Republic of Iraq

Ministry of Higher Education

And Scientific Research

University of Baghdad College of Dentistry

Baby feeding appliance

A Project Submitted to The College of dentistry, University of Baghdad, department of Prosthodontics in Partial Fulfillment for the Bachelor of Dental Surgery

By

Ali sinan abbas

Supervised by:

Asst. prof.

Dr. Ihab Nabeel Safi

B.D.S, M.Sc, Ph.D

2023 A.D. 1444 A.H

Certification of the Supervisor

I certify that this project entitled "**Baby Feeding appliance**"

Was prepared by the fifth-year student **Ali Sinan Abbas** under my supervision at the College of Dentistry/University of Baghdad in partial fulfilment of the graduation requirements for the Bachelor Degree in Dentistry.

Certification of the supervisor

Asst. prof. Dr. Ihab Nabeel Safi

Dedication

To my family, I could never done this without your faith, support, and constant encouragement. Thank you for teaching me to believe in myself, and in my dreams.

To all people who supported and encouraged me throughout the process, Family, Friends, and Colleagues. Many thanks to all of you.

Acknowledgment

In the name of **Allah** the most compassionate and most merciful. I am most grateful to God for the presence of health, patience, guidance, and protection through the duration of this study and achieve this study, which I hope it will be useful and objective.

Deep thanks to Prof. **Dr. Raghad Al-Hashimi,** the Dean of the College of Dentistry, the University of Baghdad, I would like to thank "**Dr. Abdulbasit Ahmed Fatihallah"**, the head of Prosthodontics for his scientific support, encouragement and advice

I am gratefully thankful to my supervisor Assist. Prof **Dr**.**Ihab Nabeel Safi,** for his kindness, advice, instructions, valuable unlimited cooperation and continued encouragement throughout work and writing of my study. I have indeed learned a great deal from him.

I would like to present special thanks for teaching staff for

their great ethics and to all colleagues and all members of prosthodontic Department for their helpful assistance.

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abbreviation	the word
SNS	Supplemental nursing system
NAM	Nasoalveolar molding
CLP	Cleft lip and palate

Chapter one
Review of Literature

Introduction

Cleft lip and palate is a common craniofacial anomaly that affect the development of the facial structures during the first trimester of the embryological period, the etiology is multifactorial which includes both genetic factors and environmental factors. During the development of the fetus, separate areas of the face develop individually and then join together. Any disturbance in this fusion can result in cleft formation. The type and severity depends upon the fusion defect **(Martyn and Andrew, 2016).**

A child born with cleft lip and palate may experience difficulties while feeding due to lack of seal of the oral cavity due to incomplete facial and palatal structures. Difficulty in feeding leads to inadequate nutrition and affects the health of the infant. Feeding difficulties should be assessed and intervened as early as possible, as they are an important aspect of the multidisciplinary team approach in the management of cleft lip and palate **(Naveen, 2019**).

The goal in feeding an infant with orofacial cleft is to provide nutrition, which is one of the prime concerns as he may not gain weight at the rate of a normal child. A feeding technique which improves the suckling reflex is important for these children. Suckling maximizes oral stimulation, which facilitates oral motor development**. (Goyal, 2012; Malavika, 2019).**

The different feeding interventions which have been reported and recommended for infants with cleft conditions, feeding appliance is a favorable feeding option in these infants as the feeding plate obturates the cleft and restores the separation between oral and nasal cavities. It creates a rigid platform toward which the baby can press the nipple and extract the milk. It facilitates feeding, reduces nasal regurgitation, reduces the incidence of choking, and shortens the length of time required for feeding. The obturator also prevents the tongue from entering the defect and interfering with the spontaneous growth of palatal shelves toward the midline. Feeding plate restores the basic functions of mastication, deglutition, and speech production until the cleft lip and/or palate can be surgically corrected **(Goswami, 2016).**

Aim of the review:

The purpose of this review is to identify the most appropriate feeding techniques and devices that can be used to facilitate safe and efficient feeding in patients with cleft palate develop evidence-based guidelines and recommendations for feeding interventions in patients with cleft palate.

1.1 Cleft lip and palate

Cleft of lip and palate 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. Patient with oro-facial cleft deformity needs to be treated at right time and at right age to achieve functional and esthetic wellbeing **(Chaurasia, 2020).**

1.1.1 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), It is maybe unilateral or bilateral, symmetrical or asymmetrical **(Figure 1), (Tarun, 2020).**

Figure 1 patient with cleft lip (Tarun Vyas, 2020)**.**

1.1.2 Cleft palate

The failure of fusion of the palatal shelves of the maxilla, and sometime the perpendicular plate of palatine bone resulting in a cleft of the hard and/ or soft palates. Clefts arises during the fourth developmental stage. Exactly where they appears is determined by locations at which fusion of various facial processes failed to occur, this in turn is influenced by the time in embryologic life when some interference with development occurred**.** Sometimes it appears as a simple defect in the submucosa that disrupted the continuity of musculature in the palate area or more complicated that bifid uvula and affect both the primary and secondary palate **(Figure 2).** This type of cleft may occur with syndromes including Down's, Treacher-Collins, Pierre-Robin, **(Martyn and Andrew; 2010; Proffit, 2012; Chen, 2014).**

Figure 2 : Patient with cleft palate (Chen, 2014).

1.2 Classification for cleft lip and palate

Modern medicine's complex landscape requires a common language understandable by clinicians, patients, hospital administrators, payors, government agencies, and other stakeholders. Cleft classification also plays an important role in studying the epidemiology of orofacial clefts. Orofacial clefts are etiologically heterogeneous, and untangling the interactions of environmental and genetic risk factors leading to orofacial clefts requires accurate classification of cleft type (**Dixon et al., 2011)**.

