JPRAS Open 19 (2019) 50–55

Contents lists available at ScienceDirect

JPRAS Open

journal homepage: www.elsevier.com/locate/jpra

Case Report

Orthopaedic traction with passive nasoalveolar moulding in a bilateral cleft lip and palate patient – Rediscovering the old

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ARTICLE INFO

Article history:
Received 15 April 2018
Revised 17 October 2018
Accepted 25 October 2018
Available online 23 November 2018

Keywords:
Pre-surgical nasoalveolar moulding
Lip taping
Nasal stent
Columellar lengthening

ABSTRACT

Introduction: A 22-day-old male infant presented with complete bilateral cleft lip and palate with prominent premaxillary segment, wide alar base, flat alar domes and no columellar tissue, thus leading to a severe facial deformity. A presurgical nasoalveolar moulding (PNAM) procedure was planned to facilitate an optimal surgical approximation of the cleft and surrounding tissues.

Methods: PNAM was performed on the basis of the hypothesis that 'The palatal shelves continue to grow unabated if adequate relief is provided by wax mock up while preparing the feeding plate'. An intraoral device, which consisted of an acrylic feeding plate, was constructed after adequate wax mock up in the cleft area for passive moulding, along with extraoral traction force through active lip taping. A nasal stent was subsequently attached to lift the nasal domes and lengthen the columella. The changes thus achieved with PNAM were assessed using innovative photographic and model analyses.

Results: On completion of PNAM, the qualitative photographic changes showed significant premaxillary setback, columellar lengthening and fullness of alar domes. The quantitative model analysis revealed reduction in the anteroposterior cleft gap by 5 mm and 5.5 mm on right and left sides, respectively. Transverse distance between the two palatal segments reduced by 3.5 mm,

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https://doi.org/10.1016/j.jpra.2018.10.007

8 mm and 8.5 mm in anterior, middle and posterior regions, respectively.

Conclusion: Orthodontic intervention performed for 11 weeks by PNAM helped to retract the premaxilla, reduce the cleft gap, improve the arch form, approximate lip segments and distinctly lengthen the columella. Hence, it improved the morphology of the nose by correcting the flattened nasal wings. This aided the surgeon to achieve an optimal surgical repair.

Introduction

Presurgical nasoalveolar moulding *(PNAM)* serves to act as a preparatory phase for performing primary lip and palatal surgical repair. This procedure has witnessed modifications in the standard protocol given by Grayson, Cutting[1–4] and McNeil. Extraoral traction forces through lip taping play a crucial role in fulfilling the PNAM objectives in bilateral cleft cases.

The present case demonstrates a combined effect of *ACTIVE* lip taping force and *PASSIVE* nasoalveolar moulding in a patient with *complete bilateral cleft lip and palate***.** Photographic and model analysis are employed to evaluate the changes achieved with PNAM.

Case report

A 22-day-old male infant presented with a complete bilateral cleft lip and palate with a prominent premaxillary segment, thus leading to a severe facial deformity. From the frontal view, although the face looked grossly symmetrical, a collapsed nose and wide alar base were evident. The profile examination revealed severely protruded premaxilla attached to the base of the nose, thus making the nasolabial angle zero with no visible columella. The submental view showed flattened alar domes with absent philtrum. The tip of the nose was obscured by a premaxillary segment, and lower lip was trapped behind the protruded premaxilla (Figure 1A).

Treatment objectives

(1) Retraction of the premaxilla with extraoral traction by lip taping.
(2) Maintenance of the arch form using passive appliance.
(3) To create a clinically appreciable columellar tissue.
(4) To harmonize the nasal tip projection.

Treatment progress

An impression of the cleft and the surrounding alveolar and palatal area was recorded with an impression compound, followed by a Polyvinyl Siloxane impression material using an acrylic custom tray. Impressions were poured into a dental stone, and model casts were made out of it. On the final model, the cleft region was blocked through wax mock-up and marginally overfilled to approximate the contour and topography of an intact arch. The oral feeding plate was fabricated using methyl methacrylate self-cure resin. The premaxillary segment was not covered in this feeding plate to permit its retraction.

A day later, the feeding plate was delivered for full-time wear except for cleaning after feeds. A 1/2-inch micropore tape was *actively* applied across the cleft lip, extending from one cheek to another, and continued throughout the treatment.

