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The relation between cleft lip and palate with orthodontics treatment

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Orthodontics in Partial Fulfillment for the Bachelor in Dental Surgery

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CERTIFICATION OF THE SUPERVISOR

I certify that this project entitled “The relation between cleft lip and palate with orthodontics treatment” was prepared by Manar Karim Aziz under my supervision at the College of Dentistry/University of Baghdad in partial fulfillment the graduation requirements for the Bachelor degree in dentistry.

Supervisor 'name

Date

DEDICATION

To who raised me, taught me, protected me, loved me unconditionally .To you mom & dad ..You are the reason for what I have reached today and what I will reach to in future.

To my three oldest brothers Ali, Ahmed, Munaf ..

To my brother's wives Shahad & Afnan who are close to my heart ..

To my friends who love me truly and helped me in different ways ..

And to the all people who I adore,

THANKE YOU for being in my life ..

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Introduction

Cleft lip and palate are one of the most common congenital anomalies of craniofacial region. Everyday some 700 children with cleft lip and/or cleft palate are born in the world, which means that a baby with such a cleft is born every 2 minutes. Cleft lip and palate is most prevalent among Asians, least in Africans, and in Caucasians its prevalence is intermediate and hence incidence varies according to geographic location, ethnicity, gender, and socioeconomic status(**Samuel S et al. 2014;Cooper ME et al. 2000**)

Cleft lip and palate may not be life-threatening but many functions such as feeding, digestion, speech, middle-ear ventilation, hearing, respiration and facial and dental development can be disturbed because of the structures involved. These problems can also cause emotional, psycho-social, and educational difficulties. In addition, CP is an economic burden. cleft lip and palate have multifactorial origin/ etiology with potential contributing factors, including chemical exposures, radiation, maternal hypoxia, teratogenic drugs, nutritional deficiencies especially folic acid, and genetic influences .The staff of competent cleft management center should include the following professionals: radiologist, anesthesiologist, geneticist, plastic surgeon, maxillofacial surgeon, social worker, speech therapist, neurologist, neurosurgeon, nursing staff, orthodontist, pedodontist, prosthodontist, psychiatrist, psychologist and(ENT) specialist(**Philips BJ, Warren DW.2018**).

Aims of the study

1-provide facial and dental aesthetics

2-functional occlusion

3- Improved oral health environment and speech

4- facial/dental rehabilitation is associated with the development of improved self-esteem and inclusion in to society



Chapter one

Review of literature

Chapter one

Studies have shown that women who do not take sufficient folic acid during her pregnancy or A child may receive a particular combination of gene(s) from one or both parents, or there may be a change in the genes at the time of conception, which results in a craniofacial anomaly. Thus any defect during embryonic development of lip and palate or process is delayed or absent, the branchial membrane will pull apart causing clefting so it is important to understand the development of lip and palate in the embryonic life.

1:1 Development of the cleft lip and palate

The developing frontonasal prominence, paired maxillary processes and paired mandibular processes surround the primitive oral cavity by the fourth week of embryonic development (Figure 1:1a).

B. By the fifth week, the nasal pits have formed, which leads to formation of the paired medial and lateral nasal processes (Figure 1:1b).

C. The medial nasal processes have merged with the maxillary processes to form the upper lip and primary palate by the end of the sixth week. The lateral nasal processes form the nasal alae. Similarly, the mandibular processes fuse to form the lower jaw (Figure 1:1c).

D. During the sixth week of embryogenesis, the secondary palate develops as bilateral outgrowths from the maxillary processes which grow vertically down the side of the tongue (Figure 1:1d).

E. Subsequently, the palatal shelves elevate to a horizontal position above the tongue, contact one another and commence fusion (Figure 1:1e).

F. Fusion of the palatal shelves ultimately divides the oronasal space into separate oral and nasal cavities (Figure 1:1f) .