More specific classification systems enable greater subgrouping of clefts, which can facilitate identification of the causes and biologic mechanisms for the cleft. The value of cleft classification to epidemiology is perhaps best illustrated by the different recurrence risks for cleft lip alveolus and palate, which is a key difference used in genetic counseling. A standardized, accurate phenotypic classification of clefts is thus crucial to understand the epidemiology of the cleft **(Sivertsen et al., 2008; Grosen et al., 2010).**

1.2.1 Veau classification

A cleft palate may be either unilateral or bilateral and is either complete or incomplete. A complete cleft of the entire palate involves the length of the primary and secondary palate **(Agrawal, 2014)**; The Veau classification was developed by French surgeon Paul Tessier in the 1960s. It categorizes cleft palate into four main types, based on the location and severity of the cleft **(Figure 3)**, **(Alonso, 2017).**

- Class I: Cleft of the soft palate only
- Class II: Clefts of the soft and hard palates, posterior to the incisive foramen
- Class III: Complete unilateral cleft lip and cleft palate (Primary and secondary palates)
- Class IV: Complete bilateral cleft lip and cleft palate

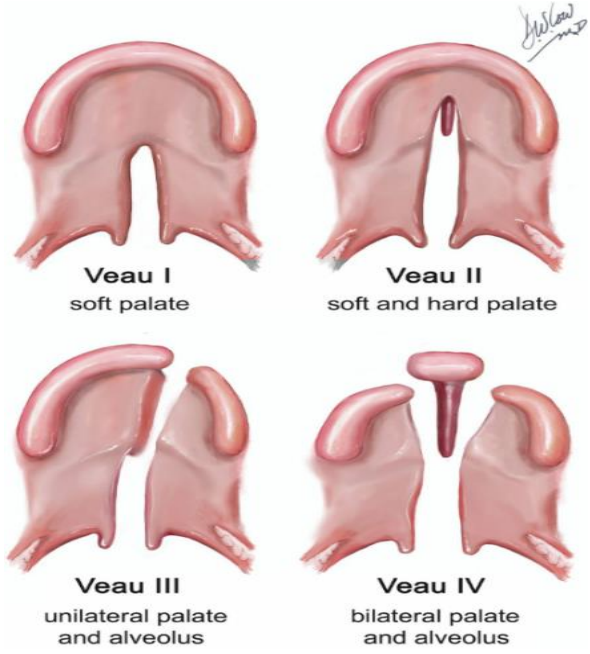

Figure 3 veau classification of cleft palate

1.3 Causes of cleft lip and/or palate

The causes of isolated cleft palate and cleft lip and/or palate remain largely unknown but are thought to be a combination of genetic and environmental factors. Many clefts run in families and these may be syndromic or non-syndromic occurrences ***(*Grosen et al., 2011).** Some of the possible causes of cleft lip and palate are the following:

1.3.1 Genetic factors

Cleft lip and palate can be caused by mutations or changes in certain genes that are involved in facial and oral development. For example, mutations in the IRF6 gene have been associated with an increased risk of cleft lip and palate. In addition, Cases of isolated cleft palate show a familial clustering effect. For cleft lip and/or palate it is estimated that there is a 60% concordance rate in monozygotic twins and 10% in di zygotic twins **(Goodacre and Swan, 2011; Chapel, 2009).** Advanced paternal age, parental folate deficiency, and hypoxia are associated with an increased risk of cleft lip or palate **(Savitz D A; 1991; Divya, 2017).**

1.3.2 Environmental factors

Exposure to certain environmental factors during pregnancy may increase the risk of cleft lip and palate. For example, maternal smoking, alcohol consumption, or exposure to certain toxins (such

as pesticides or solvents), certain medications such as anticonvulsants (phenobarbital and phenytoin) have been associated with an increased risk of this condition **(Dixon et al., 2011).**

1.3.3 Nutritional deficiencies:

Deficiencies in vitamin B12 levels and lack of folic acid, during pregnancy have found increase the risk of cleft lip and palate. This is because these nutrients are important for proper fetal growth and development **(Munger, 2021).**

1.3.4 Medications

Certain medications, such as antiepileptic drugs, have been associated with an increased risk of cleft lip and palate. However, the risks and benefits of these medications should be carefully considered by healthcare providers and pregnant women **(Rezaallah, 2019).**

1.3.5 Infections

Maternal infections during pregnancy, such as rubella or cytomegalovirus, may increase the risk of cleft lip and palate. This is because these infections can affect fetal development and disrupt the formation of the face and mouth **(Divya, 2017).**

1.4 Effects of cleft lip and/or palate

The main complications and subsequent management of cleft palate and/or lip and isolated cleft palate can be broadly classified into the following:

1.4.1 Feeding

Babies with cleft palates have a fistula between the oral and nasal cavities, the baby is unable to compress the breast, between the tongue and palate, to generate a negative suction feeding and overcome the pressure. This prevents the newborn from breastfeeding **(Masarei et al., 2007).**

1.4.2 Hearing loss

The incidence of otitis media with effusion has been reported as high as 97%, Hearing disorders are prevalent among individuals with orofacial clefts. These disorders are a result of chronic otitis media with effusion due to eustachian tube dysfunction, The tensor veli palatini muscle that normally functions to open the eustachian tube fails to do so causing pressure and fluid build-up in the middle ear with subsequent infections, inflammation, and scarring **(Sharma and Nanda, 2009; Gani et al., 2012).**

1.4.3 Speech

1-Cleft palate repair is designed to allow separation of the nasal and oropharynx. If unsuccessful or if left untreated, velopharyngeal insufficiency (VPI) results and speech distortion develops as the child grows**.** The inability to generate intraoral breath pressure due to nasal air emission in cleft palate patients frequently manifests as articulation difficulties, particularly consonant weakness, and unintelligible speech. The most common articulation error in velopharyngeal insufficiency is the consonant /s/. As the incompetence increases, other sibilants and fricatives (/f/, /v/, /th/, /sh/, /z/, /s/, /zh/) become involved. Still greater incompetence in this critical valve will lead to reduced intraoral pressure in association with plosives **(Wyatt, 1996)**.

