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Assessment of Presurgical Nasoalveolar Moulding (PNAM) in unilateral cleft lip and palate (UCLP)

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Abstract

Midface symmetry is an important indicator of success of complete unilateral cleft lip and palate (CUCLP) treatment. There is little literature on the long-term effects of Presurgical Nasoalveolar Molding (PNAM) on Midface symmetry in children treated for CUCLP.

The study had been planned in total 4 Pmch Patna Patients undergoing Presurgical nasoalveolar moulding in unilateral cleft lip and palate. The approval institutional ethical committee was taken before conducting this study. The written informed consent was obtained from the parents before the use of any pictures or records for analysis.

PNAM has proved to be an effective adjunctive therapy for reducing hard and soft tissue cleft deformity before surgery. However, it is important that parents or caregivers become active members of the treatment plan. This study showed that PNAM therapy improved the nasal aesthetics, decreased the cleft size and aligned the maxillary arch with a reduction in cleft alveolus and palate size in UCLCP patients.

Keywords: unilateral cleft lip and palate (CUCLP), presurgical nasoalveolar molding (PNAM)

Introduction

Cleft lip and cleft palate, also known as orofacial cleft, is a group of conditions that includes cleft lip (CL), cleft palate (CP), and both together (CLP). A cleft lip contains an opening in the upper lip that may extend into the nose. The opening may be on one side, both sides, or in the middle. A cleft palate is when the roof of the mouth contains an opening into the nose. These disorders can result in feeding problems, speech problems, hearing problems, and frequent ear infections. Less than half the time the condition is associated with other disorders. Cleft lip and palate are the result of tissues of the face not joining properly during development. As such, they are a type of birth defect. The cause is unknown in most cases. Risk factors include smoking during pregnancy, diabetes, obesity, an older mother, and certain medications (such as some used to treat seizures) [1, 2]. Cleft lip and cleft palate can often be diagnosed during pregnancy with an ultrasound exam [1].

A cleft lip or palate can be successfully treated with surgery. This is often done in the first few months of life for cleft lip and before eighteen months for cleft palate. Speech therapy and dental care may also be needed. With appropriate treatment, outcomes are good.

Cleft lip and palate occurs in about 1 to 2 per 1000 births in the developed world. CL is about twice as common in males as females, while CP without CL is more common in females. In 2013, it resulted in about 3,300 deaths globally, down from 7,600 deaths in 1990. The condition was formerly known as a "hare-lip" because of its resemblance to a hare or rabbit, but that term is now generally considered to be offensive [3].

Within the first 2–3 months after birth, surgery is performed to close the cleft lip. While surgery to repair a cleft lip can be performed soon after birth, often the preferred age is at approximately 10 weeks of age.). If the cleft is bilateral and extensive, two surgeries may be required to close the cleft, one side first, and the second side a few weeks later. The most common procedure to repair a cleft lip is the Millard procedure pioneered by Ralph Millard. Millard performed the first procedure at a Mobile Army Surgical Hospital (MASH) unit in Korea [4].

Often an incomplete cleft lip requires the same surgery as complete cleft. This is done for two reasons. Firstly the group of muscles required to purse the lips run through the upper lip. In order to restore the complete group a full incision must be made. Secondly, to create a less obvious scar the surgeon tries to line up the scar with the natural lines in the upper lip (such as the edges of the philtrum) and tuck away stitches as far up the nose as possible. Incomplete cleft gives the surgeon more tissue to work with, creating a more supple and natural-looking upper lip. Often a cleft palate is temporarily covered by a palatal obturator (a prosthetic device made to fit the roof of the mouth covering the gap).

Cleft palate can also be corrected by surgery, usually performed between 6 and 12 months. Approximately 20–25% only require one palatal surgery to achieve a competent velopharyngeal valve capable of producing normal, non-hypernasal speech. However, combinations of surgical methods and repeated surgeries are often necessary as the child grows. One of the new innovations of cleft lip and cleft palate repair is the Latham appliance [5]. The Latham is surgically inserted by use of pins during the child's 4th or 5th month. After it is in place, the doctor, or parents, turn a screw daily to bring the cleft together to assist with future lip or palate repair.

If the cleft extends into the maxillary alveolar ridge, the gap is usually corrected by filling the gap with bone tissue. The bone tissue can be acquired from the patients own chin, rib or hip.

This has been shown that correction of nasal cartilage deformity and non-surgical elongation of a deficient columella can be achieved in combination with moulding of alveolar process with premaxillary retraction through PNAM. This is possible because the cartilage has a high degree of plasticity in the neonatal period. The temporary plasticity of cartilage is due to high levels of hyaluronic acid, a component of proteoglycan intercellular matrix, which is found circulating in infants for several weeks after birth.