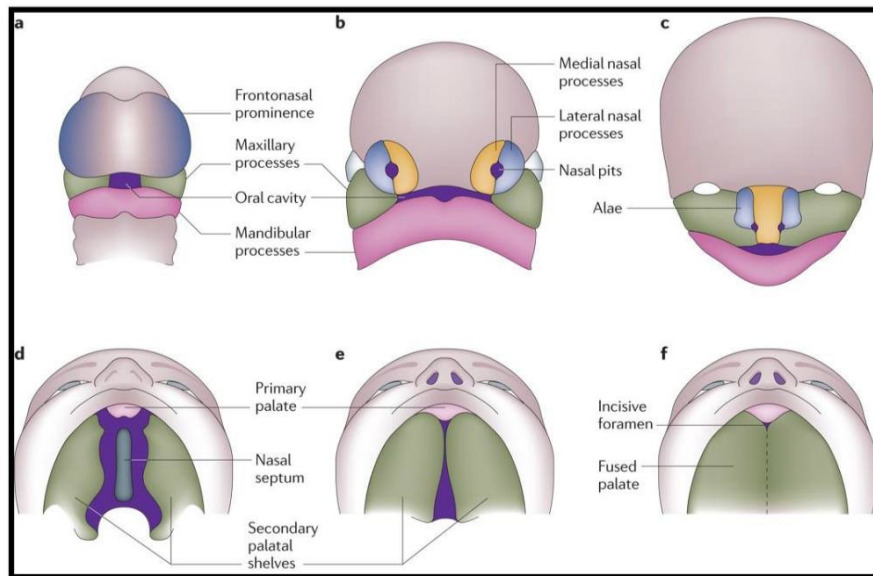


Figure 1: Development of the cleft lip and palate [5].

(Figure 1:1)

If this process is delayed, or if one mass is absent, the branchial membrane will pull apart and a CL will ensue. If the maxillary prominence on the affected side fails to merge with the merged nasal prominence, a unilateral cleft will result. If tissues fail to merge on both sides, two grooves are formed, resulting in a bilateral CL.

Based on the general evaluation there are certain parameters that should be considered, which include:

1. Growth considerations

Unilateral complete clefts of the lip and palate typically become more maxillary-deficient and mandibular prognathic in appearance. Typically, this is a result of sagittal maxillary deficiency. However, vertical maxillary deficiency may also accentuate the class III tendency, resulting in overclosure of the mandible to

achieve occlusion of the teeth. Alternatively, a class III skeletal relationship can be camouflaged by increasing the vertical dimension to rotate the mandible down and back. Since facial growth is the result of the interaction of genetic and environmental factors, continued growth in early adulthood may enhance or detract from treatment results obtained during childhood and adolescence.

2. Skeletal-facial considerations

In general, a patient with an oral cleft may show a wide spectrum of orthodontic problems with the cleft palate related anomalies superimposed on them. It is common that the maxilla exhibits deficiency in all three dimensions anteroposteriorly, transversely, and vertically. Posterior crossbites are common even in cases that exhibit only an isolated cleft palate (not extending into the alveolus). Anterior crossbites are also commonly observed.

3. Dental considerations

Dental problems faced by the orthodontist include the following:

- Absence of teeth adjacent to the cleft.
- High incidence of missing teeth in other regions especially missing bicuspids.
- Malformed teeth
- Supernumerary teeth
- Ectopically positioned teeth
- Lack of osseous support for some teeth compromising the possibility to move these teeth to the desired positions.
- Poor oral hygiene, caries, periodontal disease

4. Soft tissue considerations

Isolated palatal clefts not extending into the alveolar bone and lip may not affect facial esthetics to any significant degree. In general, lip contour and thickness in these patients appear normal. Presence of a complete unilateral or bilateral cleft palate, however, may be associated with potentially severe maxillary growth deficiency, manifesting itself with straight or concave facial profile, thin upper lip, protrusive lower lip.

1:2 Clinical characteristics presented in CLP

Clefting of the lip and/or alveolus can occur either unilaterally (one-side) or bilaterally (both sides). The morphological alterations caused by the cleft are related to its severity and classification.