2-Sounds most frequently misarticulated include /s/ (63%), /z/ (61%), /d/ (48%), /ch/ (44%), /p/ (11%), and /b/ (9%) **(Johns et al., 2003)**.

3-Sound substitutions are characteristic of young children who are still in the process of learning speech. Speakers with cleft palates substitute a nasal consonant for a consonant that requires intraoral pressure (for example, substituting /m/ for /b/). In some instances, this response is regarded as a nasally distorted /b/ rather than the substitution of /m/. Omissions are another form of speech error in

which final consonants are deleted as a means of avoiding nasal emission.

4-Some speakers with VPI seem to accept their loss of intraoral pressure and continue to articulate accurately. These speakers may have weak consonants and audible escape, but placement is accurate, and intelligibility may be only slightly impaired. Others attempt to compensate for their valving deficits by seeking new approaches to consonant articulation. These individuals produce a sibilant-like consonant pharyngeally rather than in the anterior palate. They adopt gross articulation errors, which are referred to as pharyngeal fricative and glottal stops. Patients substitute a glottal stop (whispered cough) for stop-plosives (/p/, /t/, /k/, /b/, /d/, /g/). Glottal stops are made by closing the glottis, building up pressure within the trachea, and then suddenly reopening the glottis to release a transient puff of air. Patients also substitute pharyngeal fricatives for fricative consonants. Pharyngeal fricatives are produced by positioning the tongue close to the back wall of the throat or by decreasing the side to side diameter of the throat by moving the walls of the pharynx inward. Air is then forced through the constricted pharyngeal airway to produce a turbulent sound.

5- Other vocal distortions seen include reduced loudness, monotone quality, and occasionally a strangled voice quality **(Sie, 2006).**

1.4.4 Dentition

Dental irregularities often occur when the cleft involves the alveolus. Dental anomalies range from supernumerary teeth, altered teeth dimensions and development and impacted teeth **(Vettore and Sousa Campos, 2011).**

1.4.5 Patient social life

The adults we spoke to who were born with a cleft lip and/or palate had a variety of experiences when interacting with others. They talked about differences in the level of comfort that other people showed when meeting or mixing with somebody who either looked different, or sounded different or who had hearing difficulties. Such experiences were generally more positive in adulthood than those in childhoods or during the teenage years. A common view expressed by the adults was that their self-confidence increased the older they got. Improvements in self-confidence were associated with support and guidance from family and friends and also support from speech and language therapists, psychologists and counsellors. Confidence in social situations also seemed to have a positive impact on aspirations and life plans **(Divya, 2017).**

The support that these people received from others had helped them to develop strategies for dealing with and counter-acting unwanted comments or negative reactions from others, either in

social situations or at work. They believed that negative comments about cleft and its associated symptoms were usually based on ignorance and fear rather than intentional cruelty. The adults we spoke to were open about answering questions about their cleft and were happy to addressing comments from members of the public as this can help raise awareness of the condition.

1.5 Feeding intervention in patients with cleft lip and palate:

Infants physiologically spend most of their early weeks in feeding, feeding is a time of not only gratifying the hunger and thirst of the infant, but also of social interaction when the baby is most alert, thus allowing the mother and child to bond babies use reflexes such as creating a negative intraoral negative and using rhythmic intra oral muscular movements while getting fed. This co-ordinated mechanism is hampered in situations such as clefts in the oro-facial region. The most notable problems are insufficient suction, excessive air intake, choking, nasal regurgitation, fatigue, inadequate milk intake, failure to gain weight, and excessive time required to feed. Inability to feed satisfactorily can lead to maternal stress and anxiety, and thus lead to poor mother and infant bonding **(figure 4) (Nassar, 2006; Redford-Badwal, 2007).**

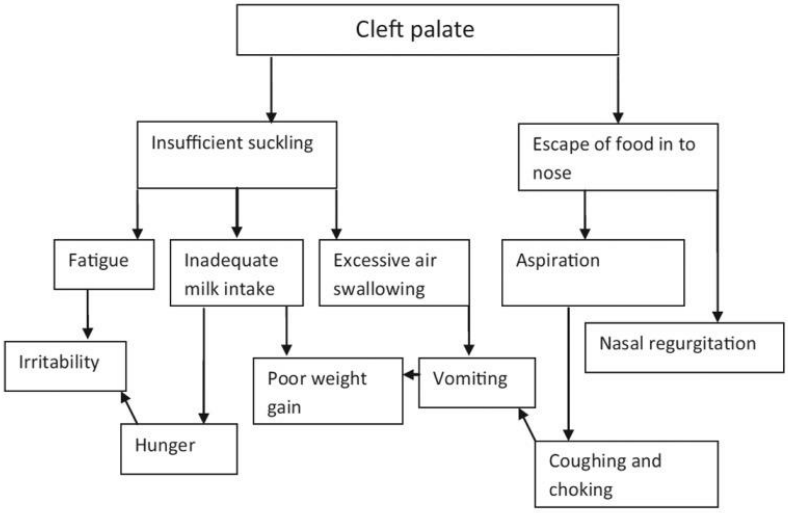

Figure 4 the elements of the feeding problem and their interrelationships in infants with cleft palate (Devi ES, 2012)

Problems with oral feeding occur in varying degrees in infants born with cleft lip/palate and/or craniofacial syndromes the infant's feeding and swallowing skills may be significantly impaired, characterized by inefficient oral feeding skills coupled with poor airway protection ability during swallowing. Therefore, timely identification of feeding problems by the speech pathologist and the dentist with subsequent intervention and modification in the feeding method is essential, along with provision of early feeding instruction to families **(Cooper-Brown , 2008).**

