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A Narrative Review on the Modifications in Nasoalveolar Moulding : Newer Prospectives

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Abstract

This narrative review provides an idea on the various modifications of NAM in paediatric dentistry. The articles reviewed were retrieved from reliable scientific sources upto 2023 years. The search engines used were PubMed Central, Scopus, and Web of Science. The keywords used were as follows: modifications of NAM, recent advances in NAM. There were no restrictions made on the year of publication, but the articles published in English were evaluated. The articles mentioning modifications of NAM in paediatric dentistry were very few. With the continual advancements within the technology and material science in the field of dentistry, this paper is aimed toward reviewing the present literature on various applications together with its specific modifications in NAM.

Keywords: NAM, Paediatric, Dentistry.

Introduction

A congenital impairment of the maxillofacial development known as cleft lip and palate detrimentally impairs a child's facial features and phonological abilities and may even result in psychological issues [1, 2]. The most severe cleft lip abnormality, complete bilateral cleft lip and palate (BCLP), demands interdisciplinary cleft team therapy. Patients with BCLP frequently have columellar deficit and a protruding premaxilla [3, 4].

Numerous options are accessible for addressing cleft lip and palate, including lip adhesion surgery [5], lip tapping without surgical intervention [6], presurgical infant oral appliances (PSIO), and presurgical Nasoalveolar moulding (NAM) appliance, which was hailed as a turning point in the care of infants with clefts by improving the aesthetics of both the lips and the nose [7]. NAM devices come in active, semiactive, and passive varieties.

Passive appliances deliver no force but function as a fulcrum upon which forces mould the alveolar segments in an unpredictable manner, they maintain the distance between the two maxillary segments while external force is applied with a primary goal of repositioning it posteriorly. Active maxillary appliances move alveolar cleft segments in a predetermined manner with controlled forces. With NAM equipment, a variety of mechanical retention techniques, including elastic chains, screws, springs, and plates, can be utilised [8].

This article elaborates on the recent modifications and advances that are seen in the fabrication of NAM.

Material and methodology

The articles reviewed were retrieved from reliable scientific sources upto 2023 years. The search engines used were PubMed Central, Scopus, and Web of Science. The keywords used were as follows: modifications of NAM, recent advances in NAM.

Discussion

On instances of tissue irritation and erythema bilaterally on the cheeks with the regular NAM. A modification was done by using the elastic loops of the N95 mask. It was used to fasten the moulding plate and connect them together to form a crude head strap. Later a surgical tape and an orthodontic elastic were looped at the straps' ends. The proposed modification posed several advantages; it is easy to remove and reapply the molding plate without the additional hassle of sticking and removing tapes. It reduced the initial difficulty barrier for the parents and resulted in an improved compliance. The presence of adjustable loops allows to titrate the force applied by the elastics. No tissue irritation [9].

Jack screw was incorporated in the NAM appliance when the treatment was delayed. In this case the traditional PNAM technique was not advised. As a result, the professionals used a multi-staged approach to provide targeted rectification. In stage one the alignment of posterior lateral segments with simultaneous derotation of the premaxilla was done. Premaxilla guided retraction and columella lengthening in stage two. The third stage involves shaping the nasal cartilages and adjusting the nasal projection. The jack screw was incorporated in the 2nd stage and positioned anteriorly and posteriorly between the anterior premaxillary component and the posterior acrylic component (the two lateral maxillary halves).; the cast was sectioned into the premaxillary and lateral maxillary segments. Regions where development was allowed, plaster relief was applied to accommodate for growth changes. The plate was then relined with soft liner intraorally to enable placement into the present arch dimensions, extended to the proportions of the patient's cast, and placed at the completion of Stage 1. To allow the anteroposterior section to approximate the intended position in Step 2 the appliance was activated in the reverse direction, 0.5 mm each day.

To avoid repeated modifications in retracting premaxilla and adjusting the spatial orientation of the nasal stents, the nasal stent placement in stage 3 was also adjusted by

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inserting it in the posterior segment [10]. To elevate the nasal tip and place the alar cartilages in an ideal position, the swan neck-shaped nasal stents were positioned mesially. To avoid injuring the nasal mucosa, the nasal stents were kidney-shaped and coated with soft acrylic. The nasal stents were activated until there was a slight blanching at the tip of the nose. When a vertical pull was deployed on the columella, a prolabial acrylic bar was employed to link the two nasal stents and serve as a restraint for the nasal equipment [11].

Negm et al. incorporated the construction of modified active naso-alveolar molding by scanning the master cast after standardised impression taking protocols. A 3D virtual model was used to measure the angle of deviation and the amount of separation of premaxilla in relation to the vomer. The amount of screw opening was adjusted to the future position of the premaxilla.

