasoalveolar molding technique NAM). This nasoalveolar molding technique takes the advantage of malleability of immature cartilage and its ability to maintain permanent correction of its form1,3,4,5. The orthodontic plate is held in place in combination with surgical tapes and elastics applied to cheeks and cleft segments.

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Cho B.\textsuperscript{6} managed unilateral cleft baby, by lip adhesion along with the positioning of passive nasoalveolar appliance in infants with 3-6 weeks of age.

Da Silveira AC, Oliveira N, Gonzalez S, Shahani M, Reisberg D, Daw Jr JL\textsuperscript{7} et al, modified nasoalveolar molding for management of cleft lip and palate. The key modification is the use of an orthodontic wire from the palatal position with an acrylic bulb presented inside the nose underneath the apex of the nasal cartilage as nasal stent.

Grayson BH, Maull D\textsuperscript{8} reviewed the nasoalveolar molding technique (NAM) presented in 1999, preserving the presurgical change achieved through coordinated and modified surgical technique of primary cleft repair.

Suri S, Tompson BD\textsuperscript{5} introduced a modified muscle activating orthopedic appliance for presurgical nasoalveolar molding in infants with unilateral cleft lip and palate, held in place with outriggers. This modified technique, which amalgamates nasal molding with muscle activated alveolar molding infant orthopedic plate, is reported to improve alveolar position, nasal septum alignment, nasal symmetry, and nasal tip projection prior to primary lip and nasal surgical lip repair.

Cenk Doruk and Bence\textsuperscript{9} presented a case report on extraoral nasal molding in infants with unilateral cleft lip and palate. They used extraoral nasal molding appliance (ENMA).

This article describes a modified self retentive nasoalveolar molding plate that incorporates simple acrylic stent for nasal molding and palatal adjustment for alveolar molding in unilateral cleft of the lip and palate. The objective of this presurgical nasoalveolar orthopedic appliance was to achieve presurgical reduction in osseous and soft tissue deformity, resulting in an improved surgical outcome with minimal lip scar and enhanced nasal and facial aesthetics. In our experience, this purpose was successfully achieved.

METHODS

The technique for presurgical nasoalveolar molding was used on 4 days old male baby with complete unilateral cleft lip and palate (Fig 1, 2). The case was treated over a period of three and a half months, with a custom made orthopedic plate incorporating nasal stent, made in selfcure acrylic on the labial vestibular flange of orthopedic plate (Fig 3, 4). The nasoalveolar orthopedic plate was made self retentive by adding soft acrylic on its palatal surface in the defect part. Adhesive steri strip 1/4x 4 inches was applied extraorally to approximate cleft lip and alveolar segments (Fig 5). The nasoalveolar molding plate and nasal stent are adjusted on weekly bases over a period of three months. The molding plate was adjusted by adding 1mm of hard acrylic on the palatal surface and removing about 1mm soft acrylic along the medial surface on both sides. The nasal stent was activated by adding soft acrylic on outer and upper surface of the stent to elevate lower lateral cartilage thus achieving nasal and alar base symmetry and nasal tip projection (Fig 6).

The patient was then referred for initial lip repair to the maxillofacial plastic surgeon. Excellent postsurgical results were attained with minimal lip scar and enhanced nasal and facial aesthetics (Fig 10, 11, 12).

Photocopies were taken for the pre and post treatment casts for recording linear and angular measurements. These measurements were recorded to see the approximation of alveolar cleft segments. Among the linear measurements intermolar width, intercanine width and anterior cleft gap were recorded. Angular measurements were obtained from mid-sagittal plane used as a reference line and the line bisecting the reference line from the most anterior portion of labial segment i.e. labial frenum. Angular measurements were made to record the malalignment or rotation of major alveolar cleft segment.

RESULTS

For nasoalveolar molding therapy, results were based on the measurements from pre, post molding and post surgical casts. Linear measurements were recorded (Fig 6, 7,8 and Table I). Intermolar width was 32 mm in the pre treatment stage and remained 32mm, after nasoalveolar molding and surgical lip repair. Intercanine width was 19mm in the pre and post molding stage, where as it was reduced to 17mm after cleft lip surgery.

Anterior cleft gap was 9.5mm initially and was reduced to 8.6mm after nasoalveolar molding and 4.5mm after surgical lip repair.
Fig 1: Pre-treatment front view
Fig 2: Pre-treatment lateral view

Fig 3: Front view
Fig 4: Side view

Modified pre-surgical infant orthopedic plate with nasal stent

Fig 5: Appliance in situ
Fig 6: Approximation of cleft lip segment with steri strip
Fig 7: Pre-treatment cast photography

Fig 8: Postmolding cast

Fig 9: Post-surgical cast photocopy

Fig 10: Post-surgical view upper lip

Fig 11: Post-surgical front view

Fig 12: Post-surgical lateral view
TABLE 1: LINEAR MEASUREMENTS FROM THE CAST PHOTOCOPIES.