- A newborn with a unilateral CLP will present extraorally with the nasal alar cartilage on the side of the cleft displaced and flattened, and the tip of the nose deviated toward to the non-cleft side (Fig. 1:2A). Intraorally there will be separation of the palatal shelves to various degrees, and the palatal segment on the side of the cleft is often tilted medially and superiorly. There is also a direct communication between the oral and nasal cavities on the affected side of the palate. The median portion of the lip is isolated in the midline and remains attached to the premaxilla and to the columella. The premaxilla typically protrudes considerably forward of the facial profile **(Allori, AC et al. March 2017)**.



(Figure 1:2A)

- the alveolar and palatal bone defects of cleft individuals remain, leading to the malposition of teeth adjacent to the cleft. Frequently observed in CLP individuals are dental anomalies (number, shape, position) and compensatory positioning of the teeth. The agenesis of the maxillary lateral incisor, on the affected side, is the most frequent dental anomaly (figure 1:2 B)

(Menezes R, Vieira A.2008;Ribeiro LL et al.2003).



(Figure 1:2B)

Patients with unilateral or bilateral cleft lip, alveolus and palate may require orthodontic treatment during the following four different stages:-

1. Neonatal maxillary orthopedics in an infant.
2. Orthodontic-orthopedic treatment during the primary dentition.
3. Orthodontic treatment during the mixed dentition.
4. Orthodontic treatment alone or in conjunction with orthognathic surgery in the permanent dentition.

1:3 Orthodontic treatment stages in cleft lip & palate patients

1:3:1. Neonatal maxillary orthopedics in an infant.

Immediately after birth (Birth to 12 months), feeding instructions, counseling, diagnosis by a geneticist, and a pediatric consultation are provided. The newborn hearing test is mandatory at birth. If the cleft is wide, lip taping is started immediately. This is almost always done in bilateral clefts but also often in wide unilateral clefts. Primary correction of congenital clefts of the lip and palate should be designed to carry the interrupted embryonic process to normal completion. This is best accomplished by maxillary alignment with presurgical orthodontics, Active orthopedic force is given by three piece of tape joined together by two elastic bands (figure 1:3). The central portion of the tape tends to cover the premaxilla in bilateral cleft cases, thus stabilizing the segment, obliteration of the alveolar cleft and construction of the nasal floor with periosteoplasty. Presurgical orthopedics or nasoalveolar molding (NAM) in bilateral and wide unilateral clefts. The NAM appliance is fabricated using acrylic from a cast of the infant's maxilla. It is then adjusted weekly or

biweekly to correct the nasal and alveolar deformities progressively(**Grayson BH. 2001**).

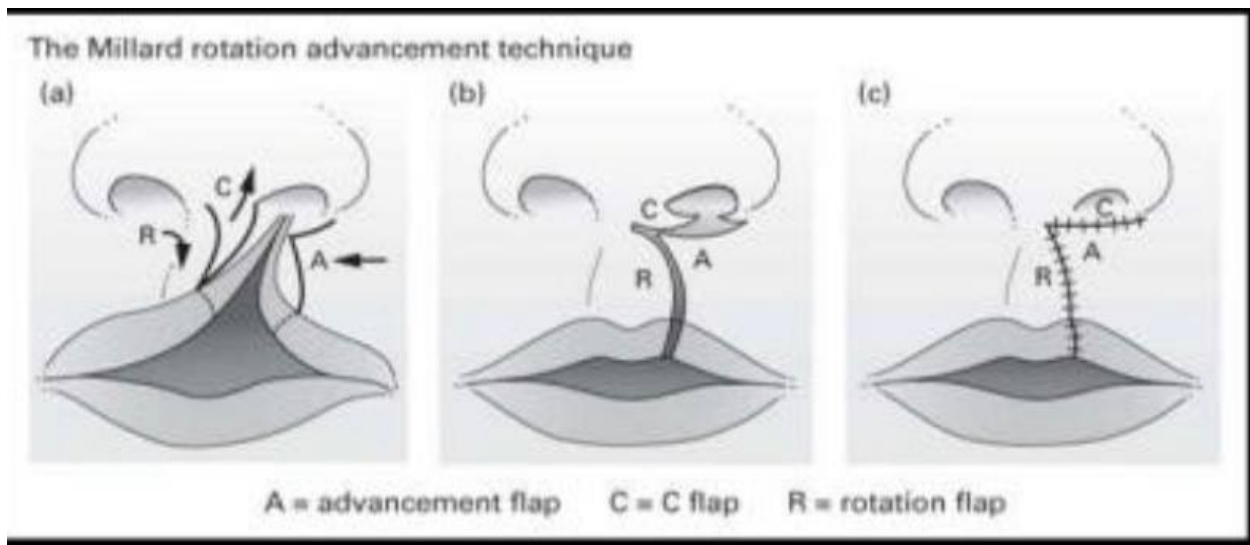
NAM has been shown to have positive clinical effect, yet evidence is lacking and there is still much debate on the efficacy and limitations of NAM The goal with NAM is to manipulate the segments to allow a tension-free lip repair.(**Oberoi S et al. 2009 ;Hathaway RR, Long RE Jr.2014**).