1.5.1 Feeding techniques

The infant born with a cleft has similar nutritional requirements as other infants born. Maintaining the nutrition is the first priority, and finding a feeding technique as close to normal as possible is second. Mother's interest in breast feeding should never be summarily dismissed. In fact, breast feeding is a superior technique in certain cleft conditions. Finally, it is in the infants best interest to find a feeding technique that also maximizes stimulation; Infants with cleft lip, cleft palate or both as their sole health problem, swallow normally, however suck abnormally, due to their abnormal muscle attachments and abnormal communication between the nose and oral cavity. The levator and tensor muscles that attach along the back of the hard palate and extend along the midline in normal situation fail to do so when a cleft is present. This abnormal anatomy and architecture make it relatively impossible to isolate the oral cavity, build negative pressure and create suction **(Devi, 2012).**

Techniques commonly used to facilitate oral feeding in infants with cleft lip and palate and craniofacial syndromes include positioning, oral facilitation techniques, assisted fluid delivery, and changes in the viscosity of fluid. Optimal positioning as key to successful feeding for facilitation of coordinated jaw, cheek, lip,

and tongue movements for sucking/swallowing is frequently described in reports of oral-motor intervention**. (Arvedson, 2012).**

Table 1: Summarize of oral facilitation techniques.

Technique	Rationale
Positioning	**● Maintaining flexion, midline orientation, and neutral alignment of the head and neck facilitates oral-motor patterns, airway protection, and efficient feeding.** **● Positioning at 60 degrees assists with posterior transfer of fluid and decreases tendency for nasopharyngeal reflux.**
Assisted feeding	**● Assistive squeezing, in synchrony with infant's sucking efforts, help to compensate for infant's inability to create suction for fluid extraction.**
Lip, cheek, and chin Support	**● Supporting lips, cheek, and chin by external support facilitates sucking movements.**
External pacing	**● Imposing pauses during infant feeding helps to maintain appropriate respiratory phase pattern for airway protection**
Liquid viscosity	**● Thickening liquids slightly creates a more cohesive bolus that moves more slowly through the hypopharynx, allowing more time for airway closure to occur**

1.5.2 Feeding equipment

There is a wide variety of specialized nipples, bottles, and cups available for use with infants who present with cleft lip and palate or other feeding difficulties, Likewise, there is a wide variety of independent descriptive studies regarding these specialized items that report varying degrees of effectiveness with

feeding, The feeding devices described here are designed to overcome circumstances that might otherwise impede a successful feeding. Many feeding equipment are available in the market **(Redford-Badwal, 2007; Miller, 2011).**

1.5.2.1 Nipple shields:

Helpful in babies with latch-on difficulties, nipple shields are made up of thin, pliable silicone for maximum comfort. When used, nipple shields open section aid for greater skin to skin contact **(Figure 5), (Jindal, 2013).**

Figure 5: Nipple shield (devi, 2012)

1.5.2.2 Supplemental nursing system (SNS):

This includes a breastfeeding assistance kit for the mothers and babies facing special challenges, such as inducing lactation. This is ideal for long-term supplemental feedings at the breast.

It has an adjustable flow-rate system with color-coded tubes for different feeding rates and also employs a neck strap for maximum convenience **(Figure 6), (Jindal, 2013).**

Figure 6: Supplemental nursing system (Devi, 2012)

In most cases, these babies are unable to breast-feed though one can always try to breast-feed. If breast feeding is not achieving the outcomes, then it may be necessary to bottle feed as well. Various specially designed feeding bottles and teats are available like Haberman feeder, Mead-Johnson cleft palate nurser bottle, Pigeon bottle are available **(Figure 7)**. These bottles are made up of soft, squeezable plastic to help draw milk from the bottle with very little pressure **(Jindal, 2013).**

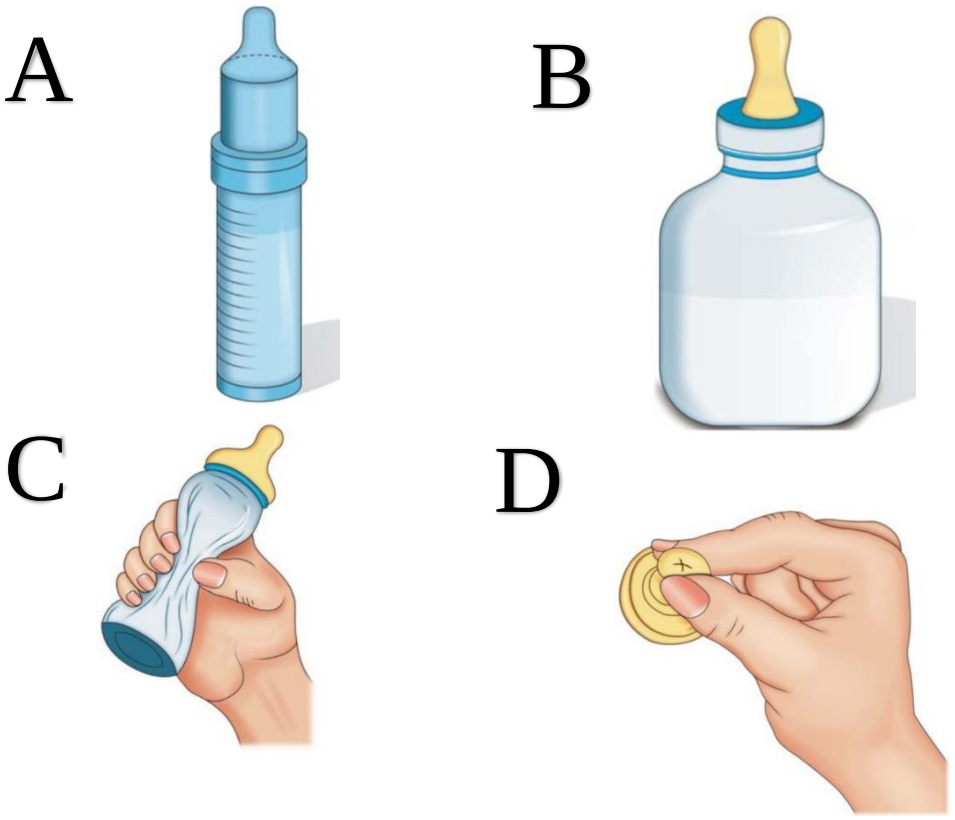

Figure 7: specially designed feeding bottles and teats (a) haberman feeder (b) mead johnson nurser bottle (c) Pigeon squeezable bottle for feeding (d) cross cut nipple for feeding (Jindal, 2013)

