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Review Article

Role of orthodontist in cleft lip and palate

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Abstract

Cleft lip and palate is one of the most common congenital anomalies occurring round the world varying with the race, ethnicity and geography. Cleft lip and/or palate problems tends to worsen as the individual grows older. Although it occurs as a different entity in itself but its presence can hamper aesthetics as well as functions by effecting growth, dentition, speech, hearing and overall appearance resulting in social and psychological problems for the child as well as the parents. Cleft lip and palate is of a multifactorial origin such as inheritance, teratogenic drugs, and nutritional deficiencies and can also occur as syndromic or non-syndromic cleft. Treatment of Cleft Lip and Palate comprises of different specialists having an individual insight in a particular case ultimately reaching to a consensus for a successful culmination of the treatment. Although appropriate timing and method of each intervention is still arguable. An orthodontist plays a role in pre surgical maxillary orthopaedics, in aligning the maxillary segments and dentition, in preparation for secondary alveolar bone grafting and finally in obtaining ideal dental relation and preparing the dentition for prosthetic rehabilitation or orthognathic surgery if required. Therefore, for efficient treatment outcome and refinement of individual techniques or variations of the treatment protocol a highly able team of specialists from different specialities is a must, preferably on a multicentre basis.

More Information

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Introduction

Cleft lip and palate are one of the most common congenital anomalies of craniofacial region [1]. 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 [2]. 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 [3].

Cleft lip and/or palate problems may or may not be severe in a young child, but they tend to worsen as the individual grows older. Although cleft lip and palate is a single anomaly it causes a range of functional as well as aesthetic problems which consist of a very severe impact on several systems and functions that include facial growth, dentition, speech, hearing and genetic aspects because of the complex mode of inheritance. It also causes social and psychological problems that have a lasting impact on the children and parents [3].

Although inheritance may play a role, cleft lip and palate is not considered a single gene disease but of a multifactorial origin/ etiology with potential contributing factors, including chemical exposures, radiation, maternal hypoxia, teratogenic drugs, nutritional deficiencies especially folic acid, physical obstruction and genetic influences [2]. Moreover, Orofacial Clefts can occur as syndromic or non-syndromic cleft with the latter accounting for the majority of cases (70% of CL/P cases and 50% of CP cases) [4]. In humans, non-syndromic cleft of the lip and palate has a multifactorial etiology and may entail a polygenic inheritance in combination with exogenous factors.

In the past, many children born with cleft lip and palate received Inadequate care as a result of diagnostic errors, failure to recognize and treat the full spectrum of health problems associated with complete unilateral cleft lip and palate and complete bilateral cleft lip and palate, unnecessary and poorly timed treatment and inappropriate or poorly performed procedures [5] whereas today, oral clefts may be diagnosed at beginning of the 2nd gestational trimester through advanced techniques of prenatal control.

Therapeutic management of cleft lip and palate is a long and complex procedure demanding the cooperation of experts from different scientific fields. The level of cooperation and the ethos of our noble profession calls for organization of experts at a single centre, where treatment planning and implementation will be performed. The staff of competent cleft management centre should include the following professionals: radiologist, anaesthesiologist, geneticist, plastic surgeon, maxillofacial surgeon, social worker, speech therapist, neurologist, neurosurgeon,

nursing staff, orthodontist, paediatrician, paedodontist, prosthodontist, psychiatrist, psychologist and an ear-nose-throat (ENT) specialist [6].

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 orthopaedics; 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.

Orthodontic management of cleft lip and palate

Orthodontic treatment may be performed at different stages of the patient's development, depending on the particular problem. Patients presenting with a cleft lip only or a soft palate cleft may never require orthodontic treatment. Treatment of a syndromic patient has to be done in consultation with different specialities. 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.

Neonatal maxillary orthopedics in an infant

Infant orthopedics/ presurgical orthopedic intervention is performed on the maxillary arch of a newborn before the surgical repair of the lip. It was introduced in the 1950s and may be used in patients with bilateral or unilateral cleft lip, alveolus, and palate. The rationale behind this method involves orthopedic realignment of the "collapsed" segments using various mechanisms ranging from simple passive appliances to more active orthopedic appliances to extraorally activated pin-retained appliances. Neonatal maxillary orthopedics aims at securing a good maxillary arch form in acceptable relationship with the mandible and to restore normal oral function.

Esenlik [7] summarized the arguments of the proponents of the use of infant orthopedics who state that this approach allows a more normalized pattern of deglutition, prevents twisting and dorsal position of the tongue in the cleft, improves arch form and position of the alar base, facilitates surgery, and improves outcome in general.