(figure 1:3)

Surgical repair of cleft lip (cheiloplasty) that is commonly done between three to six months of age is done by three techniques:

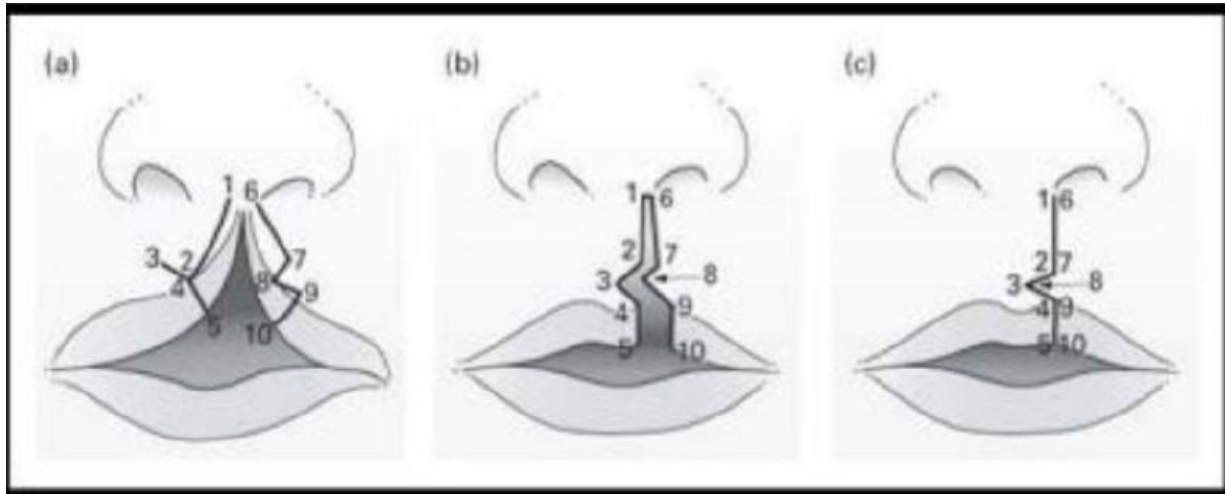
1-Millard's repair, rotation flap and columella flap are planned on the medial side of the cleft and advancement flap on lateral side of cleft. Full thickness of the lip is cut along the marking a rotation flap is rotated towards the cleft defect; rotation gap is produced on the mesial side, which is filled with an advancement flap (Figure1:5)



(Figure1:5)