A long nipple to press against the tongue, with a Y-cut in the tip of the nipple is recommended. Position has to be as upright as possible, with the head in one hand and the bottle in another. With these squeeze bottles, it is good to practice first with water, so as to determine how firmly and frequently the bottle needs to be squeezed to get a steady flow **(Jindal, 2013).**

1.5.2.3 Modified cup feeding devices

These are specialty feeding devices that are used when cup feeding is recommended. For example, a baby cup feeder which comes as a small, 40 ml polypropylene cup with gradations for both ounces and milliliters. It has a smooth lip for the baby's comfort, a snap lid for convenient storage and a write-on surface for easy labeling. Another one is the Soft Feeder, which is made up of a soft silicone special reservoir, and controls fluid unlike regular cups **(Figure 8), (Kaufman, 2012).**

Figure 8: Baby cup feeder (Devi, 2012)

1.5.2.4 Specialized feeding teats

In order to facilitate the mechanical assistance for milk flow in children with cleft lip and palate and with significant problems in generating an intra-oral negative pressure, various nipples have been tried, such as, those with a Cross-cut opening to allow for more gravitational milk flow with varying degree of success, so that the infant can only swallow without much effort in sucking,

or those with enlarged openings this consists of a soft orthodontic vented shaped teat **(Figure 9)**,The air system vent helps to prevent the teat from collapsing and prevents the infant swallowing air **(Devi, 2012).**

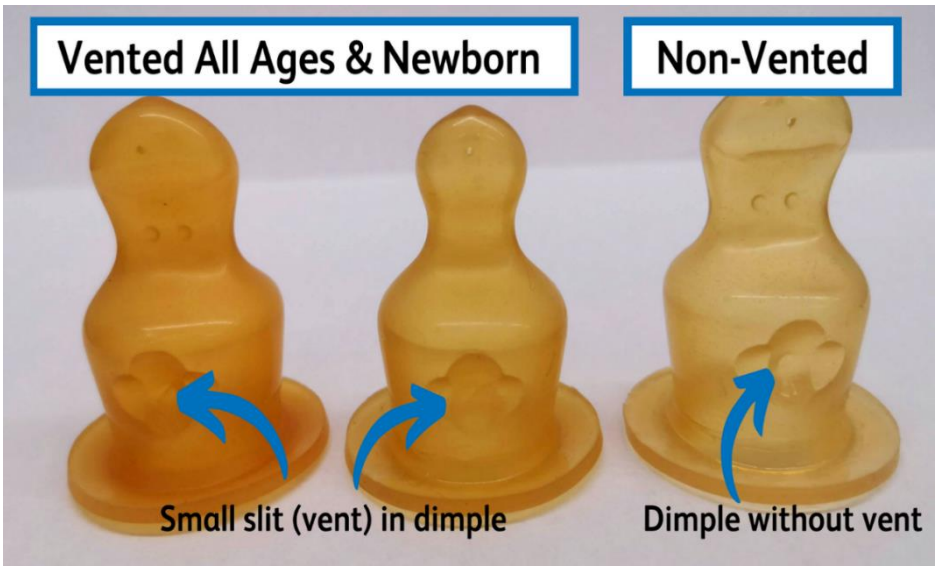

Figure 9: Specialized feeding teats (Devi, 2012).

The main difference between vented and non-vented feeding teats is the way they allow air to flow during feeding.

Non-vented feeding teats do not have any openings to allow air to enter the bottle, which means that the flow of milk is solely determined by the baby's sucking action. This can result in a vacuum being created inside the bottle, which can cause the nipple to collapse and make it difficult for the baby to feed. Non-vented teats can be useful for babies who have trouble with excessive air intake or who need a slower flow rate.

Vented feeding teats, on the other hand, have small openings or vents on the nipple or around the base of the teat that allow air to flow into the bottle during feeding. This helps to equalize the

pressure inside and outside of the bottle, preventing the formation of a vacuum and reducing the amount of air that the baby ingests while feeding. Vented teats can be helpful for reducing colic, reflux, and gas in infants.

It's important to note that both vented and non-vented teats can be used for feeding infants with cleft palate, but specialized feeding teats for cleft palate patients may have additional features such as a longer nipple or a specially designed valve system to help control the flow of milk and reduce the amount of air that is swallowed.

1.6 Treatment of patients with cleft lip and palate

A team for the multidisciplinary treatment of a child with an orofacial cleft includes the following specialists:

- Pediatrician
- Nurse practitioner
- Plastic surgeon
- prosthodontist
- Otolaryngologist
- Geneticist
- Genetic counselor
- Speech pathologist
- Orthodontist

- Maxillofacial surgeon
- Social worker
- Psychologist

No single treatment concept has been identified, especially for a CLP. The timing of the individual procedures varies in different centers and with different specialists (**Figure 10**), ***(Van, 2008).*** In this manner, it is possible to provide long-term follow up through the entire child's development and achieve all of the following treatment goals: normalized facial aesthetic, integrity of the primary and secondary palate, normal speech and hearing, airway patency, class I occlusion with normal masticatory function, good dental and periodontal health, and normal psychosocial development **(Nivaldo, 2012).**