Specific types of infant orthopedics

1. Kernahan Rosenstein Procedure

The Rosenstein appliance is a passive plate that is inserted prior to lip surgery. Then, the lip is closed and the arch segments are molded until they are in butt alignment, after which the segments are stabilized by a small subperiosteal onlay rib graft. The plate is retained for 6–8 weeks postgraft, and the palate is usually closed at or before 12 months of age [8,9]. In complete bilateral cleft lip and palate, the appliance covers the lateral segments, holding them in position while an extraoral elastic band and later on the restored lip molds the premaxilla backwards.

2. Latham-Millard Pinned Appliance [10]

In the Millard-Latham method of neonatal maxillary orthopedics, forces are applied using a pinned palatal appliance to manipulate mechanically the maxillary segments into close approximation, followed by alveoloperiosteoplasty and lip adhesion. The treatment was based on the concept of facial growth hypothesis, and was ultimately used by Millard in treatment of complete unilateral and bilateral clefts. The aim of the procedure is 'to carry the interrupted embryonic process to normal completion' by maxillary alignment, stabilization of the alignment along with tunneling of the alveolar cleft with periosteum, and reconstruction of the nasal floor to support the alar base.

3. Zurich Approach

During early 1970s early maxillary orthopedic treatment was essential in Zurich, while surgical intervention was postponed in order to minimize subsequent growth disturbance, create optimal conditions for the maxillary segments to develop to their entire growth potential, maintain or improve arch form, and to control effects of surgical lip closure. The appliance used is a passive plate of compound soft and hard acrylic resin, and it is worn 24 hours a day for about 16 to 18months, till the soft palate is closed surgically. The hard palate is closed after 5 years of age. During the course of treatment the lip is closed at about 6months of age.

4. Nasoalveolar Molding

The benefits of PNAM (Presurgical Nasoalveolar Molding) [11-14]. are-

(a) Improved long term nasal esthetics,

(b) Reduced number of nasal surgical procedures,

(c) Reduced need for secondary bone grafts if gingivoperiosteoplasty (GPP) is applicable,

(d) Effective retraction of the protruded premaxilla, and lengthening of the deficient columella, along with producing a limited maxillary growth disturbance.

The first goal of PNAM in bilateral cases is to move the premaxillary segment posteriorly and medially, while preparing the lateral alveolar clefts to come in contact with the premaxilla. The posterior lateral palatal shelves are molded to the appropriate width to accept the premaxilla. The premaxilla is retracted and derotated as necessary using the molding plate in conjunction with external tape and elastics. In addition, another important point is the elongation of the columella.

In PNAM, nasal stents are added to the alveolar molding plate. The molding plate itself is mainly used to approximate the alveolar segments and retract the protruding premaxilla in Complete Bilateral Cleft Lip and Palate in order to reduce the nasal deformity to a degree that enables the start of more precise nasal molding with stents. Retention of the appliance[15] in the mouth is secured by tapes on the cheeks, which engage the intraoral plate with orthodontic rubber bands.

The appliance is adjusted every 1–2 weeks in 1 mm increments by removing hard acrylic resin, and adding soft acrylic resin. Once the maxillary alveolar segment gap is less than 6 mm, a nasal stent can be added to the appliance using acrylic resin placed on 0.036 inch-thick wire. The stent is positioned 3–4 mm into the nostril [16] just below the soft tissue triangle of the nose. The size and shape of the stent is adjusted by adding soft acrylic to help create a "tissue expander" effect on the length of the cleft-side columella, as well as to reposition the malpositioned lower lateral cartilage.

Presurgical orthopedic has remained controversial with different methodologies and approaches differing in efficacy and efficiency so the assessments on the effects of different combinations of cleft surgery and orthopedics methods are still needed.

Orthodontic orthopedic treatment during the primary dentition

In children with an alveolar cleft defect, a delay in the eruption of primary teeth in the vicinity of the alveolar defect may occur. The primary lateral incisor may be malformed or congenitally missing. Apart from this, the primary dentition develops as in non-cleft children. 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) may be associated with the crossbite. In some cases, removal of the occlusal interference by equilibration may alleviate the problem. In other cases, orthodontic tooth movement may be necessary. It was believed that orthodontic treatment in the primary dentition, although possible, is contraindicated [17]. Limited patient cooperation may preclude the use of removable appliances at this stage and the likelihood of prolonged treatment contraindicates this approach.

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. Further growth of the craniofacial complex often accentuates a previously mild skeletal discrepancy. 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. The purpose of treatment in mixed dentition stage should be to achieve a favourable occlusion with positive overjet and overbite which can be achieved by means of anterior orthopedic traction (protraction) [18].