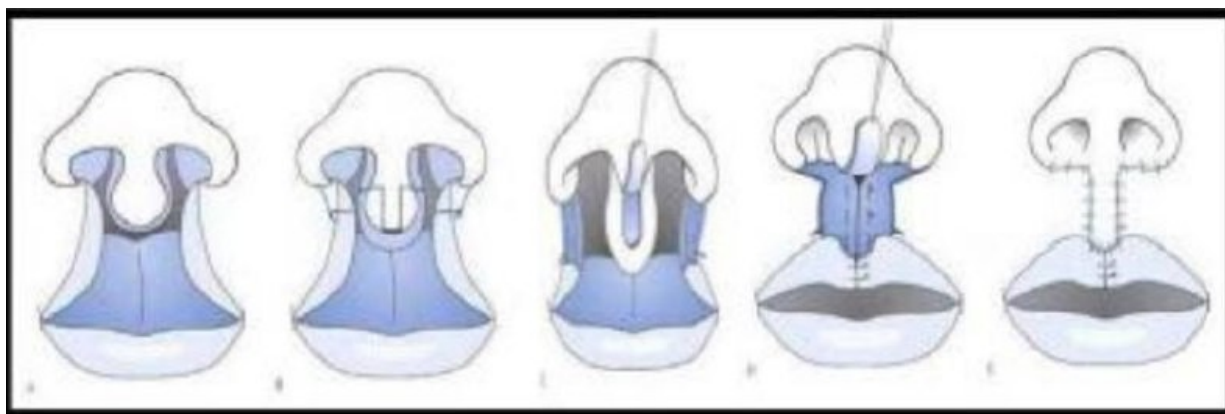
2-Tennison-Randall's repair, a triangular flap is created on the lateral side of the cleft to fit into the triangular defect produced on the mesial side of the cleft. This procedure can be planned exactly after initial measurement. The result cannot be modified once the lip is cut. The scar is more prominent than in other procedures

(figure 1:6)



(Figure1:6)

3-veau's repair, simplest one-stage straight line closure is done and produces satisfactory result in a bilateral cleft lip. In this method, vermilion flap from either lateral side of the cleft is brought down over the prolabium to augment the vermilion in the center of the upper lip(Figure1:7) (**Berkowitz S. 2013**).

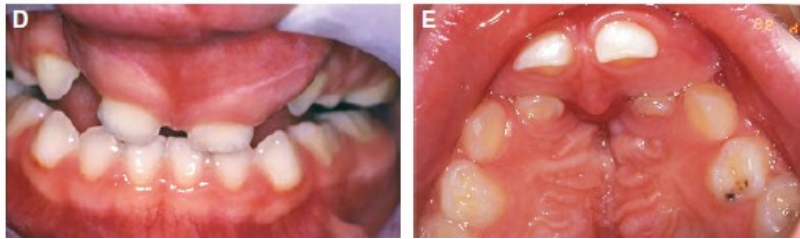
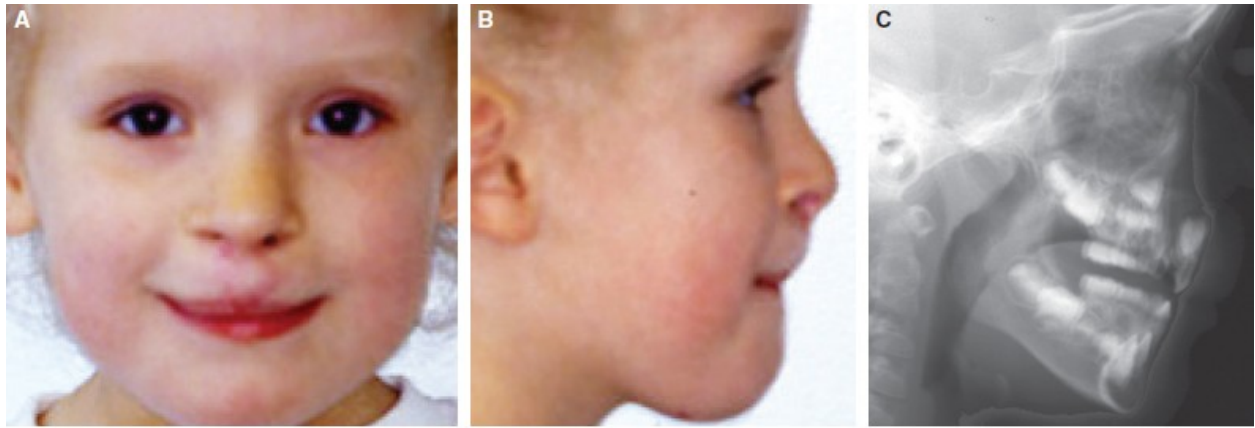