Hence based on above literature findings this study has been planned in PMCH Patna patients regarding Presurgical nasoalveolar moulding in unilateral cleft lip and palate.

Methodology

The study had been planned in total 4 PMCH Patna Patients undergoing Presurgical nasoalveolar moulding in unilateral cleft lip and palate. The approval institutional ethical committee was taken before conducting this study. The written informed consent was obtained from the parents before the use of any pictures or records for analysis.

Inclusion criteria

- All un-operated cases
- No associated syndromes and systemic illness
- Moderately to well-nourished healthy babies.

Exclusion criteria

- Patients above 45 days of age
- Syndromic, malnourished and systemically ill babies
- Patient's/guardians who were unwilling to go through the PNAM therapy.

Results & discussion

Photographs of the 4 patients were taken before the start of PNAM and after the completion of the PNAM therapy. These photographs were subjected to analysis, for measurements, using Vista Dent software, which calculated the measurements based on the pixels. Intraoral models were prepared from the impression taken before the start of PNAM and after the completion of the PNAM therapy. Direct measurements were done on the models.

Fig 1: Unilateral Cleft Lip and Palate

Fig 2: Nasoalveolar moulding

These parameter obtained were then subjected to statistical evaluation to study the effect of PNAM, results on continuous measurements are presented as mean standard deviation (minimum-maximum). Significance has been assessed at 5% level of significance. Student's t-test has been used to find the significance of study parameters on the continuous scale within each group. Post-operative results were stable at 6 m follow-up.

He goal of PNAM is to align and approximate the alveolar cleft segments while at the same time achieving correction of the asymmetric nasal cartilage and soft tissue deformity. These corrections are achieved by adding a nasal stent to the labial vestibular flange of a conventional intraoral moulding plate. The nasal stent and alveolar moulding plate are adjusted gradually over a period of 5–6 months to achieve nasal and alveolar symmetry, nasal tip projection, and approximation of the cleft alveolar segments before primary lip, nasal, alveolar surgical repair. The nasoalveolar orthopaedic appliance is held in place with a combination of adhesive tapes applied to the cheeks and cleft lip segments [6]. The presurgical reduction in osseous and soft tissue cleft deformity considerably reduces the magnitude of the surgical challenge, resulting in improved surgical outcomes [7].

The advantages of presurgical infant orthopaedics may be considered from a soft tissue perspective as well as from the usual osseous perspective. The presurgical reduction in soft tissue and cartilaginous deformity facilitates achievement of surgical soft tissue repair under minimal tension and optimal conditions for scar formation. There is also a reduction in the number and complexity of minor soft tissue revision surgeries required to maintain acceptable nasolabial aesthetics as the nose grows.

The role of PNAM in the reduction of postcleft asymmetry has been a matter of controversy in the literature [8]. Although immediate postsurgical benefits of PNAM are evident and potential long-term positive effects of PNAM in CUCLP have

been proposed [9], the lack of studies of long-term effects of PNAM complicates the understanding of the role of underlying muscular tensions and the surgery itself in the shaping of the face [10].

We found significant differences between the patients with cleft and control participants with respect to the pronasale (P = 0.025) and subnasale (P = 0.024), which is in agreement with previous long-term studies [11]. However, there were no significant differences between the PNAM and NNAM groups. A similar lack of significance for the bilateral landmarks supports the view that while PNAM may facilitate the surgical closure of the cleft lip, there is no sufficient evidence to definitively demonstrate long-terms benefits of the technique [12].

Most of the criticism of PNAM has been focused on potential midface growth restrictions.20–22 Our findings are in line with those of Lee *et al*., [13] who suggested that PNAM does not alter growth. The absence of differences between the PNAM group and the NNAM group indicates that in the long-term growth is unlikely to be influenced by the technique used.

The results of this study should be viewed in the light of its limitations. Oral cleft treatment is a multistep procedure, and each step has its own effect on facial morphology. These effects cannot be separated from each other in a retrospective study [14]. Furthermore, the outcome of oral cleft therapy depends upon the initial deformities [15].

Conclusion

PNAM has proved to be an effective adjunctive therapy for reducing hard and soft tissue cleft deformity before surgery. However, it is important that parents or caregivers become active members of the treatment plan. This study showed that PNAM therapy improved the nasal aesthetics, decreased the cleft size and aligned the maxillary arch with a reduction in cleft alveolus and palate size in UCLCP patients.

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