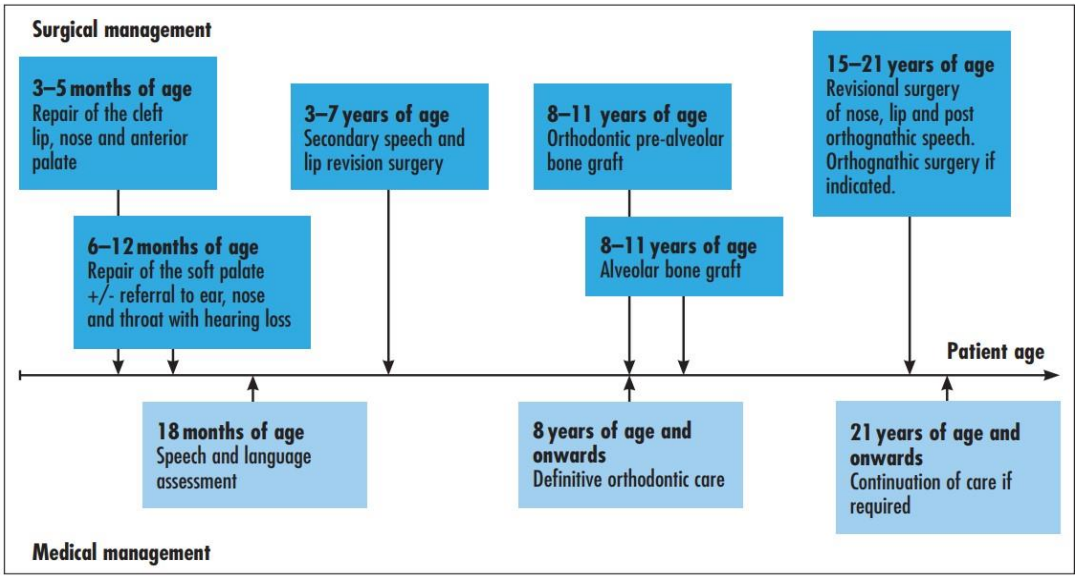

Figure 10 Timeline summarizing the management of cleft lip and palate

Early repair has been shown to benefit speech development, but may inhibit facial growth to a greater extent as transverse facial growth is not complete until 5 years of age.

✓ **In the past**, doctors prefer to wait until the child reaches the ages of 10 to 12 years before doing surgery. Waiting until maxillary growth was completed or when all the milk teeth have gone and the adult ones are in place saves having repeated corrective surgeries.

✓ **Recently**, specialists prefer to correct the jaw earlier, arguing that speech therapy is less effective when the patient is older. Most experts repair cleft palates beginning at 10 months of age.

Surgery on isolated soft palate clefts has been advocated as early as 3 months of age **(Leow, 2008; Rohrich, 2000)**.

Treatment protocol currently used in most cleft treatment centers:

Newborn - Diagnostic examination, general counseling of parents, feeding instructions, palatal obturator (feeding appliance); A dentist may start to repair the palate and bring the lips together within a week of birth. This treatment, called nasoalveolar molding (NAM) aims to prepare the infant for future surgery.

Genetic evaluation and specification of diagnosis; recommendation of a protocol for the prevention of a cleft recurrence in the family

Age 3 months - Surgery to close the cleft lip may happen within 3 to 6 months of the baby's birth. so that is it no longer noticeable.

- Age 6 months - Presurgical orthodontics, if necessary; first speech evaluation
- Age 9 months - Speech therapy begins
- Age 9-12 months - Repair of CP (placement of ventilation tubes if not done at the time of CL repair)
- Age 1-7 years - Orthodontic treatment
- Age 7-8 years - Alveolar bone graft
- Older than 8 years - Orthodontic treatment continues

Other surgical procedures can be performed in patients with severe clefts as necessary; cleft palate can be treated with surgery to correct the jaw. In many countries, the infant is monitored by a cleft palate team or craniofacial team until they reach adulthood, and sometimes for life.

Around 1 in 5 children need only one surgical procedure, but most will need a combination of surgical methods and operations as they grow.

Sometimes, the gap, or cleft, reaches the maxillary alveolar ridge, which is the edge of the upper jaw, where it meets the teeth. In this case, the surgeon fills the gap with bone tissue, which is taken from another part of the body, such as the hip.

These days, scarring, as a result of surgery, is often minimal, but the individual may undergo further surgery later in life to improve the appearance of the face

Nonsurgical treatment of the cleft palate is attempted with prosthodontic devices designed to correct velopharyngeal incompetence. Candidates who may benefit from prosthodontic devices are those who do not want or are too high risk for surgery, those in whom surgery has failed, or patients who would benefit from better alignment of the maxillary segments prior to definitive surgery **(Grayson, 2004**). The major disadvantage is that the prosthesis must be readjusted every 2 weeks until growth is finished. Additionally, the device may be irritating to the fragile mucosal surface, difficult to clean, and require cooperation on the child's behalf. Obturation is practical beginning at ages 3 to 4 years. The principle advantage is achieving as high or a higher rate of velopharyngeal competence than with surgery while avoiding potential surgical complications, such as restricted maxillary growth. Optimal timing of cleft palate repair must take into account other medical conditions and speech development **(Vig, 2015)**.

