ijlpr 2022; doi 10.22376/ijpbs/lpr.2022.12.6.SP24.L74-87

International Journal of Life science and Pharma Research

ISSN 2250-0480

Review Article

Pediatric Cleft Lip and Palate

Surgical Management of Pediatric Cleft Lip and Palate - Review Article

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Abstract: The most prevalent serial congenital defects affecting the orofacial region are cleft lip and palate. It can happen alone, in various combinations, and/or in tandem with other congenital malformations, most notably congenital cardiac conditions. They are also associated features in over 300 recognized syndromes. To attain functional and aesthetic well-being, patients with oro-facial cleft deformities must receive treatment at the appropriate time and at the appropriate age. Coordinated treatment from a variety of specialities, including oral and maxillofacial surgery, otolaryngology, genetics/dysmorphology, speech/language pathology, orthodontics, prosthodontics, and others, is necessary for the successful management of a child born with a cleft lip and palate. The purpose of this article is to review what is known about cleft lip and palate among general practitioners. The current study aims to summarize and update current evidences regarding surgical management of cleft lip and palate in pediatrics. The objective is to identify clinical judgments about cleft treatment that are supported by randomised controlled trials (RCTs) and to educate parents and future mothers and fathers how to prevent the occurrence of CLP in the first place. Introduction, epidemiology, clinical characteristics, etiologic factors, and management of cleft lip and palate have all been covered in a review of the literature.

Keywords: Cleft Lip, Cleft Palate, Congenital Anomalies, Genetic and Environmental Factor and Syndrome.

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Received On 01 September 2022

Revised On 04 October 2022

Accepted On 11 October 2022

Published On 23 October 2022

This research did not receive any specific grant from any funding agencies in the public, commercial or not for profit sectors.

Citation Ashwag Siddik Noorsaeed , Rawabi Mohammed A Alkhudhayri , Alanood Mohammed Alzogibi , Huriyah Saad S Almutairi , Amjad Mohammed B Barnawi , Reham Tariq M Tallab , Mohammed Abdulmajeed M Alghadeer , Mohammed Hassan A Alzahrani , Tariq Abdullatif S Al Naeem and Almajhdi, Faisal Fahad N , Surgical Management of Pediatric Cleft Lip and Palate - Review Article.(2022).Int. J. Life Sci. Pharma Res.12(6), L74-87 http://dx.doi.org/10.22376/ijpbs/lpr.2022.12.6.SP24.L74-87

1. INTRODUCTION

Cleft of lip and palate (CL/P) are most common serial congenital anomalies to affect the orofacial region. It can occur isolated or together in various combination and/or along with other congenital deformities particularly congenital heart diseases.[1] A cleft is a congenital abnormal space or gap in the upper lip, alveolus, or palate. cleft lip and cleft palate can be well-defined as: cleft lip: The failure of fusion of the frontonasal and maxillary processes, resulting in a cleft of varying extent through the lip, alveolus, and nasal floor (an incomplete cleft does not extend through the nasal floor, while a complete cleft implies lack of connection between the alar base and the medial labial element) [2]. Cleft palate is a developmental defect in the hard palate that results in a communication between the oral and nasal cavities resulting in nasal reflux during feeds[3]. Global occurrence of orofacial clefting is around 1.5 per 1000 live birth (about 220,000 new cases per year) with extensive difference across geographic areas, ethnic group, and nature of cleft itself[4]. In the United States, the incidence of CLP is about 1 in 1600 babies; that of CL without CP is about 1 in 2800; and that of CP alone is about 1 in 1700[5]. In the developed world, most scientists believe that clefts occur due to a combination of genetic and environmental factors (e.g., maternal illness, drugs, malnutrition) [1]. The management of cleft lip and palate represents a commitment to the care of the afflicted child over the course of the child's development into adulthood.[6] The approach of the patient with cleft lip and palate is multidisciplinary, and the cleft team should be ideally com- posed by craniofacial surgeons, otolaryngologists, geneticists, anesthesiologists, speech-language pathologists, nutritionists, orthodontists, prosthodontists, and psychologists, and to be capable of treating even rare facial clefts with excellence, neurosurgeons, and ophthalmologists[7]. Different the artistic nature of the cleft lip repair, the cleft palate repair is very practical in nature. A team approach has decreased the morbidity and secondary deformities caused by the cleft and mostly focuses quality of speech[8]. Most surgeons today perform some modification of an intravelar veloplasty, vs. a two flap palatoplasty with double opposing z-plasty to achieve levator muscular repositioning[9]. There are numerous procedures for surgical reparation of the cleft lip and palate. Reparation is frequently staged, with the lip accomplished first, followed by the palate. The most utilized repairs of the lip are the Millard rotation-advancement technique for unilateral cleft lip and the Mulliken technique for bilateral. Palatoplasty for cleft palate linked with cleft lip and for cleft palate alone is completed later, at 9-15 months of age. Techniques for repair include straight line repair, the Furlow double Z-plasty, and Veau-Wardill-Kilner V-Y pushback.[10]

2. AIM OF THE STUDY

The current study aims to summarize and update current evidences regarding surgical management of cleft lip and palate in pediatrics.

3. METHODS

Study Design: Review article. Study duration Data was collected between 1 May and 30 July 2022. Data collection Medline and PubMed public database searches was carried out for papers written all over the world on surgical management of cleft lip and palate in pediatrics. The keyword search headings included "cleft lip, cleft palate, surgery, anomaly, pediatrics", and a combination of these were used. For additional supporting data, the sources list of each research was searched. Criteria of inclusion: the papers was chosen based on the project importance, English language, and 20 years' time limit. Criteria for exclusion: all other publications that do not have their main purpose in any of these areas or multiple studies and reviews was excluded.

4. STATISTICAL ANALYSIS

No predictive analytics technology was used. To evaluate the initial results and the methods of conducting the surgical procedure, the group members reviewed the data. The validity and minimization of error was double revised for each member's results.