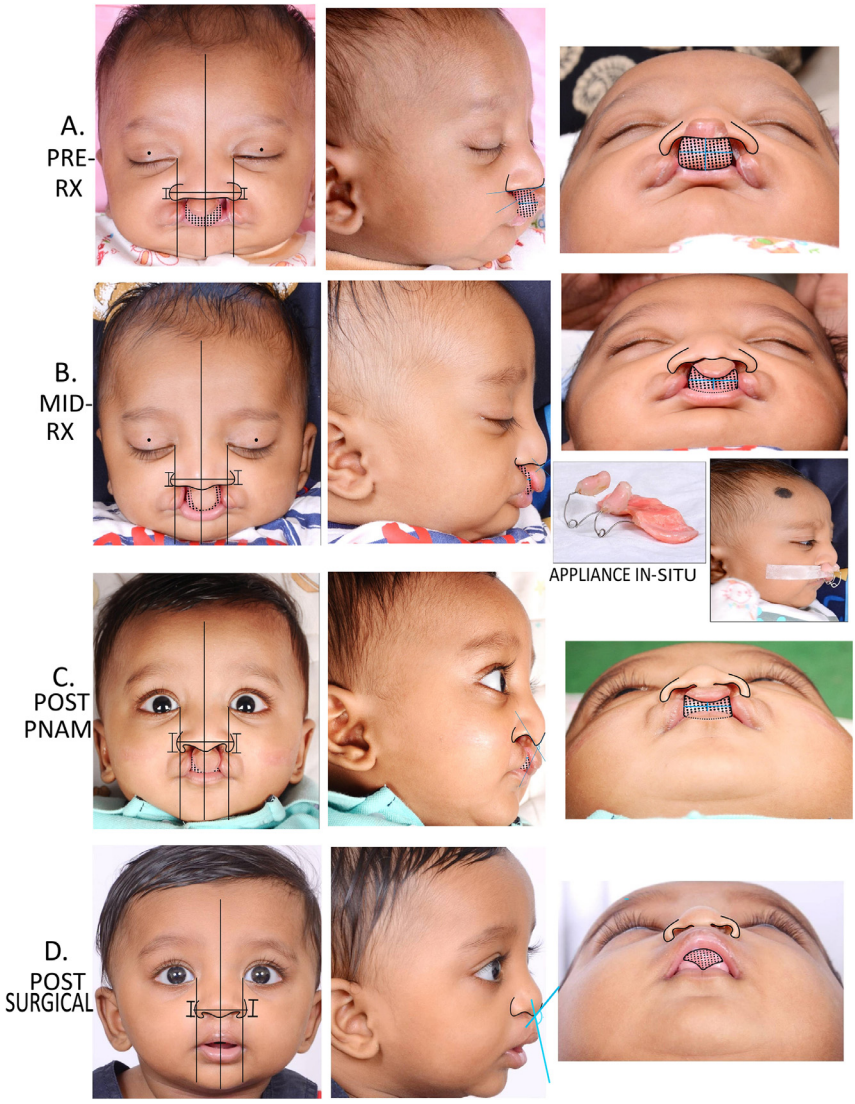
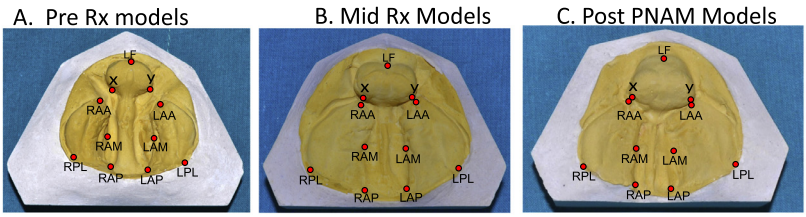


Figure 1. Photographic analysis.

After comfortable acquaintance with the assembly for a week**,** a nasal stent of 0.036" S.S. wire bent into a 'swan neck' configuration (Figure 1B**)** was embedded into the plate at both the cleft sites.[3] A loop was added for activation to maximize the stretching effect, lift the nasal domes and initiate columellar lengthening.

Appreciable retraction of premaxilla and reduction in cleft gap was achieved in approximately 11 weeks, along with shaping up of the cartilaginous septum, alar tip and medial and lateral crus, all resembling the normal nasal anatomy (Figures 1 and 2**).** Passive moulding and active lip taping were continued until primary surgical lip repair was completed (at 7 months of the patient's age).

To quantify the changes during the treatment, several landmarks were established on the scanned pictures of the stone models at each stage (Figure 2**).**



Abbreviation	Anatomic landmark
LF	Labial frenum
RAA	Right alveolar anterior (most anterior and superior point of right alveolar segment)
LAA	Left alveolar anterior (most anterior and superior point of left alveolar segment)
RAM	Right alveolar middle (middle of right alveolar segment)
LAM	Left middle (middle of left alveolar segment)
RAP	Right alveolar posterior (most posterior and medial point on right alveolar segment)
LAP	Left alveolar posterior (most posterior and medial point on left alveolar segment)
RPL	Right posterior lateral (most posterior and lateral point on right alveolar segment)
LPL	Left posterior lateral (most posterior and lateral point on left alveolar segment)

Figure 2. Model analysis.