Various authors have suggested growth modification at this stage [19,20].

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

1. Rygh and Tindlund [19] recommend utilization of a quad-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 [20]. 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

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.

But as the deficiency of tissue is an inevitable consequence of a cleft, not only may there be missing teeth but also the supporting alveolar bone at the cleft site is variable. In the past, rehabilitation of the maxillary dentition was dependent on the expertise of the prosthodontist to replace the missing teeth and alveolus in the cleft defect with a fixed or removable partial denture, or in the most severe cases, an overdenture. This challenge to restore the cleft site was resolved with the advent of secondary alveolar bone grafting in the 1970s [21,22]. This provided the orthodontist with one of the most important milestones in managing the cleft site, allowing for the orthodontic movement of teeth across the intact alveolus or the placement of implants for the prosthetic replacement of missing teeth in the cleft site. Elimination of the residual cleft provided a major advance in the contemporary management of the cleft maxilla and is an example of the outcome of a coordinated and problem-oriented approach to developing new strategies of treatment [17]. The decision to intervene orthodontically during the mixed dentition stage of development depends on a careful assessment of the problems present and the potential risks and benefits. Such treatment is not offered routinely to all cleft palate patients but it has been more common since the advent of the alveolar bone grafting procedure [18].

The timing the bone graft surgery is more dependent on dental development than on chronological age. Ideally, the permanent cuspid root should be approximately one-half to two-thirds formed at the time the graft is placed. This generally occurs between the ages of 8 and 11 years [23]. Rarely, is the graft placed prior to this time, although occasionally it may be placed at an earlier age to improve the prognosis of a lateral incisor. Once teeth have erupted into the cleft site, their periodontal support will not improve with a bone graft. Instead, the height of the crest alveolar bone resorbs to its original level. It is for this reason that it is essential to perform the graft prior to the eruption of permanent cuspid, or if the lateral incisor will erupt into the cleft, the graft should be placed earlier. Although results from primary bone grafting have indicated a significant adverse effect on maxillary development, performing a secondary bone graft at an age when maxillary growth is almost complete has resulted in no effect on subsequent facial development [24].

Sequencing of treatment: Secondary bone grafting has been divided into the categories of early (2-5 years of age), intermediate (6-15 years) and late (16 years to adult). Since the results of an Oslo study, in which 378 consecutive patients who had undergone alveolar bone grafting, were published [22]. contemporary opinion supports the intermediate period as the most appropriate time for grafting. This has the greatest benefit and least risk for interfering with midfacial and skeletodental growth and development. This sequencing of procedures, including presurgical orthodontics, requires interdisciplinary communication and cooperation, but the benefit is improved and more predictable patient care is achieved.

Orthodontic treatment alone or in conjunction with orthognathic surgery in the permanent dentition

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 [24]. 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. These dynamic properties of the face make the management of facial growth both challenging and rewarding [18,24]. A patient whose orthodontic treatment in the permanent dentition allowed camouflage can help in correcting mild skeletal discrepancy and prosthetic replacement of the missing teeth.

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, ie, 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 at this stage of development, often despite attempts to correct these problems at the mixed dentition phase of treatment.

3. Dental considerations

Dental problems faced by the orthodontist [25] include the following:

1. Absence of teeth adjacent to the cleft, most often the permanent lateral incisors
2. High incidence of missing teeth in other regions, especially missing bicuspids

3. Malformed teeth

4. Supernumerary teeth

5. Ectopically positioned teeth

6. Lack of osseous support for some teeth compromising the possibility to move these teeth to the desired positions

7. Accentuated curve of Spee in the maxilla, the mandible, or both

8. Collapsed arch form

9. Poor oral hygiene, caries, periodontal disease.

Orthodontic concepts and techniques used in the treatment of the permanent dentition of cleft palate patients are no different from those applied in the treatment of non cleft patients.

There are certain unique characteristics, however, that the orthodontist needs to be aware of in the management of the cleft palate patient.

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. On occasion, a slight maxillary hypoplasia may occur, presumably as a result of an extensively scarred palate. 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, sagittal deficiency of the maxilla, a thin upper lip, protrusive lower lip, and a deformed nasal tip with inadequate horizontal projection [26].

5. Treatment timing considerations

The timing and sequencing of orthodontic treatment require close communication with the team. Deciding to delay surgical orthodontic treatment until growth is stabilized may be sound judgment but not always in the patient's best interest, especially when psychosocial development is affected [27]. In some instances, skeletal surgery may be indicated before growth is completed, knowing that a further procedure may be necessary should the patient outgrow the correction. As a general rule, skeletal surgery, orthodontic intervention, and final prosthetic rehabilitation should be completed before soft tissue revision or rhinoplasty is instituted. The outcome of soft tissue surgical procedures when combined with surgical orthognathic movement of the maxilla and mandible is unpredictable.