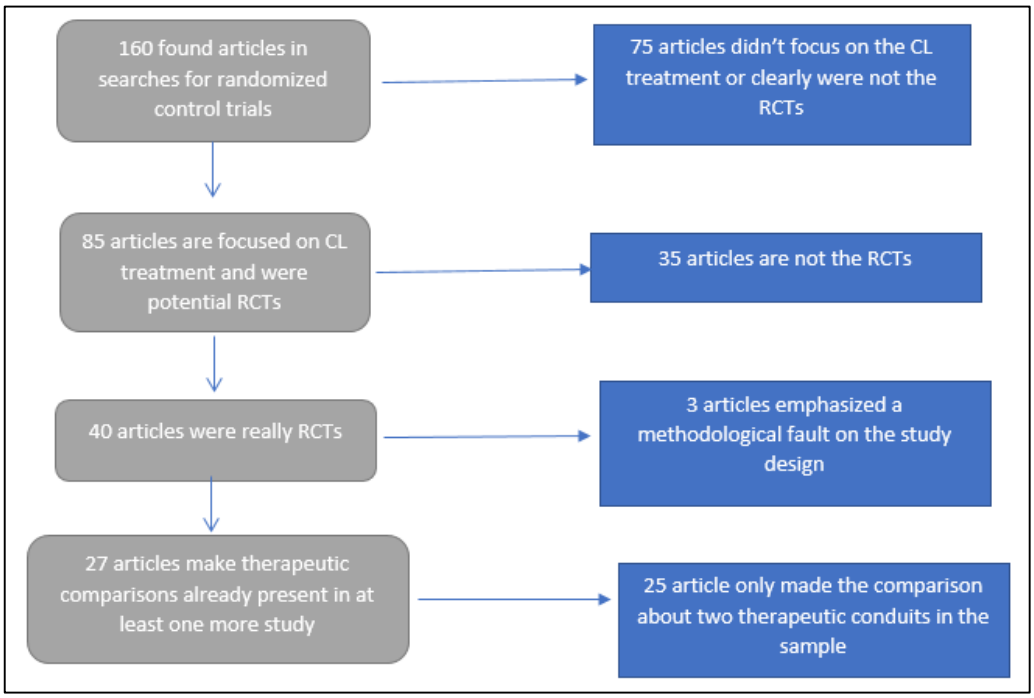


Fig. 1: flow chart outlining the selection process of the articles.

4.1 Prevalence & Classification

According to estimates, 1 in 700 births in the United States result in an oral cleft. Interesting racial predilections can be seen in clefts, which are more common in Asians than in Blacks. Orofacial clefts affect boys 3:2 times more frequently than girls. Boys are more likely than girls to have cleft lip and palate combined, although girls are somewhat more likely to have isolated palate clefts (without cleft lip). Lip, alveolar ridge, and the hard and soft palates are frequently affected by oral clefts. Deformities are bilateral in one-fourth, unilateral in three-fourths. When a defect is unilateral, the left side is affected more likely than the right. It is common for the cleft to be partial, so that it does not extend all of the way from the lip to the soft palate. Cleft palates can develop without cleft lips. The anatomy is divided into primary and secondary palates, which is a helpful classification. The lip and alveolus are part of the main palate, while the hard and soft palates are part of the secondary palate, which includes the structures that are posterior to the incisive foramen. As a result, a person may have both the primary and secondary palates cleft, or just one of them. Lip clefts can range in size from a tiny cut on the vermilion border to a large cleft that divides the nasal floor and reaches into the nasal cavity. Soft palate clefts can also exhibit a wide range of variations, from a bifid uvula to a large inoperable cleft. The smallest type of cleft palate, known as bifid uvula, primarily affects the uvula. Soft palate submucosal clefts can occasionally be noticed. Because they are difficult to recognize on a quick scan, these clefts are also referred to as occult clefts. A loss of continuity in the soft palate's musculature is the issue in such a cleft. The muscle deficiency is covered, nonetheless, by the continuous mucosa of the nose and mouth.[11]

4.2 Epidemiology

The average incidence of orofacial clefting is 1.5 per 1000 live births (or 220,000 new instances year), with significant regional, racial, and cleft-specific variation. The prevalence appears to be highest among Asians (0.82 - 4.04 per 1000 live births), middle-range for Caucasians (0.9 - 2.69 per 1000 live births), and low for Africans (0.18 – 1.67 per 1000 live births). Japanese reported 0.85 to 2.68 orofacial clefts per 1000 live births, compared to Chinese who exhibited 1.76 per 1000 live births[12]. Roughly 25% of all clefts are isolated CL, while about 45% are CL/P mixed. Boys experience CL/P more frequently and with greater severity than girls. With a ratio of 4:1, unilateral clefts are more frequent than bilateral clefts, and for unilateral clefts, about 70% take place on the left side of the face. Females are more likely than males to have a cleft palate. The majority of CL/P cases show as a syndrome because it is commonly accompanied by other developmental problems. According to some sources, there are around 300 different syndromes, and syndromic clefts make up about 50% of all cases. All clefts appear to have a hereditary component, even though it is estimated that only around 40% of instances are directly related to genetics[4]. According to several epidemiological studies, there is a 3.2% risk that a parent with a cleft will have a child with cleft lip and palate and a 6.8% chance that they will have a child with an isolated cleft palate (Grosen et al., 2010). A cleft in one parent and one sibling increases the likelihood of a cleft lip or palate in the following kid by 15.8% and a cleft palate in the following child by 14.9%. (Christensen et al., 1996). If a parent already has a child who has a cleft, there is a 4.4% probability that their second child will also have a cleft lip and palate, and a 2.5% risk that their third child will have an isolated cleft palate.[13]

4.3 Embryology

During this process, the five basic facial prominences are combined to shape the basic morphology of the face. Rectal protrusions do not fully mix and integrate, which results in the development of the delicate and robust tissues that make up the roof of the mouth, which causes CLP.[14] Between the fourth and sixth months of pregnancy, a failure mix results in cleft lip, whereas between the sixth and twelfth months of pregnancy, cleft palate occurs. An examination of the embryology of the lip, nose, and palate is necessary to comprehend the cause of oral clefts. From the fifth to the fourteenth day of life, the entire operation takes place. [15]
The "critical time" of the embryonic stage is what it is. It is during this phase that known or suspected teratogens, or agents that cause birth defects, can affect how the human craniofacial morphogenesis develops.[14]

4.4 Etiology

left lip and palate have a complicated aetiology that is thought to combine genetic predispositions with varying environmental interactions. The following are the etiological factors for cleft lip and palate:

A. Non-genetic: This category covers a variety of environmental (teratogenic) risk factors that can result in CL/P.

4.5 Smoking

Although there is a weak association between maternal smoking and CLP, it is nonetheless important. A relative risk of between 1.3 and 1.5 has consistently been found in a number of investigations. The combined effect was stronger when maternal smoking and a favourable genetic background were taken into account. In addition, Beaty et al. (2002) found that newborn MSX1 genotypes and maternal smoking together increased the risk for CLP by 7.16 times.[16]

4.6 Alcohol consumption

Heavy maternal drinking not only raises the risk of CLP but also leads to foetal alcohol syndrome. In a dose-dependent way, Munger et al. (1996) demonstrated that maternal drinking raised the risk for CLP by 1.5–4.7 times. But there was no evidence that moderate alcohol use increased the risk of orofacial clefts. It has not yet been proven that drinking and genotypes affect the risk of CLP.[16]

4.7 Other factors

Environmental factors include chemical exposure, stress during pregnancy, and maternal illnesses.[17] reduced blood flow to the nasomaxillary area. [18]While older parents have only been linked to cleft palate, rising maternal and parental age is also thought to raise the incidence of cleft lip with and without palate.[19] Severe craniofacial abnormalities can develop in foetuses exposed to retinoid medications.[20]

B. Genetic: Numerous epidemiological findings have established the importance of genetics in the genesis of cleft lip and palate. Numerous studies have demonstrated that the

concordance rate between monozygotic twins (60%) and dizygotic twins and siblings (5–10%) is significantly higher.[19,21,22] Genetic reasons comprise:

(1) Syndromic: In this case, the cleft is accompanied by another birth defect. Typically, a single gene (monogenic or Mendelian) disease is to blame.

(2) Non-syndromic: In this instance, the majority of people with a cleft lip or palate (up to 70% of cases) have a cleft as an isolated characteristic. A cleft in this form is neither a pattern of malformation that is well-known nor can a known cause of the disorder be determined.[21]

4.8 Classification

CLs might be entire, incomplete, or in microform. A notch or groove in the soft tissues of the lip is described by a microform CL (Fig. A). Although there is a notch at the vermilion-cutaneous junction, all of the lip tissues are present. Comparatively, partial CLs result in orbicularis oris dehiscence and can vary in the degree to which the skin is involved (Fig. B). A narrow band of soft tissue known as a Simonart band spans the superior side of an incomplete CL at the nasal sill. Complete CLs cause an aberrant implantation of the orbicularis oris onto the ala and columella by extending along the length of the lip and into the nasal sill (Fig. C). Additionally, in bilateral CL, the intermaxillary segment is anteriorly displaced and the orbicularis oris is absent from the intermaxillary segment (fig. D). CPs can also be categorised according to how much of the anatomical system they affect. While the overlaying mucosa is intact, submucous CPs are distinguished by an underlying dehiscence of the palatal muscles. Submucous CPs might be difficult to diagnose since they do not have an associated mucosal abnormality. A bifid uvula, a zona pellucida, and midline notching of the hard palate are physical examination findings connected to a submucous CP (blue line in the midline of the soft palate representing the lack of musculature and increased transparency). A defect that extends posteriorly from the incisive foramen through the soft palate to the uvula is referred to as a secondary palate cleft. In contrast, a primary palate cleft affects the portion of the palate that extends from the front of the incisive foramen to the alveolar arch. The primary palate and secondary palate are both involved in a complete CP. In Fig. E, examples of the various CP types are displayed. Keep in mind that the terms primary and secondary palate refer to the palate's embryologic ancestry. The terms "hard palate" and "soft palate," in contrast, relate, respectively, to the anatomic findings represented by the anterior bony palate and the posterior soft tissue/muscle palate.[23]

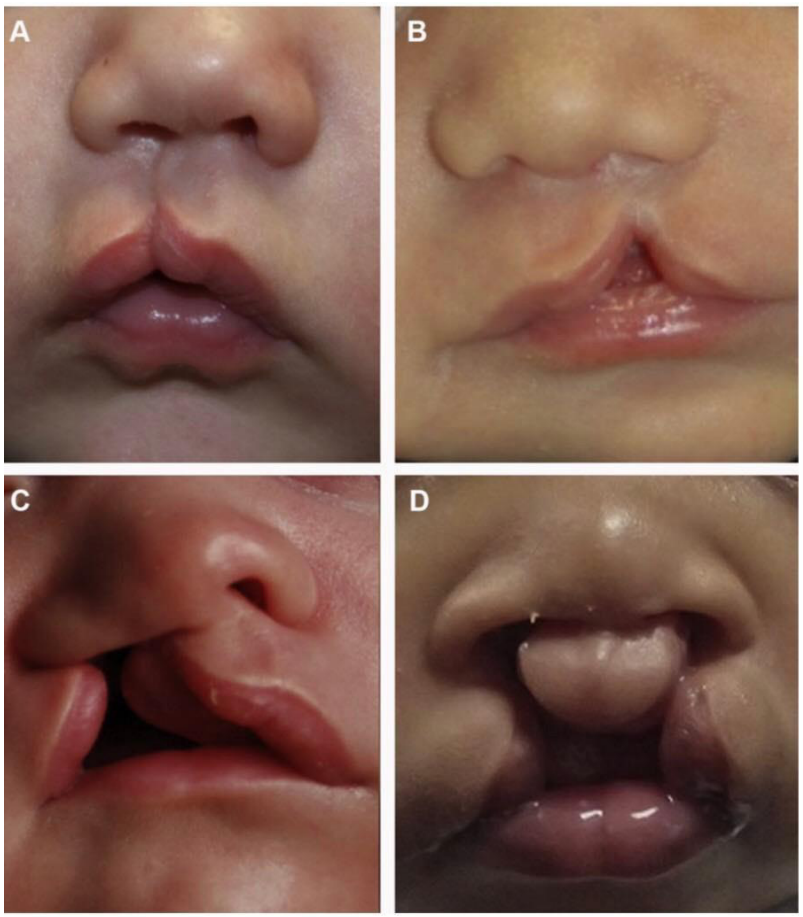


Fig.A: Microform right cl.
Fig.B: Incomplete left cl.
Fig.C: Complete right cl.
Fig.D: Bilateral complete cl.

