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HOW WE CAN CREATE INTERDISCIPLINARY TREATMENT PLAN AND IT'S EXPANSION

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INTRODUCTION

In the past, the birth of a child with cleft lip alveolus and palate (CLAP) meant a lifetime of facial and dental deformity of a magnitude that was a devastating physical and psychosocial event. The cleft can be complete or partial and can be unilateral or bilateral. The child faces a gauntlet of medical and dental procedures that are a great physical and mental challenge and family sacrifice.The family finds themselves in a totally different child rearing experience that requires real dedication, and financial resources have to be managed to provide even the most basic amount ofcare involved.

The purpose of this paper is to acquaint the reader, briefly, with the management of the overall sequencing of care and the role of dentistry in this care. The team required for ideal care includes many types of healthcare professionals, and through this case presentation, we will focus primarily on the demands on the dental and craniofacial approaches required. The good news is, given today's knowledge and skills available to cleft patients, their final outcome can be surprisingly good. We will accomplish this through the presentation of a single patient from beginning to end. There is great variability of timing and treatment for each individual patient, and we will present one patient for illustration.

The early phases of treatment begin at birth, and the infant must reach a sufficient weight to undergo the first procedure: primary lip and palatal repair. This procedure is needed for the child to feed properly and, in addition, it is an important aesthetic step as well.

Figure 1. This 6-year-old boy was born with a unilateral cleft lip alveolus and palate with the characteristic nasal and lip deformities. He had already undergone lip and palatal repair as an infant, and presented with the nasal deformity frequently seen as a sequelae of the defect.

Figure 2. This results in either unilateral or bilateral crossbite. Interruption of the septal contribution to the anteroposterior development of the maxilla often results in in varying degrees of Class III malocclusion and crossbite.

Figure 3. The first phase of dental treatment included orthodontic treatment for posterior maxillary expansion and advancement of the premaxilla, which prepared the cleft site for placement of a bone graft and soft-tissue closure by his oral and maxillofacial surgeon.

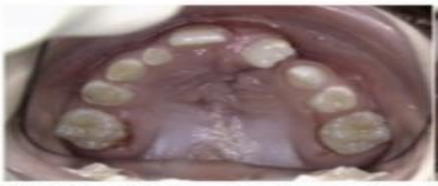

Figure 4. The occlusal view before his orthodontic and surgical stage of treatment.

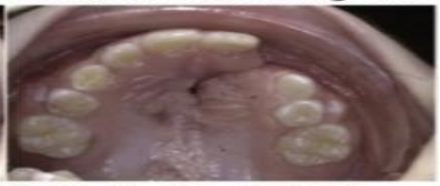

Figure 5. The occlusal view after the orthodontic and surgical stage of treatment. The palatal closure was not completely successful (and was to receive final repair later), but was obturated by his retainer that was worn full-time.

AGE 6 YEARS

Orthodontic Assessment, Expansion, and Bone Graft

This 6-year-old boy (Figure 1) was born with a unilateral CLAP with the characteristic nasal and lip deformities. Treatment in the initial phase for the cleft patient usually starts with posterior maxillary expansion, frequently required because of the compromise of normal transverse maxillary growth due to the absence of a midpalatal suture. This results in either unilateral or bilateral crossbite. In addition, interruption of the septal contribution to the anteroposterior development of the maxilla often results in diminished anteroposterior maxillary growth, resultingin varying degrees of Class III malocclusion (Figure 2); and the naso-septal defect diminishes nasal growth and projection as well as asymmetry. Expansion of the maxilla is necessary for occlusal improvement, but it is also desirable for other reasons. The purpose of the posterior expansion (usually initiated at ages 5 to 7 years) is to prepare for alveolar bone grafting of the alveolar defect. The purposes of alveolar bone graft placement are for:

Canine eruption. Bone should be in place as the emerging canine follicle to complete the normal eruption process into the alveolar ridge with adequate bone for reception of the tooth and its long-term maintenance.

Alveolar continuity. The alveolar bridge is needed for completion of the canine eruption as well as lip support and lateral nasal base support. A desirable element of orthodontic expansion is to over-expand, so that once the graft undergoes healing with resulting loss of volume, the alveolar ridge has adequate height and width. This can be highly variable.