(Figure1:7)

Surgical repair of the palate (palatoplasty) is generally done around 10 months, and pressure equalization tubes are placed at the same time. The surgical technique is Z-plasty or two-flap palatoplasty based on the width of the cleft palate. A second-team evaluation with emphasis on speech/language assessment is done 3–4 months after palate repair (Vargervik K et al. 2009)

1:3:2. Orthodontic-orthopedic treatment during the primary dentition

Primary dentition: 1–7 years, evaluations are scheduled as needed, typically every 1–2 years. There may be need for speech therapy, fistula repair, soft palate lengthening for correction of velopharyngeal insufficiency, medical and behavioral intervention, treatment of middle ear disease, or dental treatment. In children with an alveolar cleft defect, a delay in the eruption of primary teeth may occur. The primary lateral incisor may be malformed or congenitally missing. Apart from this. Although the distribution of the adipose tissue and the soft tissue drape of the young child camouflages the developing skeletal deficiency of the midface in children with clefts, the dentition often reflects the underlying skeletal discrepancy. Unilateral or bilateral anterior and/or posterior cross bites may be present. A functional shift (ie, a slide from centric relation to centric occlusion). At 5–6 years, lip revision and/or columella lengthening in bilateral clefts may be indicated. Radiographs are usually obtained at this time, allowing assessment of jaw growth, dentition, and alveolar cleft defect. During this period, those individuals have a dental home where they are followed by our pediatric dentist. This is especially important because children with CL/P have a higher susceptibility to caries than those without a cleft (Daniels KM et al. 2018; Maine RG et al. 2012; Oberoi S et al. 2011; Al-Dajani M. 2009).



(figure 1:8)

1:3:3. Orthodontic treatment during the mixed dentition

The mixed dentition stage starts at approximately 6 years of age with the eruption of the first permanent molars and incisors. Patient evaluation includes an appraisal of the soft tissue condition (ie, presence or absence of oronasal communication); the skeletal aspects of malocclusion in all three planes of space; and dental problems, such as missing/malformed teeth, malpositioned/rotated incisors, anterior and/ or posterior crossbites. Cleft lip and palate patients often develop maxillary retrusion after cleft repair. One of the main treatment objectives during mixed dentition is to prepare the maxillary segments for alveolar bone grafting which is essential to provide a bony continuity of the maxilla (figure 1:8) (Singla S et al. 2018).

The advantages of alveolar bone grafting are several:

- 1- closure of the oro-nasal fistula
- 2- repair of the alveolar cleft
- 3- provide bony support and mucosal coverage to the adjacent teeth
- 4- provide a bony matrix to support the teeth erupting in the cleft site,
- 5- facilitate prosthetic restoration by improving the periodontal status,
- 6- stabilize the bony segments,
- 7- provide adequate volume of bone for implant rehabilitation.

Successful bone fill in the alveolar cleft also allows the permanent canine to erupt mesially as it is often used for substitution of a missing lateral incisor