4.9 Prenatal Diagnosis of Cleft Lip and Palat

Mothers and families may experience psychological hardship as a result of giving birth to and raising a child with an orofacial cleft. Prenatal counselling is made possible by the antenatal diagnosis of an orofacial cleft, and it can help families get ready to care for their unborn child. Additionally, prenatal diagnosis enables families to get to know the craniofacial team members before to delivery and may make it easier to carry out the advised early postpartum evaluation of afflicted infants. Between 18 and 20 weeks of gestation, anatomic ultrasonography tests are regularly performed in the US. An orofacial cleft can be detected with two-dimensional (2D) ultrasonography in low-risk patients, however detection rates have ranged from 0% to 70%, according to a systematic study. Compared to infants with CL/P, infants with CPO had a lower detection rate. The sonographer's experience, the gestational age, and whether or not the laboratory regularly conducts facial imaging all have an impact on the prenatal ultrasonography detection rate. Three-dimensional (3D) ultrasonography has demonstrated an ability to detect a CP when a CL has already been found on 2D ultrasonography (up to 100% sensitivity), demonstrating an overall gain in diagnostic accuracy compared to 2D investigations.[23]

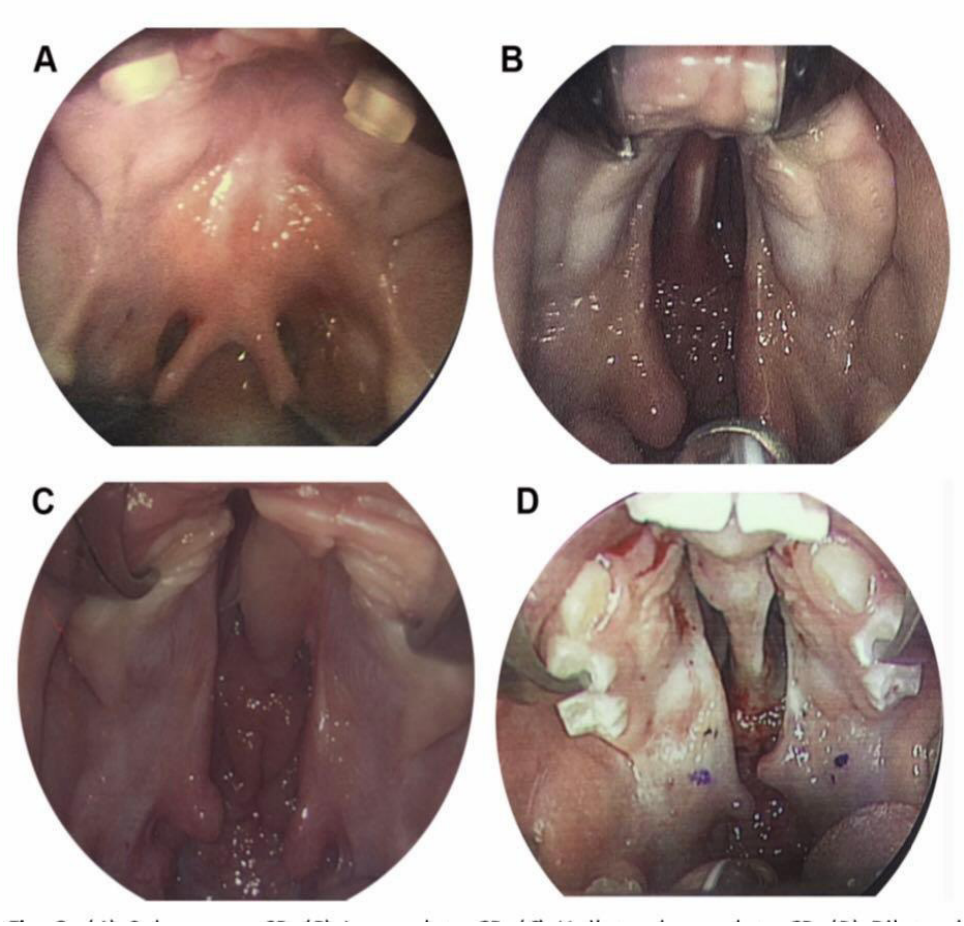


Fig.E : A-submucous cp.
B-incomplete cp.
C-unilateral complete cp.
D-bilateral complete cp.

4.10 Early Multidisciplinary Evaluation

The American Cleft Palate-Craniofacial Association highlights the value of treating these patients in a multidisciplinary manner within their first few days of life. 20 An early dysmorphology examination is crucial given the prevalence of coexisting disorders. If there are more abnormalities, a full genetics evaluation should be considered. A coordinator can help families organize their follow-up care after discharge once a newborn is assigned to a craniofacial team. Patients with CLP should be monitored in a multidisciplinary clinic until early adulthood and frequently require the care of several medical disciplines.[23]

4.11 Feeding Evaluation

Infants with CLP frequently experience early eating issues. When a patient has CL or CP, it may be difficult for them to form a seal, or they may be unable to produce enough suction or negative pressure to feed. 21 Children with orofacial clefts are more likely than other children to experience poor weight gain and dehydration when these regular feeding routines are altered. Depression is a risk factor for mothers of infants who have feeding difficulties, which can make caring for their kids more difficult. A speech-language pathologist should be consulted for impacted neonates given the high prevalence of feeding issues in the cleft community. The specialist can do an evaluation and offer advice. Patients with a CL typically have success breastfeeding, however those with a CP frequently fail. Families of children with CPs are encouraged to bottle feed their infants for nutrition, but they are also allowed to temporarily breastfeed their babies if they prefer to foster mother-infant connection. The Mead Johnson Cleft Lip/Palate

Nurser, the Haberman Feeder, the Pigeon Feeder, and the Dr. Brown's Specialty Feeding System are just a few of the cleft-specific bottles available. These bottles can be essentially divided into two categories: stiff bottles and aided delivery (squeeze) bottles. Parents can squeeze the reservoir of assisted-delivery bottles (Haberman and Mead Johnson) to boost the flow of milk or formula. In contrast, the baby can release the milk flow from inflexible bottles (like Pigeon and Dr. Brown's) by compressing the unique nipple. There is no proof that the choice of bottle affects the growth outcome in a cleft patient population using squeezable versus stiff bottles. Families should therefore be advised to use the bottle that is most effective for their particular kid.

