NASAL SYMMETRY ACHIEVED BY NASOALVEOLAR MOLDING IN CLEFT LIP AND PALATE PATIENTS - A LITERATURE REVIEW

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OBJECTIVE: To review the significance of Nasoalveolar Molding in achieving Nasal Symmetry in Cleft lip and Palate patients before Lip repair.

METHODOLOGY: A Data search was performed based on available electronic data base, hand search articles and books since 1994-2010. This included Cochrane data base, medline, pubmed, research journals, and papers. The total of nearly 900 articles were found related to naso alveolar molding among which filtered results showed with 302 randomized control trials. Inclusion criteria included both unilateral and bilateral cleft lip and palate cases who had presurgical nasoalveolar molding with nasal stents ; prior to primary lip repair , whilst the exclusion criteria was syndromic patients , interrupted treatment timings, more than six months of age, immunocompromised, autoimmune diseases , previous history of lip or nasal surgery before nasoalveolar molding for any reasons. Overall 28 studies met the basic inclusion criteria.

RESULTS: Nasal symmetry is preferably well achieved by Nasoalveolar Molding.

KEY WORDS: Unilateral Cleft lip Palate, Bilateral Cleft lip Palate, Nasoalveolar Molding, Rhinoplasty, Gingivoperiostoplasty, Cheiloplasty.


INTRODUCTION

Presurgical infant orthopedics has been used as an evident mode of treatment from early centuries. Through Hofman et al, Desault, Hullihan, Brophy, Mencel, Matsuo and Grayson modifications are being made in order to correct the cleft alveolar arch. All aims were to reduce the alveolar cleft width along with nasal symmetry. Nasal symmetry reflects the proportionate relationship among nasal alar base width, columellar length and nasal tip; steps being taken to improve the cleft region along with maintaining harmonious nasal morphology to enhance facial esthetics. Previously the only way for achieving nasal symmetry was by surgical means but with the advent of nasoalveolar molding before surgery, it significantly enhances the result of surgeries and reduces the side effects of early surgeries. It was started from simple bonnet band, then silicon tubes with further advancement of molding acrylic plates. Intraoral acrylic molding plate was later constructed with added nasal stents covered with soft lining to reduce the alveolar gap with nasal symmetry. Although the technique is the extension of previous methodologies where silicon tubes was used to mold the nostrils1. All the above studies were conducted to achieve midfacial region symmetry of which nasal anatomy and morphology is the basic component along with alveolar arch width and gap reduction. Sequential molding of Nasoalveolar region helps to prevent early side effects prior to lip surgery and hence gaining maximum benefits of lip surgery and later the Periogingivoplasty. Correction of cleft lip and palate with concomitant nasal symmetry in order to establish physiological oronasal functionality is necessary for good facial growth. Therefore the primary aim of this review was to gather the results obtained by using nasoalveolar molding and how they all accounted to be a part of nasal symmetry.

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METHODOLOGY

A Data search was performed based on available electronic data base, hand search articles and books since1994-2010. This included Cochrane data base, Medline, pubmed, research journals, and papers. The total of nearly 900 articles were found related to nasoalveolar molding among which filtered results showed 302 randomized control trials.

The search strategy was based on PICO including search terms such as, unilateral and bilateral cleft, infant orthopedic treatment, nasoalveolar molding, acrylic plate with nasal stents and nasal symmetry. The Inclusion criteria included both unilateral and bilateral cleft lip and palate cases who had presurgical nasoalveolar molding, with nasal stents for nasal molding, prior to primary lip repair, whilst the exclusion criteria was syndromic patients, interrupted treatment timings, more than six months of age, immunocompromised, autoimmune diseases, and previous history of lip or nasal surgery before nasoalveolar molding for any reasons.

Overall 28 studies met the basic inclusion criteria. The Randomized trials filtered during study period were emphasizing more on surgical means, their sample size was not consistent, and highlighting surgical outcomes more as compared to orthodontic follow up. Further most of them were mentioning the word not detail randomization only their name suffix.