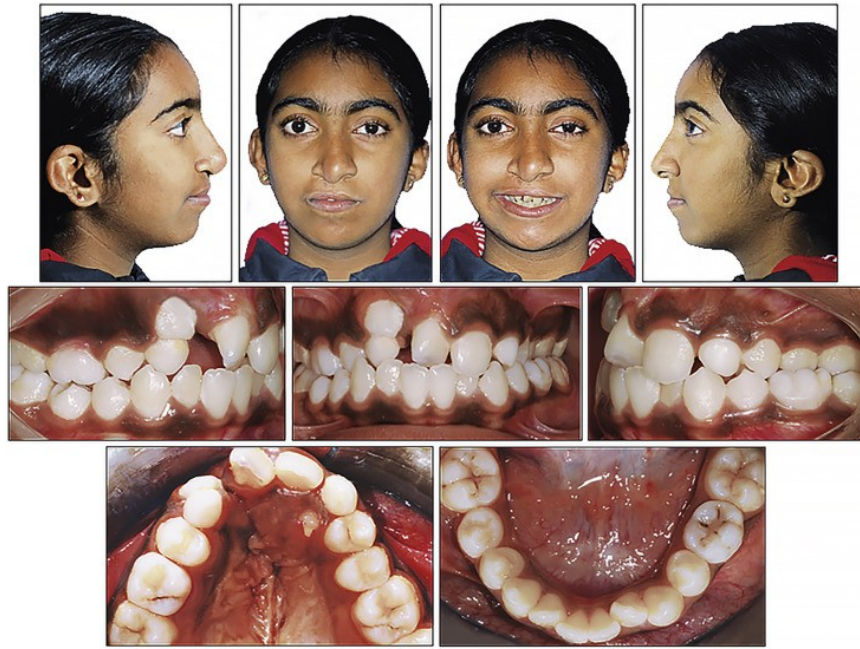
(Vargervik K et al. 2009; Oberoi S et al. 2008; Oberoi S et al. 2010; Pena WA et al. 2009; Trindade IK et al. 2005)

Some suggested and used treatment modalities are described hereby in brief:

1. Rygh and Tindlund recommend utilization of aquad-helix appliance soldered to bands on the primary second molar teeth and canines to expand the upper arch. The latter is accompanied by the placement of a protraction face mask to modify and redirect growth. The effectiveness of the technique has been shown but lack of longitudinal data has raised questions on the long-term benefits of this approach.
2. In another study the treatment was done in which a customized intraoral splint made up of 0.36” stainless steel wire without maxillary expansion was used. The wire framework had inbuilt horizontal hook, in the canine region extending from the main wire on each side buccally, which was covered with self-cure acrylic on both sides, forming a splint with a vertical height within 2–3 mm of total clearance of upper incisors and lower incisors. Protraction was carried out with a Delaire type face mask. Heavy elastics (0.25 inch, 8 ounces) were attached to hooks extending from the splint near the maxillary canines. The line of the Role of orthodontist in cleft lip and palate protraction force was downward and forward, at an angle from 15° to 30° to the occlusal plane. The force applied ranged between 420 g and 480 g, and patients were instructed to wear the face mask for 16–18 h/day(Singla S et al. 2018).

1:3:4. Orthodontic treatment alone or in conjunction with orthognathic surgery in the permanent dentition

At the age of 12 years or older, after eruption of the permanent second molars, the second phase of orthodontic treatment is started. Diagnostic records are obtained at this time. According to the vertical, sagittal, and transverse assessment, the individuals may present with no skeletal discrepancy, mild skeletal discrepancy, or moderate-to-severe skeletal discrepancy. Individuals with isolated clefts of the lip, alveolus, or the soft palate may present with no skeletal discrepancy. In such cases, the treatment planning is done to provide a stable occlusion. Issues related to rotations, crowding, and spacing can be corrected using conventional fixed orthodontic mechanics. palatal expansion appliances can be helpful in correction of crossbite relationship if any. Individuals presenting with mild skeletal discrepancy may be good candidates for orthodontic camouflage(**Mancini L et al. 2017**). Individuals presenting with severe skeletal discrepancies may be candidates for jaw surgery, most often maxillary advancement. Phase II orthodontic treatment may then be postponed so that jaw surgery can be done while the orthodontic appliances are still in place(**Oberoi S et al. 2012;Oberoi S et al. 2008**). With the advent of bone-anchored maxillary protraction devices and temporary anchorage devices, skeletal discrepancies can be now be addressed with a more conservative approach than jaw surgery. Facemask anchored to the mini-plates or Bollard plates(**figure 1:9**) (**De Clerck HJ et al. 2009**)