4.12 Early Cleft Interventions

During the newborn stage, lip taping and nasoalveolar moulding (NAM) are routinely applied in an effort to lessen the severity of a cleft abnormality. These therapies may lessen the width of the cleft, enhance nasal symmetry, and improve caregivers' psychological results. There is still debate over the effectiveness of specific approaches, and clinical practise patterns differ greatly. Preoperative lip taping is frequently applied to newborn children with CLs. At our facility, lip taping is frequently done on infants with complete CL. The tape is placed across the cleft while pushing the lip together beginning within the first week of birth (Fig. F). Families are given instructions on how to apply the tape every day before being released and are given a follow-up appointment in the cleft surgeon's office. Skin discomfort is the most frequent lip tape side effect. If this happens, you can tape up after applying a dressing to protect the skin. At our facility, NAM is frequently employed in patients with broad unilateral or bilateral CL/P. Improved nasal symmetry in unilateral CL deformities, an increase in columellar length in bilateral CL deformities, and better alignment of the alveolar arches are some potential advantages of NAM. NAM, however, necessitates a family commitment. The time commitment and requirement for many initial clinic visits for prosthetic modifications should be discussed during a family gathering as soon as possible. A maxillary impression must be taken (usually within the first few weeks of life) once the family and craniofacial team (cleft surgeon, prosthodontist) consent to moving forward with NAM (Fig. G). Depending on the prosthodontist's comfort level, either the clinic or operating room can be used to take the impression. The prosthodontist then sees the family in a week for the initial fitting. The NAM is worn constantly and the parents are shown how to apply it. For up to six months, children are visited every one to two weeks in the clinic to evaluate the prosthetic fit and therapeutic outcomes. Skin discomfort, poor compliance, and inability of the device to stay in place are the most often mentioned NAM side effects. The last two issues highlight how crucial it is to choose the right patient and family because a family that is not dedicated to the procedure is unlikely to have adequate compliance or results. The family is recommended to employ lip tape if NAM is not an option.[23]

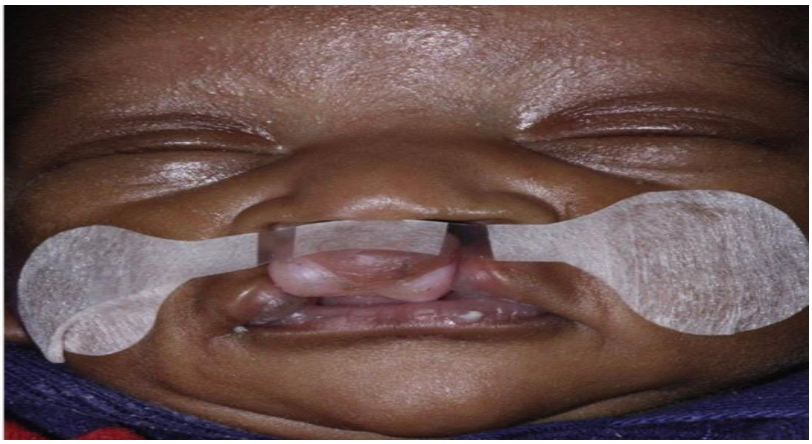


Fig.F : Bilateral CLP patient with lip taping applied to provide pressure to shift the intermaxillary segment posteriorly

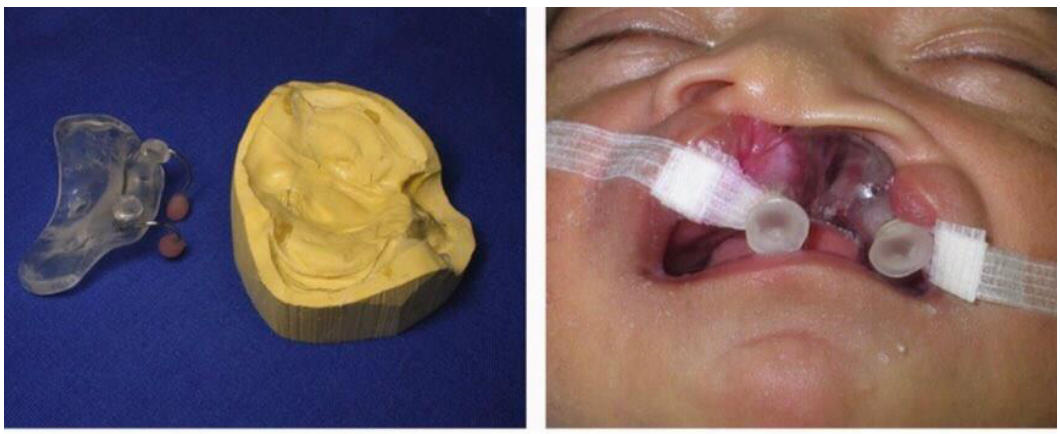


Fig.G : A- NAM impression and prosthesis
B- patient with unilateral CLP and NAM

5. CLINICAL FEATURES

Few studies have examined primary care doctors' knowledge and expertise in relation to the physical, dental, and behavioral/emotional needs of a child with an oral cleft up to this point[24,25]. Two categories can be used to group the numerous clinical findings in patients with cleft lip and palate: *issues with the teeth in cleft lip and palate*. Among the many atypical dental problems are: newborn and natal teeth: The primary or secondary dentition in clefts does not seem to be affected by the presence of neonatal teeth. In contrast to neonates without clefts, the majority of natal teeth in clefts are found around the lateral margin of the premaxillary and maxillary segments.[26,27]

5.1 Microdontia

With CL/P, little teeth (microdonts) are frequently discovered. In situations where the lateral incisors are present, this is typically more frequent. Upper lateral incisors are typically peg-shaped.[26]

5.2 Taurodontism

There have been reports linking various syndromes and dental developmental issues to taurodontism (Cichon and Pack, 1985). [27]

5.3 Actopic Eruption

Primary lateral incisors may erupt ectopically next to or inside the cleft side, and permanent canines on the side of alveolar clefts may also erupt palatally as a result of clefts. Permanent incisor eruption may be delayed.[27, 28]