<table>
<thead>
<tr>
<th></th>
<th>I.M.W</th>
<th>I.C.W</th>
<th>Anterior cleft gap.</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Pre treat</td>
<td>Post molding</td>
<td>Post surg</td>
</tr>
<tr>
<td>Pre treat</td>
<td>32</td>
<td>32</td>
<td>32</td>
</tr>
</tbody>
</table>

TABLE 2: ANGULAR MEASUREMENTS FROM THE CAST PHOTOCOPIES.

<table>
<thead>
<tr>
<th></th>
<th>Pre treat</th>
<th>Post molding</th>
<th>Post surg</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angular</td>
<td>14</td>
<td>25</td>
<td>11</td>
<td>3</td>
</tr>
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Angular measurements were made to record the rotation of major alveolar cleft segment (Fig 7, 8, 9 and Table II). Initially it was 14 degree that was increased to 25 degree after nasoalveolar molding and was then relocated to 11 degree attaining a 3 degree correction of major cleft segment.

DISCUSSION

The goal of presurgical nasolaveolar molding is to align and approximate cleft alveolar segments while at the same time achieving correction of nasal cartilage and the soft tissue deformity.

This nasoalveolamatrix1,3,4,5,10.dic plate takes the advantage of high degree of plasticity and lack of elasticity in neonatal cartilage which is reported to be due to high levels of hyaluronic acid, a component of the proteoglycan intercellular matrix1,3,4,5,10. As the estrogen level increases, the elasticity of the cartilage decreases1,4,11,12. With the neonatal levels of maternal estrogen highest immediately after birth, the period of plasticity is slowly lost during the first month of the postnatal life. It is during the first 2 to 3 months after birth when active soft tissue and cartilage molding is most successful.

Another benefit of presurgical nasoalveolar orthopedic plate is that when anterior cleft segments are approximated so that the lip segments are in closer apposition, the lip surgery become easier, more precise and under less tension with minimal scar formation1. The surgeons routinely request presurgical infant orthopedic as a supportive measure for the primary surgical correction of clefts5.

Our technique of using custom made nasoalveolar molding orthopedic plate with acrylic nasal stent in combination with steri strip is partly similar to NAM technique by Grayson BH, Cutting CB who used acrylic nasal stent attached to the vestibular shield of an oral molding plate to mold the nasal alar cartilage into normal form and position during neonatal period. Compared to the modified technique applied by Suri S5, our method was very easy and simple. Suri used 0.032 inch stainless steel wire incorporated into the plate and custom bent in situ to form a nasal stent and the wire was adjusted to gently lift the alar dome cartilage. In our experience, simple fabrication, easy manipulation and cost effective treatment approach was the main goal.

The nasoalveolar molding orthopedic plate used in our technique was self retentive. Soft acrylic added to the palatal surface of the plate in the area of cleft served as a mean of retention. There was no need for extra oral attachments, as compared to NAM technique used by Grayson1 in which orthopedic plate was held in place in combination with surgical tapes and elastics applied to the cheeks and cleft lip segments for the sake of retention.

For apposition of cleft lip segments, we used steri strip applied to cheek and lip segments, similar to Suri7Grayson1,8ing nasal molding replaced the tape elastics across the cleft lip by a continous segment of surgical tape when the lip segments are in apposition, maintaining the effect of a simulated nonsurgical lip adhesion. Similarly Grayson78 made use of surgical tapes and elastics for close apposition of cleft lip segments. Cho6 managed cleft lip and palate by lip adhesion along with the positioning of passive nasoalveolar appliance. Lip adhesion is reported to create force acting on the cleft alveolus. There after, the greater alveolar segment is guided by the appli-
ante, while the lesser alveolar segment is prevented from collapsing.

From the nasoalveolar molding therapy we achieved significant approximation of alveolar cleft segments. Intermolar width remained the same, after nasoalveolar molding and surgical lip repair. The intercanine width however, showed a reduction of 2mm. Anterior cleft gap was reduced to 4.5mm after initial surgical lip repair. Angular measurements on other hand were made to record the rotation of major cleft segment. With this appliance, the major segment showed a further increase of 11 degree rotation after alveolar molding. Increase in rotation is perhaps the effect of alveolar molding, consequent to soft acrylic filling the defect and also due to improper reduction of soft acrylic along the mesial of the major cleft segment. After surgical lip repair it was relocated achieving a 3 degree correction of the major cleft segment. This intervention device successfully addressed the problems related to the defect and ended up in aesthetic outcome of initial nasal and lip repair.

CONCLUSIONS

The nasoalveolar orthopedic plate was used in newborn male baby presenting with left side complete unilateral cleft lip and palate for a period of three and a half months. Successful results were obtained with this device. On the basis of these results, following conclusions are drawn.

1 The nasoalveolar molding plate improves alveolar position i.e. the approximation of cleft alveolar segments.

2 Nasal symmetry, nasal septum alignment and nasal tip projection are achieved.

3 The appliance being self retentive is comfortable to wear.

4 Extraoral attachments are not needed.

5 It facilitates function.

6 It renders initial lip repair easy more precise and tension free.

SUGGESTIONS

1 Proper trimming of soft acrylic along the mesial surface is suggested for relocation of the major alveolar segment.

2 Thorough intraoral examination to assess coordination of the lesser alveolar segment with the mandibular arch is also suggested.

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REFERENCES