Table 1
Photographic analysis.

Stage of treatment	Frontal view		Profile view	Submentovertex view
	Alar height (in mm)	Alar width (in mm)	Nasolabial angle (in degree)	Depth of premaxilla (in mm)
Pre treatment	8(R), 8(L)	43	0°	12
Mid treatment	9(R), 8(L)	38	100°	2.5
Post pnam	11(R), 11(L)	34	120°	1.5

Results

Comprehensive qualitative photographic analysis was performed in frontal, profile and submentovertex views. *Frontal* photographic analysis depicted gain in vertical alar height by 3 mm on both the sides and 9 mm reduction of alar base width **(**Table 1**).** This can be attributed to aggressive lip taping and premaxillary retraction, thereby harmonising the alar base support. *Profile* photographs unveil a remarkable increase in nasolabial angle by 120°, which was nil to begin with **(**Figure 1A–C**).** *Submentovertex* photographic analysis depicts remarkable correction in premaxillary visibility from 12 mm to 1.5 mm **(**Table 1**).** Significant columellar lengthening can be appreciated in the submentovertex view and profile view.

Model analysis (Table 2) shows excellent *reduction* in the cleft gap at alveolus by 5 mm on the right (i.e., 6 mm to 1 mm) and 5.5 mm on the left (6.5 mm to 1 mm). Transverse gap between the two palatal segments reduced by 3.5 mm (i.e., 22.5 mm to 19 mm) in the anterior region *(RAA-LAA)***,** 8 mm (i.e., 21.5 mm to 13.5 mm) in the middle *(RAM-LAM)* and 8.5 mm (i.e., 19 mm to 10.5 mm) in the posterior region *(RAP-LAP)***.** However, with narrowing of the cleft gap, transverse growth of the

Table 2
Model analysis.

Stage of Rx	Alveolar cleft gap (right) in mm	Alveolar cleft gap (left) in mm	RAA-LAA in mm	RAM-LAM in mm	RAP-LAP in mm	RPL-LPL in mm
Pre treatment	6	6.5	22.5	21.5	19	39
Mid treatment	1.5	1	22	15	12.5	41
Post PNAM	1	1	19	13.5	10.5	45

Note: Cleft gap is measured from the points x-RAA and y-LAA for right and left sides, respectively. x is the point on the premaxilla intersecting the line drawn from LF-RAA. y is the point on the premaxilla intersecting the line drawn from LF-LAA.

arch continued unabated, thereby increasing the arch width by 6 mm at the posterior end of the alveolar segment *(RPL-LPL)*.

Discussion

The rationale behind the PNAM procedure as suggested by Grayson[1] is to approximate the alveolar segments, which permits the surgeon to perform gingivoperiosteoplasty and surgical lip repair. This approximation is done by actively moulding the alveolar segments towards each other, thus directing them to their final and optimal position.[5] *Active moulding* involves the selective removal of hard acrylic and addition of soft relining material to the moulding plate. The present case differs from classical PNAM in that *no active moulding* was performed. Keeping the basic principles of PNAM intact, significant results were obtained in accordance with the hypothesis that 'The palatal shelves continue to grow unabated if adequate relief is provided by wax mock up while preparing the feeding plate'. Respective areas were kept free underneath the feeding plate (passive moulding).[6] This allowed the alveolar and palatal segments to grow naturally towards the midline without the interference of tongue, thereby reducing the cleft gap along with increasing posterior arch width.

Lip adhesion alone produced uncontrolled orthopaedic effects, whereas this force in conjunction with a *passive plate* yielded a controlled movement of the premaxilla in a predetermined manner.

Although mild extension of acrylic along the palatal margins is believed to aid in retention, it is evident from the present case that the upward pressure by the tongue and strong suckling reflex provide enough thrust to hold the plate against gravitational pull, thus making this passive moulding appliance a self-retaining feeding plate.

Moreover, reshaping of the deformed alar cartilage and stretching of the nasal mucosa enhanced the surgeon's ability to achieve a proper surgical repair.

Conclusion

Change is the law of life. Faint divergence from the classical modality can create a remarkable difference in severe bilateral cleft lip and palate patients. PNAM, when performed before primary lip repair, in addition to providing psychological reassurance to parents, enhances surgical outcome, reduces the need for future soft tissue revision surgeries and reduces the overall cost of treatment.[5] Globally, the literature is replete with studies being carried out in the field of PNAM using active or passive procedures. However, a *combination procedure of passive moulding and active orthopaedic traction*, as done in this case, adds tincture to a new philosophy of treatment modality in *bilateral cleft lip and palate cases*.

Conflict of Interest

None.

Funding

None required.

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