5.4 Melanocyte Hypoplasia

Comparing CL/P participants to non-cleft populations, it was discovered that enamel hypoplasia was more common, particularly in the case of the maxillary central incisors (Vichi and Franchi, 1995). [27] delayed tooth development: When a cleft defect develops, a number of growth factors that are crucial for craniofacial development may be overexpressed or underexpressed. An atypical dental lamina can result from this aberrant expression, which can also alter odontogenesis.[29]

5.5 Other Associated Conditions

4.13 Speech Impediments

Muscle phonation is impacted by the malfunctioning of the m. levator veli palatini. The most frequent findings are consonant sound retardation (p, b, t, d, k, g). Another defining symptom of most people with cleft lip and palate is abnormal nasal resonance, which is often accompanied with difficulties articulating.[25, 30]

4.14 Ear Infection

Otitis medium is seen in these patients as a result of the m. tensor veli palatini muscle's dysfunction, which opens the Eustachian tube. In a situation where infections are common, outcomes that could result in hearing loss could happen. The incidence, however, substantially rises when there is a submucous cleft palate present.[25,31]

4.15 Feeding Issues

Because of the opening in the roof of the mouth, a kid with a cleft palate may have trouble sucking through a normal nipple. The capacity of the external lips to make the required sucking movements and the ability of the palate to permit the necessary build-up of pressure inside the mouth so that food may be driven into the mouth are both related to an infant's ability to suck. Most babies need a unique or unusual nipple to feed themselves correctly. Before returning home, it could take a few days for the infant and parents to get used to using the nipple. With a cleft palate nipple, the majority of infants learn to feed normally.[25]

5.6 Complications:

Unilateral CL repair complications include a lack of vermilion or a whistle deformity, under-rotation of the high point on the cleft side, muscular dehiscence, and nasal asymmetry. At around age five or older, secondary lip surgery is often explored. Obstructive sleep apnea (OSA), palatal fistula, and VPD are long-term effects of palatoplasty. Nasal regurgitation of oral intake and hypernasality may result from fistula formation. Although they are outside the purview of this article, palatal fistula closure procedures can be complicated. Patients with clefting have a higher incidence of OSA; screening for the condition's symptoms should be done often in this patient population. 49 Given their high risk status, a polysomnogram is advised before any future surgical operation.[23]

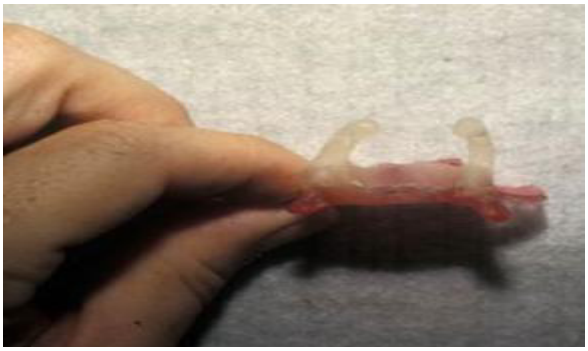
5.6.1 Causes

The classification of cleft lips and palates as complex conditions. This indicates that both genetic and environmental factors can contribute to patients having cleft palates at birth. The decisions mothers make during pregnancy appear to have some ability to at least slightly alter the hereditary elements. Actually, during development, the parts of the roof of the mouth do not fuse together. It may result in a full opening of the mouth and can occur on either one or both sides.[32]

5.7 Pre-Surgical Orthopedic Therapy For Cleft Lip And Palate

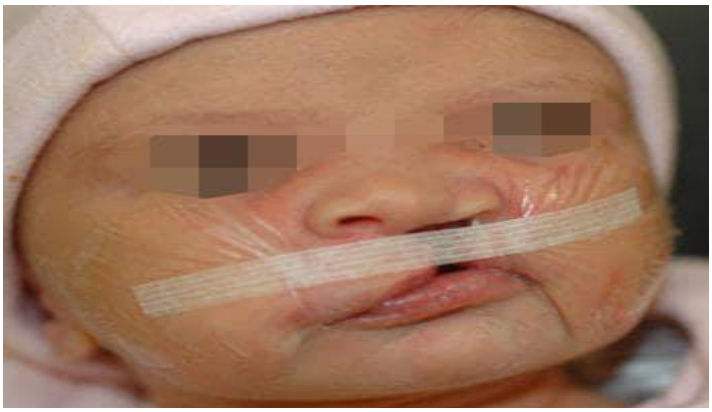
Orthodontic procedures are employed in presurgical orthopaedic therapy to shape the maxillary, alveolar, and nasal tissues of an infant with a unilateral or bilateral cleft lip and palate.[33] These techniques are also known as neonatal infant orthopaedics, presurgical infant orthopaedics, and nasal-alveolar shaping. Because the infant does not yet have teeth, the term orthodontics is incorrect; therefore, orthopaedics is recommended[34]. Presurgical orthopaedic therapy is frequently used; in the UK, neonates treated for cleft lip and palate have presurgical appliances in 47–51% of cases.[35] Presurgical moulding was used in 71% of centres in the United States and Canada before bilateral cleft lip surgery, with nasoalveolar moulding being the most common type of this procedure, used in 55% of centres[36]. Appliances fall into two categories: passive and active. Using mechanical devices like elastic chains, screws, and plates, active appliances are fixed intraorally and apply traction. While external force is used to predominantly shift the posteriorly, passive appliances preserve the space between the two maxillary segments.[37,38] The very complex passive nasoalveolar moulding device (see the illustration below) comprises of an intraoral acrylic plate that is secured in place

by extraoral elastics and tape. Later stages of treatment involve the addition of wire outriggers, which exert protracting strain on the vestibule of the nares and lengthen the columella.[39]



External lip taping, a head cap with elastic straps across the prolabium, or surgical lip adhesion can all be used to apply external tension.[39]

Naso-alveolar molding device



Tape adhesion is being used to treat a youngster with unilateral cleft lip and palate

The use of presurgical orthopaedic devices for treating clefts is debatable. The possibility of long-term growth impacts and probable feeding difficulties are arguments against their use. [40,41]The long-term results and the precise function of presurgical orthopaedics are becoming more clear as clinical experience grows.[42,43,44,45,46] Empirically, moulding can reduce the width of clefts and ease the technical demands of following surgery. The protocol's adoption in the future will depend on how long-term outcomes for those who had treatment under it fare. Indications: Presurgical orthopaedic therapy's indications are changing. Among the benefits are the following: Soft tissue shape has improved, eliminating the requirement for surgical dissection[47,48]. Ability to conduct either gingivoperiosteoplasty or primary bone grafting, which may lessen the requirement for secondary bone grafts[49,50,51]. The possibility of increased feeding effectiveness due to cleft narrowing and obturation; however, Masarei et al. observed that presurgical orthopaedic therapy did not increase feeding effectiveness in infants who underwent treatment.[52]

5.8 Contraindications

Lack of patient or family acceptance of the gadget is one of the contraindications.