Nasal base support. As in this case, the left side of the nose is flatter than the right and the nasal tip deviates to the left because of the lack of paranasal bony support as well as alveolar support (Figure 1).

Sources of grafting materials. Sources of bone grafting materials can include the patient's own bone harvested from the hip, or other sources such as "bank bone," or freeze-dried bone, from donors.

Figure 3 reflects the outcome of the orthodontic treatment of posterior maxillary expansion and advancement of the premaxilla, resulting in improved occlusal relations and successful placement of the bone graft by his oral and maxillofacial surgeon (Figures 4 and 5). At this stage, our patient was placed into retention using a maxillary Hawley retainer. Patient compliance is obviously critical for maintenance of this stage of treatment.

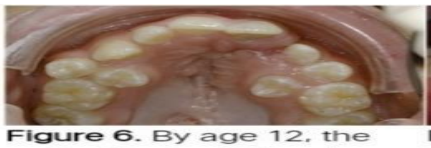

Figure 6. By age 12, the patient had additional growth and maxillary constriction resulting in severe crowding with palatally displaced maxillary premolars. These teeth were removed as part of this phase of orthodontic treatment designed to align the teeth for cosmetic reasons, understanding that the Class III growth pattern was eventually going to require combined orthodontic/surgical treatment when growth was complete.

Figure 7. The patient was kept in retention until 19 years of age. At that point, we combined a last phase of orthodontics with orthognathic surgery. This was done to advance the maxilla and chin in order to correct open bite and Class III malocclusion while improving his facial aesthetics. Final palatal closure was also performed during this procedure.

Figure 8. The final occlusal relationships, shown after the final phase of orthodontics and surgery.

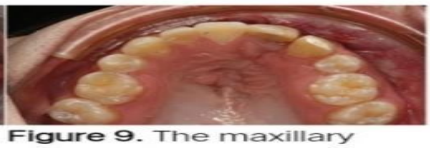

Figure 9. The maxillary arch at completion, reflecting palatal closure and arch form after bone grafting. The canine was substituted for the congenitally missing maxillary left lateral incisor.

Figure 10. After appliances were removed, the patient underwent final nasal and lip revision surgery with gratifying results. His smile was adequate; however, after a brief discussion, he was referred to his restorative dentist for porcelain veneers.

AGE 12 YEARS

Comprehensive Orthodontic Treatment

Comprehensive orthodontic treatment is required to achieve normalization of dental alignment for both functional and aesthetic reasons. In some cases, this is the final phase of orthodontic treatment, but in a percentage of cases, the skeletal growth pattern may be unfavorable and could result in a return of negative overjet. This is not because of "relapse," but instead is a result of insufficient maxillary growth in both the anteroposterior and vertical planes of space. If this occurs, even another stage of orthodontic treatment is required to coordinate with an orthognathic surgical dentoskeletal correction. This arises more frequently in the bilateral CLAP case than the unilateral CLAP patient. In this particular case, severe maxillary constriction resulted in severe crowding, so the palatally displaced maxillary premolars were removed. Of course, this would place the first molar against the canine, but given the amount of treatment and travel required of the family to get to this point in treatment, we judged it to be unreasonable to undertake the amount of treatmentrequired to incorporate of these teeth into the arch. The second phase of treatment was fairly successful, but growth was unfavorable with the patient having developed a Class III dental relationship.

Therefore, the patient was again placed into retention (Figure 6) to await maturation, and then to proceed to final skeletal correction with orthognathic surgery.

AGES 16 to 19 YEARS

Further Orthodontic Treatment and Orthognathic Surgery

In this instance, it is important to follow the patient carefully, documenting craniofacial skeletal changes through superimposition of cephalometric head films. The accepted "gold standard" for documenting cessation of growth is to obtain 3 serial head films demonstrating no discernible growth changes before committing to further treatment.

After following this growth for the appropriate amount of time and with appropriate documentation, that growth was finished (Figure 7). After orthodontic alignment for 9 months, themaxillary LeFort I surgery was performed for both maxillary advancement and expansion for occlusal correction and midfacial augmentation. This procedure was executed in a multisegmental fashion to further expand the posterior maxilla and to improve midline alignment. On the left side,the canine was placed into the lateral position to be "lateralized." The final occlusal relationships, after this final effort, are depicted in Figures 8 and 9.