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Cleft lip palate is a multivariant deformity which presents with distinct characteristics both phenotypically and genotypically. The unilateral cleft lip and palate presents as a wide nasal base and cleft at upper lip segments. The affected lower lateral nasal cartilage is displaced laterally and inferiorly which results in a depressed nasal dome with the appearance of an increased asymmetric alar rim, an oblique columella and an over hanging nostril apex. If there is a cleft of palate, the nasal septum will deviate to the non cleft side with an associated shift of nasal base and tip. While the bilateral cleft lip palate presents morphologically with procumbent or rotated premaxilla, increase alar base width and the lip segments, the prolabium and columella appears to be deficient because of nasal tip flattening and lack of prominence. Also lower lateral alar cartilages are flared and concave. Normally they should be convex.

Previously the primary method of achieving nasal symmetry was by surgical means. Nasal molding presurgically reduced significantly the significant side effects of early surgeries like scarring, midfacial retrusion etc. This was started from simple bonnet band, silicon tubes and later molding acrylic plates. Intraoral acrylic molding plate was later constructed with added nasal stents covered with soft lining to reduce the alveolar gap with nasal symmetry. The stent is made up of .036 guage round stainless steel wire shaped bilobed form. Soft denture lining material is used to avoid nasal mucosal injury. The stent and the acrylic plates are secured by elastic loops over a retention arm extending from the anterior flange of the plate. The position of retention arm is 40° down from the horizontal plane to achieve proper activation and to increase stabilization of acrylic tray. Assembly and position of stents differs and may vary from patient to patient. Generally in unilateral clefts there is one retention arm with stent but in case with bilateral cleft there are two retention arms with two nasal stents. Thus the nasolabial junction continues to be lifted and projected forward. This also uplifts the nostril apex and ultimately defining the top of columella.

Various analyses were done in which the differences were being measured and compared in order to describe symmetry along with concomittent correction achieved. Later presurgical and postsurgical comparisons were made amongst them. This included: Height of nostril, Columella angle on cleft side, Nasal tip projections, Nasal tip symmetry, Alar rim symmetry measured between alar base noncleft side with respective to cleft side, Columellar base width and symmetry with respective to noncleft side or alar base cleft side, Length of columella and Width of alveolar cleft. The above measurements were discussed in studies shown below in table 1; all the following discussed studies showed various parametric measurements for determining nasal symmetry after nasoalveolar molding.

Descriptive studies enlightened that the maxillary alveolar segment molding simultaneously support and hold the deformed nasal cartilage which sequentially corrects the central nasal tip projection and cause...
lengthening of deficient columella\textsuperscript{2,24,25} it has been shown that the slight over correction of alar base on the cleft side obtained by using pressure exerted by the nasal stent maintains nasoalveolar molding results\textsuperscript{26,27,28}. Cleft lip repair is often performed at approximately 3 months of age when the risk of anaesthesia related complications diminishes. This may be delayed however if the patient is undergoing presurgical nasoalveolar molding. At end of nasoalveolar molding various measurements have been taken to identify the differences. Three dimensional studies showed effects related to facial forms with percentage distribution. Overall face form improved with columella\textsuperscript{29}, labial tubercle\textsuperscript{51}, lower lip\textsuperscript{29}, lateral aspect of face\textsuperscript{19}, tip of nose\textsuperscript{25} and laterally to columella directly below nares\textsuperscript{29}, upper nose\textsuperscript{81}, alar dome\textsuperscript{5}, columella height\textsuperscript{30}, lateral wall of nostril\textsuperscript{30}. Cleft side alar curvature showed large decrease in size\textsuperscript{80}.