1.6.1 Management of cleft lip

Treatment of patients with cleft lip deformity is a long-term commitment. Medical treatment will largely focus on requirements from any concomitant congenital abnormalities and

based on nutritional needs. Within the first few weeks to months of life, nasoalveolar molding (NAM) can be employed with assistance from an orthodontist. This involves the creation of an orthodontic appliance that molds a protruding premaxillary segment and alveolar process into a more favorable position. This allows for repositioning of the alveolar segments, medialization of the alar base, and columellar lengthening, which allows for easier surgical repair of cleft lip and nasal cleft deformity down the line **(Walker, 2023).**

Surgical intervention for initial cleft lip usually occurs at 3 to 5 months of age. A good rule of thumb in deciding the age at which is it safe to perform primary cleft lip repair is the "Rule of 10s." If the infant is 10 weeks old, 10 pounds, and hemoglobin has reached 10mg/dL, surgical repair should be safe if no other comorbidities preclude it. There are many accepted surgical techniques for primary repair of unilateral (Millard repair rotation advancement, Fisher repair, and Mohler repair) and bilateral (Mulliken repair) cleft lips **(Walker, 2023).**

1.6.2 Management of cleft palate

Over the years, goals of cleft palate repair have remained constant and focus on three areas: anatomical closure of the palatal defect, producing normal speech, and minimizing growth

disturbance, Experts debate the advantages of different techniques but generally agree that the following principles are dictated by the goals of repair

1. Anatomical closure of the defect with Tension-free suturing

2. Reorientation of the abnormally positioned soft palate musculature to reconstruct of the levator velipalatini

3. Lengthening and retro-positioning of the soft palate

4. Minimizing denuded areas of bone and nasal or oral mucosa

5. Layered closure of the hard and soft palate

Preoperatively, for cleft palate associated with cleft lip, the lip is usually taped from about one week of life until surgery. This helps to reduce the size of the cleft and improve symmetry **(Agrawal, 2009).**

An alternative and more aggressive measure to lip taping is nasoalveolar molding (NAM) **(Fig 11),** which can lead to an improved cosmetic and functional outcome after surgery. NAM involves the placement of a prosthesis that is fitted from a maxillary impression and is worn 24 hours a day and adjusted on a weekly or biweekly basis. NAM can result in far improved nasal symmetry and alveolar alignment. However, it is a significant time

and effort commitment for families, and poor compliance can significantly impact outcomes **(Aminpour, 2008).**

For very wide clefts, lip adhesion is a surgical alternative to achieve a narrower cleft at the time of repair. It is uncommonly used as it requires an additional surgical procedure. It is usually performed as early as 4-6 weeks old. Lip adhesion involves elevation of rectangular mucoperiosteal lip flaps, which are brought together medially with absorbable suture **(Zaidi, 2018).**

1.7 Construction of baby feeding appliance

As we discussed before that most of the children with cleft palate defect are unable to be breastfed as they cannot create the negative pressure required for suckling. The surgical corrections for rectifying the clefts are deferred until the child is 3 months of age or older; the palatoplasty is performed even later, usually

between 6-12 months of age thus, a feeding obturator which is a prosthetic device that helps to restore the separation of oral and nasal cavities, It restores the basic functions until the surgical corrections of the defects are completed **(Malavika, 2019).**

1.7.1 Impression methods for baby feeding appliance

The most important part of the rehabilitation of a patient with cleft lip and palate is the impression making procedure. The making of the impression in an infant with a cleft palate is a critical procedure. For an accurate and safe impression procedure, a proper patient and dentist position are vital. A number of positions have been adopted for cleft palate impression making in infants, including upright , upside down, face down and prone position **(figure 12) (Rizwaan, 2010).**

Figure 12 positions in taking an impression for cleft patients (a) upright (b) upside down (c) face down (D) prone position

1.7.2 Materials used for the impression

Heavy body silicone impression material, polyvinyl siloxane impression material, low fusing impression compound and alginate have been routinely employed for making impressions of neonates with orofacial clefts. According to a study, alginate and cartridge delivery silicones provided good replication of the

surface detail, the impression compound has also been in use for the impressions of infants with oral clefts. The advantage of its use in infants with oral clefts are, that it can be removed before it sets in case of any emergency and it has better resistance to tearing as compared to other impression materials **(Grayson, 2005).**

1.7.3 Selection of the impression tray

Shatkin and Stark have described the use of wax as impression trays in cleft lip and palate patients. Ice cream sticks can also be used to carry materials for infant impressions. While using elastomeric impression material in putty consistency or impression compound for making the impression of the cleft in infants, the materials can be supported with the fingers and placed in the patients mouth till the material sets **(Grayson, 2005).**

The impression tray should be of enough size transversely, to include the lateral maxillary segments, to posteriorly cover up to the maxillary tuberosities and to provide a good reproduction of the mucobuccal folds. The anterior tray border is not critical, as the impression material flows forward far enough to cover the structures as the tray is seated. Rimming of the entire tray with utility wax has been suggested to provide an additional bulk of material laterally, to avoid the sharp edges of the tray and also to provide a posterior dam to prevent the material from seeping posteriorly. After their size and shape have been roughly

estimated, perforated custom acrylic trays can be fabricated **(Zaidi, 2018)**.

1.7.4 Materials used in the fabrication of baby feeding appliance

Obturators are typically fabricated from acrylic resin and are either heat- or auto- polymerized. A soft resilient material is often used to line the undercut regions of the palate, the obturators are retained by the resilient material in the undercuts or elaborate extra oral appliances which hold the obturator in place. Another technique for fabricating a feeding appliance or obturator for the cleft palate infant utilizing a resilient vacuum-formed vinyl material commonly used in athletic mouth guards. This technique can be accomplished quickly, safely and without danger to the infant, in addition, the obturator can be delivered at the same appointment that the impression is made **(Hansen, 2015)**

1.7.5 Advantages of feeding obturator (Ravichandra et al. 2010)

1. An obturator creates a rigid platform on which a baby can press the nipple and extract milk

2. It reduces potentially painful ulceration of the nasal septum by the teats because of the plasticity of the tissue conditioner on the fitting surface of the tissue conditioner
3. It helps create sufficient negative pressure that allow for adequate sucking of milk**.**
4. It facilitates feeding, reduces nasal regurgitation and the incidence of choking, shortens the time required for feeding, and prevents the tongue from entering the defect and interfering with the spontaneous growth of palatal shelves towards the midline
5. It helps to correctly position the tongue to perform its functional role in the development of the jaws and thus contributes to speech development.