Orthodontic intervention

A coordinated approach to the presurgical phase of orthodontic treatment will be indicated before the surgical procedure [26]. Approximately 12 to 18 months of orthodontics will usually be necessary to align the teeth, correct any midline discrepancy, coordinate arches, and localize space for prosthetic replacement of the teeth. The provision of space for surgical cuts between both the crown and the roots of adjacent teeth is also an important part of the presurgical preparations. Placement of full-sized arch wires provides a means of intermaxillary fixation at the time of surgery as rigid internal fixation is performed. The goal of the postsurgical phase of orthodontics is to detail the occlusion in coordination with any future prosthodontic treatment, and this should be completed within 4 to 6 months.

Treatment by orthodontics alone: In the absence of severe skeletal discrepancy and major esthetic concerns, orthodontic treatment alone may be sufficient [28].

Goals of such treatment include:

1. Tooth alignment

2. Establishment of a continuous maxillary arch with favorable arch form

3. Correction of anterior and/or posterior crossbites

4. Stability of occlusion in the presence of dental compensations

5. Favorable dentofacial esthetics

The problem of missing or peg lateral incisors is an area of concern common in the cleft patient. Should the lateral incisor space be closed orthodontically and the canines recontoured to resemble laterals or should the spaces be maintained or increased in anticipation of prosthetic replacement. The answer to these questions depends on the individual situation and should relate to the other components of the malocclusion.

Patients with cleft lip and palate usually show a tendency toward a Class III malocclusion because of maxillary deficiency both anteroposteriorly and vertically, coupled with mandibular overclosure (autorotation). Utilization of Class III elastics after initial levelling and alignment results in extrusion of the upper molars and a favourable downward and backward rotation of the mandible, Such correction results in an increased facial height, which may be esthetically preferable to the appearance of a retruded midface.

Anterior crossbite correction may occur as a result of using Class III intermaxillary forces. At an earlier stage of treatment however, a 2 X 4 edgewise appliance may be used with compression coil springs to advance the maxillary incisors labially and increase their faciolingual inclination.

Alternatively a torquing arch may be used for similar

results. Occasionally, a removable bite splint may be placed on the lower arch (before edgewise appliance placement) to facilitate the process of jumping the bite. Two to three weeks of bite splint use is often sufficient.

Patients that have a deep overbite in conjunction with the existing negative overjet (anterior crossbite) are more likely to be candidates for this method, and the use of bite splint seems to expedite the correction of the crossbite.

Correction of posterior crossbite is often difficult to achieve and more difficult to maintain in the long-term. It is likely that most posterior crossbite relapse occurs from resistance of the palatal scar tissue that only very slowly seems to be able to reorganize to a new expanded position, In addition, because the midpalatal suture is absent, no compensatory sutural bony deposition is expected to occur to help stabilize the expansion. Fixed palatal expansion devices such as W-arches and Quad-helices may be used in the maxillary arch (they may be soldered on the molar bands, or be inserted into palatal sheaths and be readily removable and adjustable by the orthodontist).

Orthodontics combined with orthognathic surgery: Alterations in the axial inclination of teeth may adequately camouflage the skeletal relationship. However, caution should be taken as the individual may outgrow the dental correction so that ultimately skeletal surgery may be necessary to obtain a normal occlusion.

If surgery is necessary, the presurgical phase of orthodontic treatment will require decompensation of the dentition so that the maxillary and mandibular teeth are placed in their correct relationship to the underlying skeletal bases. If orthodontic therapy has achieved the ideal relationship of the dentition to their skeletal bases, surgical correction of the skeletal discrepancy will result in normal class I occlusion and a normal skeletal relationship.

Postsurgical orthodontics usually extends for a period of approximately 4 to 6 months. Objectives of the post-surgical phase of orthodontic therapy include detailing of the occlusion and closure of any residual spaces while maintaining the transverse correction. Transpalatal arches or "piggy-back overlay 2" arches (0.036 stainless steel arches) inserted in the headgear tubes may serve well to maintain the transverse dimension of the maxilla or even provide expansion in the event that some postoperative relapse has occurred. Intermaxillary, through-the-bite, and/or vertical box elastics may be used as needed.