Research evaluation also enumerates the combined surgical procedures and comprehensively illustrated their results achieved. Nasal symmetry is subsequently achieved by primary cheiloplasty. Technique is performed by using methods as Triangular flap method, Rotational Advancement flap method or Hotz plate. Kim et al evaluated and discussed the effects of nasoalveolar molding and cheiloplasty\textsuperscript{16}. Closure of cleft gap during alveolar molding was usually due to backward banding of whole part of greater segment. They addressed nasal deformity in both unilateral and bilateral clefts primarily by combined cheilorhinoplasty performed by open methods approach with delicately repositioning of lower alar rim cartilage\textsuperscript{17,18}. To improve nasal tip, nasal height / width and the post operative nasal form after nasoalveolar molding; lip repair methods using Cronin’s Triangular flap method results in significant improvement\textsuperscript{19}. All these studies were aimed to achieved nasal symmetry post surgically. Nasoalveolar molding was the primary method to achieve approximate positioning and symmetry.

Evaluation in studies of bilateral cleft lip and palate showed that nasoalveolar molding significantly cause improvement in columellar lengthening and hence decreased the chances of later nasal surgeries. Lee and Sato Yuki et al emphasized the nasoalveolar molding as esthetically beneficial and discussed the role in decreasing later surgical need\textsuperscript{20,23}. Columella length showed relapse in bilateral cleft because of differential growth pattern between the columella and rest of nose in first and second post-operative years. This was reported and found to be 1.9mm. According to growth evaluation data, columella started to increase in length in third year post operatively whereas the rest of nasal growth was significantly increased in height year by year. In a preliminary study conducted by Betty et al shows that in Unilateral cleft lip and palate cases relapse in nostril width and height is\textsuperscript{10} and 29\% respectively and angle of columella [5\%] at 1 year of age\textsuperscript{14}.

Deirdre, Maull, Grayson et al elaborated in their three dimensional study on nasal morphology by digital surface scanning which pertains presurgical nasoalveolar molding to be significant and increases nasal symmetry\textsuperscript{15}. Nasoalveolar Molding was started before the age of six weeks and correction was done till age of 3 or 4 months at which time the primary lip surgery and nasal surgery is performed. This associated with increase in symmetry and was reported to be maintained up to early childhood. In this context the mean symmetry index was significant to be p<0.05. Detailed considerate analysis with measurements reflect that the nasal symmetry achieved by various methods reveal better results in both unilateral and bilateral cleft lip palate cases. Presurgical orthopaedics brings better maxillary correction. Levy et al discussed the complications with the nasoalveolar molding procedure. Broken appointments and Removal by Tongue is reported variably among which tissue irritation and removal by tongue is the predominant factor. These are collectively overwhelming conditions but subsequently found to be out weighted by the benefits achieved later\textsuperscript{21}. Further Pfeifer et al in his study compared the cost analysis and predictably found that Nasoalveolar Molding have subsequently reduced the need of later surgeries\textsuperscript{22}.

![Fig 1: Graph showing percentage distribution of complications](image-url)
CONCLUSION

Unilateral and Bilateral Cleft lip and palate have different morphology. Nasoalveolar molding is a pre-surgical treatment used to improve the surgical repair for both Unilateral and Bilateral Cleft lip and palate cases. Surgical repair alone cannot correct the multiple problems encountered with the deformities that results from cleft of the lip and palate. Nasal symmetry is preferably well achieved by Nasoalveolar Molding presurgically in all the above reviewed studies and showed to be beneficial. An acrylic orthopedic appliance with nasal stents is made to approximate the cleft and mold the nose, and hence, reducing the amount of surgical correction required during treatment. This method symmetrically molds tissues prior to surgery which included closed approximation of alveolar gap, nostril shape and width improvement. Also nasal tip projection with columellar lengthening and alar rim symmetry helps to improve over all nasal symmetry.

RECOMMENDATION

All the above discussed studies concomitantly have Limitations as more objective statistical analysis is required to predict three dimensional shape changes; also adult groups serving control are not of the same age group. Further there is no Long term data available with adequate follow up times related to surgical maneuvers or detailing. Randomized trials and systemic reviews are needed. Currently research studies show inconsistent sample size, and highlighting surgical outcomes more as compared to orthodontic follow up.

REFERENCES