5.8.1 Outcomes

Numerous sizable case-control studies have shown negative effects of vigorous presurgical orthopaedic treatment procedures. The Latham-Millard active orthopaedic device, according to Henkeland and Gundlach, had a negative impact on facial growth.[53] With regard to patients who received treatment with the Latham-Millard device, Berkowitz found worsening occlusal results.[54] Following active presurgical orthopaedic therapy in unilateral and bilateral clefts, Matic and Power observed reduced maxillary development. [55,56] Additionally, they discovered that nearly all patients who underwent gingivoperiostomy or primary bone grafting also needed secondary bone grafting. Studies on presurgical orthopaedic therapy using passive treatment have produced more conflicting results. According to Wood et al., neither the main gingivoperiosteoplasty nor the passive nasoalveolar moulding device had a negative impact on face growth.[57] Santiago et al. showed a decreased need for subsequent alveolar bone grafts in patients who underwent primary gingivoperiosteoplasty and nasoalveolar shaping device therapy[58]. Hetty et al. discovered that patients who had nasoalveolar moulding treatment within the first year of life had better outcomes than those who received treatment later[59]. Nasoalveolar shaping appears to enhance nasal shape outcomes, particularly in bilateral clefts, during preoperative care.[60] Patients with bilateral cleft lip and palate who had nasoalveolar moulding therapy did not require any additional nasal reconstruction surgery after their first repair, according to a series of cases published by Garfinkle et al. [61] Nazrian-Mobin et al. discovered that patients with bilateral clefts improved much more with nasoalveolar shaping than those

with unilateral clefts in terms of nasal columnar length and width.[62]

Results from the multicenter Dutch cleft experience were published by Bongaarts et al. They discovered that presurgical orthopaedic therapy using a passive acrylic plate comparable to the nasoalveolar moulding device did not improve occlusal outcomes.[63] In a meta-analysis of 4 case-controlled trials and 8 randomised controlled trials using presurgical orthopaedic therapy appliances, Uzel and Alparslan found no evidence of long-term beneficial impacts on the treatment outcomes for patients with cleft lip and palate.[64] Inconsistent results on nasal symmetry were observed by Van der Heijden et al. in a meta-analysis of 12 studies of presurgical orthopaedic treatment of unilateral cleft lip. Both meta-analysis authors came to the same conclusion: studies were heterogeneous, and more randomised controlled trials are required to assess the outcomes of various surgical regimens.[65]

6. TREATMENT

Depending on the type and degree of the abnormality, a patient with cleft lip and palate may need a variety of surgical procedures. Timing and treatment was modified based on the individual medical needs of each patient, but generally speaking, treatment entails a combination of the operations carried out within normal time ranges dependent on development.[66]

- **Surgical Procedures**

6.1 Initially Repairing Cleft Lip (Cheiloplasty)

Primary cleft lip repair aims to restore the lip's natural structure and function, correct the nasal deformity, build the nose's floor, and align the maxillary segments properly (gum-line). The severity of clefts ranges from partly unilateral (on one side) to bilateral (on both sides). A lip operation was done when the baby is between four and six months old. The baby must be growing and healthy. Children must weigh at least 10 pounds before the procedure can be performed, according to the rule. An further treatment must be performed at least 8 weeks following the initial surgery for bilateral lip restoration. If necessary, myringotomies and tubes may be placed in the ears during surgery. Within 30 days following surgery, a preoperative work-up is required. Prior to surgery, the patient's haemoglobin and hematocrit levels was assessed, and home care instructions was covered. Following surgery, the infant will typically stay in the hospital for one night. For them to be sent home, they must be drinking enough to be hydrated. 7–10 days after surgery, they will go back for a follow-up session to have any sutures removed that were necessary. 4-6 weeks following surgery, additional consultations with the cleft surgeon was scheduled. If necessary, palate surgery was discussed at this time, and a date was set for the operation.

6.2 *Fixing Cleft Palate (Palatoplasty*)

Regarding the timing of the procedure, the kind of palatoplasty to be taken into consideration, and the impact of the repair on speech, facial growth, and eustachian tube function, cleft palate repair is of concern to plastic surgeons, speech pathologists, otolaryngologists, and orthodontists. Closing the palatal defect and establishing a properly functioning velopharyngeal mechanism for typical speech production are the goals of this surgery. Usually between the ages of 9 and 15 months, a palate operation is performed. In an effort to give the infant the finest physiological foundation for language and speech development, it is done now. Within 30 days following surgery, a preoperative work-up involving hematocrit and haemoglobin levels must take place. After surgery, the majority of kids stay in the hospital for 1 or 2 nights. Three to four weeks following surgery, they will have a follow-up visit. Three to six months later, the patient should meet with the cleft team, including the cleft surgeon.[32]

6.3 Other Procedures

- ***The Pharyngeal Flap or Z-plasty***

Despite the closure of the palate, some children may speak with a hypernasal stutter. To extend the soft palate and reduce nasal leakage of speech sounds, a Z-plasty procedure may be used. A pharyngeal flap entails lifting a flap of tissue from the soft palate and connecting it to the posterior wall of the throat. Some of the air that used to flow out the nose is stopped by the flap. The aim of pharyngeal flap or z-plasty treatments is to minimize nasal emissions and hypernasality that are audible in speech.[32]