Retention

The importance of orthodontic retention for patients with facial cleft defects cannot be overemphasized. After removal of the fixed orthodontic appliances from the maxillary arch, a retainer should be placed immediately (ie, the same day). If the post orthodontic result includes one or more edentulous areas that need to be managed prosthodontically, a removable Hawley-type retainer with replacement teeth may he used. Patient cooperation is not usually a problem with the latter type of retainer because of the obvious esthetic benefit that the replacement teeth afford.

Temporary clear vacuum-formed retainers are not recommended because they may not provide adequate transverse control to prevent posterior crossbite relapse. When the periodontal tissues are healthy and the patient's age permits, the restorative dentist may proceed with the construction and placement of removable or fixed prostheses as needed. Fixed bridges are generally preferable whenever possible. Occasionally, preprosthetic augmentation of the edentulous area may be necessary for cosmetic purposes (ie, pontic esthetics) or before placement of implants. If the prosthetic rehabilitation involves the placement of an anterior fixed prosthesis only, it is recommended that a soldered lingual arch attached to plain molar bands be cemented for transverse retention. A conventional Hawley appliance with an acrylic palate is not a dependable form of retention, because it has been our observation that following lengthy treatments patients may no longer be motivated, and may not wear their removable retainer as instructed. The estimated length of retention with the fixed lingual arch is indefinite. Risk of caries is certainly a possibility, and it is therefore recommended that the appliance be removed at least once a year for inspection. Use of glass ionomer cement is also recommended. The lingual arch does not seem to interfere with the occlusion anteriorly or posteriorly in the majority of patients because a dental deep overbite is not very common in these patients. Nevertheless, a modified approach including a transpalatal arch, eliminating the central loop for comfort but placing extension "finger springs" to the premolar-canine area is recommended when the amount of vertical incisal overlap prevents the placement of a lingual arch in the anterior maxilla. If no dental spaces exist in the post orthodontic occlusion, a cemented lingual arch in the maxilla is recommended for long-term retention as described previously. Retention for the mandibular arch is no different than that for noncleft orthodontically treated patients.

Recent advances in the treatment procedures

1. Three dimensional printing of models

The models allow acquiring a first familiarization with the spatial features of the malformation and training of the surgical marking in a standard procedure [29].

Subsequent improvements in printed texture may lead to the possibility of performing mock operations on these casts. Some parents of children born with a cleft could find it easier to understand particular issues at stake, such as feeding, surgery, and speech therapy. Multiple copies may be delivered to a large audience during the same teaching session.

2. Computer assisted treatment planning

It is basically an advent from the conventional two dimensional methods to three dimensional simulation [30]. In facial asymmetry cases such as in cleft lip/palate patients, the additional information can dramatically improve planning accuracy and outcome. For example when an Orthognathic Surgery planning is carried out using 2D cephalometry, both occlusal and skeletal relationships have to be addressed [31]. However, if 2D cephalometry planning is transferred into a 3D simulation environment, previously undetected problems can show up as pitch, roll and yaw discrepancies, severe bony collisions in the ramus area, genioplasty malposition, and midline deviation. These issues have to be corrected respecting facial symmetry, harmony and soft tissue appearance, and the initial 2D treatment plan should be altered accordingly in agreement with the orthodontist. Although the "normal" face is almost always asymmetrical to some degree, asymmetry in its exaggerated form is the leading feature in CL/P patients, more so in the unilateral, but also in the bilateral and isolated cleft palate cases. Concomitant malocclusion and pathological dentition are ubiquitous in these cases, and facial asymmetry makes Orthognathic Surgery planning especially demanding because malocclusion, bony deficiencies and facial asymmetry all have to be addressed in the surgical plan to yield an optimal result.

Also Intraoperative findings can be predicted due to more detailed imaging of the facial bony structures in terms of position, orientation and form, and major intraoperative changes of the treatment plan due to lack of technical feasibility can be avoided.

3. Intraoral Distractors [32]

Internal devices do not cause psychological impact and allow for a longer support overtime as it offers the advantage of patient compliance and minimal discomfort. Internal Devices cause improvement in the skeleton profile and in the soft tissue, increases the nasolabial angle and also the inferior facial height [33].

Although Potential complications of the internal distractor are defective distraction vectors and insufficient distraction; disadvantages include less freedom of choice of direction and restricted jaw advancement,[33] but it seems to be a successful alternative technique for maxillary advancement in cleft lip and palate patients that require an advancement under 10 mm in correcting midface hypoplasia [32].

Conclusion

Cleft lip and palate involve a multitudinous factors required to be considered while treatment planning and execution. However, it is realistic to accept the fact that many treated patients will show some relapse and that ideal orthodontic results are often not possible to attain. However, the latter should not detract from the clinician's motivation and commitment to achieve as optimal a result as is possible.

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