1.7.6 Problems associated with use of feeding obturators (Ravichandra et al. 2010)

1. Frequent visits for examination of the oral mucosa, which is very delicate and easily damaged by the obturator; ongoing adjustments and replacements are needed to accommodate growth.

2. Repeated construction of new obturators because of baby's growth.
3. Often associated with poor oral hygiene, which can lead to fungal growth on the palate if the proper cleaning procedure for the prosthesis is not followed.
4. May be costly.
5. Associated with hazards encountered while taking impressions for construction of the obturator, such as difficulty in removing the impression due to engagement of undercuts and fragmentation of the impression upon withdrawal from the mouth with subsequent respiratory obstruction and cyanotic episodes.
6. Intra-oral placement of the obturator is challenging and can add to the burden of maintenance.

1.8 Case report

Construction of feeding appliance for newborn baby 2 days old with cleft palate, instead of using Nasogastric tube for feeding.

The patient was a 2-days-old male infant with cleft lip and palate who weighed 2.3 kg. The pediatrician referred the baby to the

dental service, prosthetics department / Educational dental hospital, because his mother was unable to feed him.

-History taken from his parents showed no known clefting or other congenital defect within the family. Intraoral examination revealed bilateral cleft of the uvula and soft palate. **(Figure 13).**

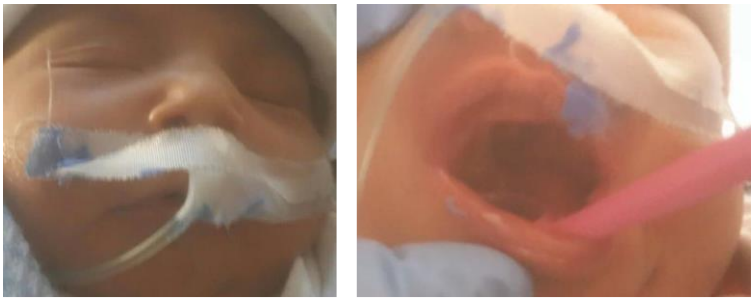

Figure 13 bilateral cleft of the uvula and soft palate

The face of the infant was positioned downward to prevent airway obstruction and aspiration of impression material while the first and second impressions were being taken with viscous vinyl polysiloxane impression material ,first impression was taken by hand figure, diagnostic cast and special tray were made ,then second impression was taken by special tray **(figure 14)**.

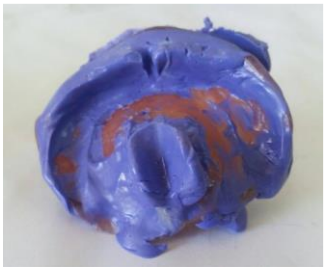

Figure 14 viscous vinyl polysiloxane impression material.

Dental stone was poured into the impression and a dental cast model was obtained for the construction of the feeding plate. Prior to the fabrication of the feeding plate, plaster was applied on the dental cast model to close the undercut in the defect. **(Figure 15).**

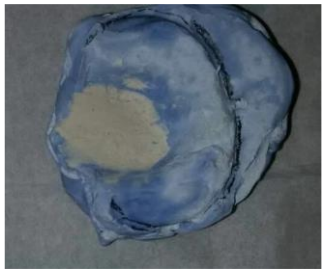

Figure 15 Dental cast model with closing the undercut in the defect

A feeding appliance was then made on the final cast by using pressure moulding technique in biostar machine, Ethylene vinyl acetate was used for fabrication of the feeding appliance. In the Biostar device (Scheu-Dental Gmbh Iserlohn, Germany) A 1-mm Biocryl C Rosa-transparent plate (hard plate) was pressed on the model **(Figure 16).**

Figure 16 the Biostar device

The edges of the plate were trimmed and polished. The completed feeding plate covering the cleft area is shown in **(Figure 17).**

Figure 17 completed feeding plate

A small hole was drilled in the anterior flange of the appliance with a round bur, and a piece of dental floss was attached through this hole for safety **(Figure 18).**

Figure 18 small hole was drilled in the anterior flange

The feeding plate was inserted into the mouth, necessary adjustments were made, and the appliance was polished again. The fit of the feeding plate with the cleft region was optimal; denture adhesive was used to increase retention **(Figure 18).**

Figure 19 Denture adhesive

CONCLUSION

1. Maintenance of adequate nutrition is essential for the growth and development of the infant because gaining weight is important for the preparation of the baby for the corrective surgery.
2. Various feeding devices have been used to feed these babies including the traditional feeding bottle, which may be rigid or squeezable, a squeezable cleft palate nurser, a traditional feeding bottle with a crosscut nipple, the Hotz plate, the Haberman feeder, a prosthetic obturator appliance, a nasogastric tube, cup and spoon feeding, and syringe feeding.
3. A feeding plate was constructed that permitted effective feeding and normal weight gain. Cleft lip and/or palate should be treated by an interdisciplinary team. Reported benefits of intraoral plates include facilitation of feeding, guidance of growth and development of the maxillary segments, normalization of tongue function, facilitation of surgery, better speech, and a positive psychological effect on parents.
4. Feeding plates have the ability to adjust the position of cleft segments into a more ideal relationship before definitive surgical repair of lip so the popularity of the infant

orthopedics is still considerable, although there are conflicting reports about eliminating future need of orthodontic treatment for the child.

5. In the presented case, the feeding plate with flexible bulb efficiently obstructed the cleft area during feeding and prevented the entrance of tongue into the cleft. In this previous case report, the feeding plate provided comfortable swallowing for the infant. In our clinic. The baby adapted to the appliance very quickly and the mother fed the baby with ease. The appliance was fabricated by pressing plates with a Biostar device; the fabrication process was easy, quick, and inexpensive. We believe this feeding plate has many advantages and can be used routinely as the initial treatment for infants with cleft palate.

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