(figure 1:9(

Chapter two

2:1 Discussion

mothers were exposed to smoking, alcohol consumption, antiepileptic medications, Corticosteroids, nutritional deficiencies (folic acid) and infectious diseases during pregnancy are in high risk of birthing babies with maxillofacial defects for which treatment should be started at the moment of the birth of the child(**figure 2:1**). The orthodontic burden of care for patients with cleft lip and/or palate is significant as patients will often present with numerous variations and complications in their skeletal, dental and medical/behavioral presentation compared to the non-cleft patient. The dentist has a key role to play in providing continuing, high-quality, preventive-based dental care. Thorough treatment-planning, patient support and skillful behavior management are important aspects of this multi-faceted care. Good communication on a regular basis between the dentist and relevant members of the cleft team helps to achieve the best oral health outcome for the patient (**Br Dent J, 2000**).



Figure 2:1

Chapter three

3:1 Conclusion

Cleft is the most common craniofacial malformation that results from a failed merging of the maxillary and medial nasal elevations (Cleft lip). results from the failure of the lateral palatine processes to meet and fuse (Cleft palate) can occur either unilaterally or bilaterally and typically happens at the junction of the lateral incisor and the first premolar teeth. The principal objective of the orthodontic treatment of cleft lip and/or palate individuals is to provide facial and dental aesthetics, functional occlusion, improved oral health environment, and speech, facial/dental rehabilitation is associated with the development of improved self-esteem and inclusion in to society (**Vargervik K et al. 2009**). Patients become more maxillary deficient and mandibular prognathic in their appearance. Over the years, the role of orthodontist has been multiple, because of its synergism with other treatment needs of the patient. The orthodontist can participate during all stages of care of cleft patient: In early stages with pre surgical maxillary orthopedics; during the intermediate stages by aligning the maxillary segments and dentition and preparation for secondary alveolar bone grafting; during the final stages by obtaining ideal dental relation and preparing the dentition for prosthetic rehabilitation or orthognathic surgery. In a patient with cleft lip and palate, the orthodontic malocclusion can be related to soft tissues and skeletal and/or dental defects. The orthodontist must make critical decisions for orthodontic intervention at the appropriate time and prioritize treatment goals for each intervention as the goal for complete rehabilitation of patients with clefts is to minimize interventions and maximize treatment outcome

Treatment plan from orthodontic perspective can be divided into the following stages based on the dentition stages: (1) presurgical orthopedics, (2) primary dentition, (3) mixed dentition, and (4) permanent dentition.

3:2 Suggestion

Smoking, alcohol drinking, drugs should be avoided for pregnant women, committed and scheduled visits to specialist doctors is very important to achieve good results. Tooth brushing is very essential during all treatment periods. A small baby brush is advised as the first toothbrush, they should be shown in detail how to brush the teeth and gums properly (figure 3:1). It is important to point out the potential

problem areas of plaque accumulation around the teeth in the cleft region. A low fluoride children's toothpaste containing no more than 600 ppm fluoride is recommended for children under 6 years of age.



(figure 3:1)

Another thing we should focus on is Teasing and bullying, they are two major problems in the daily life of an individual with CLP due to the visible implications of cleft such as facial scarring, speech and hearing loss, society reacts negatively to facial disfigurement which can be easily identified by peers. Many patients with a cleft lip and palate experience problems with teasing at school. Those individuals were shown to experience bullying more than others that results in psychosocial problems that start in the early age. Accepting the appearance of the cleft and the teeth is often a big hurdle for some patients and their parents. When patients with CLP are referred to the clinic for orthodontic treatment, the orthodontist should be taken into consideration that these patients may have been bullied in the past or may be potential victims of bullying. CLP patients who are victims of bullying should be directed to get psychological help so that they can get adequate emotional and psychological support (figure 3:2) (Hunt O et al. 2006)



(Figure 3:2)



Figure 3:3 (results of orthodontic treatment on CLP patients)

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