One vertical line was drawn in the premaxilla and vomer's centre, and the angle of deviation was determined by the intersection of the two lines. To modify the level of screw inclination, this angle was computed. The active screw orthopaedic device used by Oosterkamp et al. (2005) [12] was modified and constructed in clear acrylic resin. The side tension arms, defined by Abdel Razek [13] in 1980 was incorporated as additional oral retentive wings. Sodium alginate was used as the separating medium after the base plate wax was used to relieve the vomer and block out the vault throughout the whole length of the cleft to prepare the master cast.

Extra-oral wings were created using ready-made facebows with two straight sides made of firm, rounded, 2mm diameter, 15cm long Nickel-Chrome wire, and omega loops (at the wire's end) as a retentive aid to keep the prosthesis in place. Size One face-bows were appropriate for to newborns considering their head size and shape. A wire was modified to follow the labial and buccal surfaces of the alveolar ridge.

To retract the premaxilla, a reverse expansion screw was inserted and opened accordingly to the distance needed. To both ends of the screw, self-curing clear acrylic resin was applied before the screw was fastened to the premaxilla's palatal side at the predetermined angle. Two pieces of base plate wax were modified to fit on the prepared master cast and then trimmed to the correct size for the functional sulcus. A gypsum mould that was specially manufactured was used to produce the cast. To hold the extra-oral wire wings in place and prevent any movement when packing the cold-cure clear acrylic resin material, a gypsum mould was created for each cast. The appliance was packed, finished and polished and inserted into the infant’s oral cavity [14].

Jiansuo Hao et al. modified the NAM appliance by incorporating two nasal stents. The master cast was recovered after the impression had been taken according to the established procedure and the premaxilla and palate's limits were demarcated. Marking of the nostril position was done and base plate wax was used to approximate the contour in the cleft region and the undercut sections. An auto-polymerizing acrylic resin plate was fabricated extending from the vestibular folds to the maxillary tuberosity and the rear of the hard palate on the inside and sawed along both alveolar ridges that divided the premaxillary portion from the remaining moulding plate after the resin had dried and hardened. Premaxillary appliance covered the anterior portion and palatal plate to the remaining portion. The premaxillary appliance was connected to the anterior and mid- palatal plate using two stainless steel wires (0.5 mm round tip). Two stainless steel wires of 0.8-mm thickness were used to make the nasal stent wires which were then inserted into the palatal plate's clefts on either side and embedded

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onto the acrylic plate. The extended aspect of the wire was bent to form a loop (1-1.5 mm in diameter) for activation and the tip of the wire was covered with soft silicone to form a nasal bulb. The MPNAM device comprised two nasal stents: a premaxillary appliance and a palatal plate.

The nasal bulb was inserted inside the cleft nostril while the alveolar segments and nasal moulding were being moulded concurrently. The nasal stent wire's curve was adjusted to ensure no contact with the lower lip. A horizontal adhesive tape was applied from one side of the cheek before wrapping around beneath the wire's loop to the other side. To increase the depressing force on the premaxilla, extra adhesive tape was applied over the premaxillary apparatus [15].

Puneet Batra et al., utilised clear aligners for alveolar moulding and a nasal elevator for nasal moulding. Using a reference point and line grid system based on the anatomical components, a 3-D model of the maxilla was created to fabricate the aligner plates [16,17].

To overlay pre- and post-treatment models, the same model was loaded into MESH labs software. The major and minor cleft segments and the corresponding dental grooves on each cast were virtually separated using the OrthoAnalyzer software (3Shape) with the virtual base parallel to the occlusal plane and the midsagittal plane determined according to the child's extraoral pictures. The desired ideal arch was then determined using 3 points and an ovoid arch shape using the OrthoPlanner software (3Shape; Figure 2D). The 3D printed moulds were made using a 3D printer, followed by appliance fabrication. In unilateral CLCP individuals, the dental grooves (enclosing the tooth buds) were segment to prevent the posterior maxillary width from being reduced. In case of bilateral CLCP; further attention was essential as more 3-D control (roll, pitch, and yaw) of the premaxilla was needed due to the upward frenum strain in that area. The amount of movement needed to get the desired outcome (not more than 1 mm) was used to calculate the number of stages needed to gradually mould the segments [18].

Conclusion

NAM and its modification technique's have significantly shown to improve the surgical outcome of CLP patients especially in conditions where conventional NAM is not of compliance. It gives the operator an insight of the benefits when compared to the conventional method and thus renders the child a better and more predictable outcome.

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