- ***Repair of Fistula***

Following palatoplasty, the tissues could repair in such a way that a fistula, or aberrant opening, persists. When eating, this aperture can allow food to pass from the oral to the nasal cavity. Additionally, it might make it easier to breathe via the nose while speaking. The fistula will probably be closed when another treatment is to be performed if there are issues with either speech or feeding. This result was assessed one month following the operation.[68]

- ***Alveolar Bone Grafting***

At roughly 8 to 12 years of age, a bone grafting is typically performed to close a cleft in the gums by using a piece of bone.[67]

- ***Distraction from the maxilla (Osteogenesis)***

Distraction osteogenesis may be used in children who have a Class 3 malocclusion (the bottom jaw extends beyond the top jaw) to address the alignment process. The upper jaw is surgically released (via a LeFort I osteotomy), and it is then moved slowly forward over the course of 4-6 weeks. To build a strong jaw, new bone is formed as the upper jaw is advanced. A mouth appliance is wired to a rigid external device known as a halo, which is used to achieve this movement. Daily adjustments to the device's screws change the tension, allowing the jaw to advance.

- ***Nasal or Lip Revision (cleft rhinoplasty)***

The nose's form must be improved.[67]

6.4 Treatment for Speech and Language

In some situations, children with a corrected cleft palate still require speech therapy. Repairing a cleft palate will dramatically lower the risk of speech issues. As your child gets older, a speech - language therapist (SLT) will evaluate their speech multiple times. If there are any issues, they might advise a more thorough examination of the palate's functionality or collaborate with you to encourage your child to speak clearly.

They could suggest local SLT services close to your house. The SLT will keep an eye on your child's speech development until they are fully grown, and they will help them as long as they require it.[67]

6.5 Treating Hearing Issues

Children who have a cleft palate are more prone to get glue ear, a condition in which fluid accumulates in the ear. This is so because the middle ear and the palate muscles are related. Due to the cleft, the muscles may not function as they should, which could cause sticky secretions to accumulate in the middle ear and impair hearing. Regular hearing checks for your child was conducted to look for any problems. After cleft palate repair, hearing issues may get better, and if they don't, grommets, tiny plastic tubes, can be inserted into the eardrums to help. These enable the ear's fluid to drain. Hearing aids may occasionally be suggested.[67]

6.6 Dental Health

It is typical for the teeth on each side of a gum-related fissure to be slanted or out of position. Frequently, there may be an additional tooth or a tooth that is missing.
Your child's dental health was monitored by a paediatric dentist, who will also make treatment recommendations as needed. Additionally, crucial is getting your kid registered with a local family dentist. It may also be necessary to receive orthodontic treatment, which helps to enhance the position and appearance of teeth. This may involve the use of braces or other teeth-straightening dental devices.
Typically, brace treatment begins after all baby teeth have fallen out, however it could be necessary before a bone transplant to close the gum cleft. Children who have cleft palates are more prone to tooth decay, therefore it's critical to promote good oral hygiene habits and regular dental visits.[67]

6.7 Best Time for Surgical Repair

One of the most hotly contested issues among operators, speech pathologists, audiologists, and orthodontists has been and continues to be the timing of the surgical repair. It is tempting to perform the surgery as soon as the baby is strong enough to handle it and fix every flaw. This method of treatment, which involves closing all of the baby's clefts as soon as possible after birth, would undoubtedly be desired by the parents of a kid born with a face cleft. In fact, the cleft lip is typically repaired as soon as possible. The majority of surgeons use the "rule of 10" to determine if a baby is healthy enough for surgery (i.e., 10 weeks of age, 10 lb in body weight, and at least 10 g of haemoglobin per deciliter of blood). However, because surgical correction of the cleft is an elective procedure, the cleft surgery is postponed until medical risks are at their lowest if any other medical issue threatens the baby's health. Although many cleft teams schedule surgery repair at various times, compromise is a commonly recognized idea. As soon as medically possible, the lip is repaired. Between 8 and 18 months of age, depending on a variety of conditions, the soft palatal cleft closes. It is advantageous to close the lip as soon as possible because it has the beneficial effect of "shaping" the deformed alveolus. Additionally, it helps the kid eat and has psychological advantages. To create a functional velopharyngeal mechanism while or before speech abilities are developed, the palatal cleft is then closed. Sometimes, especially if the hard palatal cleft is extensive, it is not healed at the same time as the soft palate. In these conditions, the hard palate cleft is kept as long open as possible to allow for as much uninterrupted maxillary growth as possible.[69]

6.8 Following Up After Surgery

After surgery patients arrange a follow-up consultation with their surgeons several weeks later to ensure that the surgical site has healed adequately. Once that has been determined, patients are typically followed by the medical team every six months until they are five years old in order to closely monitor their speech development. Most patients are monitored once a year beyond the age of five while their growth and development continue.[32]

6.9 Prevention

There are numerous methods for lowering the chance that a kid may be born with cleft lip or palate. The first step is to have as healthy a pregnancy as you can, which includes abstaining from alcohol, giving up smoking, and taking folic acid-containing prenatal vitamins. [32]

7. CONCLUSION

The two main categories of clefts of the lip and palate-isolated cleft palate and cleft lip with or without cleft palate—represent a diverse range of conditions affecting the lips and oral cavity. Approximately 1/7 of every 1000 live births result in these abnormalities, with regional and ethnic variations. Effects on psychology, speech, hearing, appearance, and social integration may have long-lasting negative effects on health. Children who have these conditions typically require multidisciplinary treatment from birth until maturity and experience greater rates of morbidity and mortality than people who are not affected. In order to prevent clefts of the lip and palate, it is essential to understand the underlying causes of the conditions. Some achievements have been made thanks to technological advancements and international cooperation.

8. AUTHORS CONTRIBUTION STATEMENT

Ashwag siddik noorsaeed , mohammed abdulmajeed m alghadeer, mohammed hassan a alzahrani and rawabi mohammed a alkhudhayri conceptualized and gathered the data with regard to this work. Alanood mohammed alzogibi , almajhdi, faisal fahad n, huriyah saad s almutairi , tariq abdullatif s al naeem, and reham tariq m tallab analyzed the data and necessary inputs were given towards the designing of manuscript. All authors read and contribute to the final manuscript .

9. CONFLICT OF INTEREST

Conflict of interest declared none.

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