Figure 11. Post-restorative occlusal view, showing change of tooth shapes (canine to lateral, premolar to canine, and molar to premolar).

Figure 12. Post-restorative retracted view demonstrating how the pressed lithium disilicate (e.max Press [Ivoclar Vivadent]) veneers were used to add incisal length, to alter tooth shape (ie, canine to a lateral), and to give the patient a lighter/brighter smile. Also note how the gingival scallop of tooth No. 9 was improved with minor recontouring.

Figure 13. The final successful functional and aesthetic outcome, reflecting an interdisciplinary effort that spanned during the 12 years of treatment.

Refinement of the Soft Tissue

Once the orthodontic and orthognathic treatments were completed, final nasal and lip refinement were performed by the patient's plastic surgeon to improve the short upper lip (also referred to as a "whistle deformity"), the nasal asymmetry, and the nasal form (Figure 10).

Addressing and Finishing Smile Aesthetics

In our final assessment, the smile was adequate by many standards. Although the patient and his parents were very satisfied with the orthodontic, orthognathic, and surgical results, they were still interested in exploring further options to improve the aesthetics and overall appearance of the smile. Consequently, the final phase of his interdisciplinary treatment involved a consultation with his restorative dentist.

The clinical examination revealed a very acceptable aesthetic result, considering the difficulty in treating cleft cases, but nevertheless it was determined that some improvements could most likely be achieved. When developing the restorative treatment plan, it was important to establish the goals of treatment and to identify specific smile design characteristics that could be improved while still maintaining a conservative approach to tooth preparation.

The main area of concern involved the maxillary left side, from tooth No. 9 to tooth No. 15. Due to the missing maxillary left lateral incisor (No. 10), there was a midline shift to the left. The gingival architecture of the left central incisor (No. 9) gave the tooth a triangular appearance with an exaggerated mesial axial inclination, creating the appearance of a slight midline cant. The left canine (tooth No. 11) had been orthodontically placed in the missing lateral incisor position, and the first premolar (tooth No. 12) had been moved into the canine position. Since the second premolar (tooth No. 13) had been previously extracted, the first and second molars (teeth Nos. 14 and 15) were actually in the first and second premolar positions. A smile evaluation concluded that, while incisal display and the smile arc were aesthetically acceptable,[1,2] they could be improved by slightly increasing incisal length. Additionally, the color of the teeth was a concern to the patient, and he desired a whiter, brighter smile.

The goals of treatment established from the information gathered during the consultation with the family, as well as the clinical exam, radiographs, photographs, etc., were to:

Improve the gingival scallop of tooth No. 9 to correct the triangular appearance, exaggerated mesial inclination, and slight midline cant "Lateralize" the canine (tooth No. 11) to simulate a lateral incisor (tooth No. 10) "Cuspidize" the first premolar (tooth No. 12) to simulate a canine (tooth No. 11) "Bicuspidize" the first and second molars (teeth Nos. 14 and 15) to simulate first and second premolars (teeth Nos. 12 and 13) "Bicuspidize" the right first molar (tooth No. 3) to simulate a second premolar (tooth No. 4) Increase incisal display and improve the smile arc by adding incisal length Whiten and brighten the smile.

Studies have recognized that the dental midline can deviate by as much as 3.0 mm to the left or right and go unnoticed, as long as it is perpendicular to the horizontal plane.3 Attempting to move the midline to the right (in order to place it in the center of the smile) was not deemed to be necessaryin this case and, therefore, was not included in the treatment plan.

Porcelain veneers were chosen as the restorative option because they are minimally invasive and require very little (if any) tooth preparation, while allowing the dentist to conservatively alter the size and shape of a tooth (i.e., changing a canine to a lateral incisor) and to convert the natural tooth color to lighter shade. The actual teeth prepared were the maxillary right first molar, first premolar, canine, lateral and central incisor, and the maxillary left central, canine, first premolar, and first and second molars. The desired result was to simulate the appearance of second premolar to second premolar (teeth Nos. 4 to 13); made possible by tooth preparation and by the anatomical shape ofthe porcelain veneers (Figure 11). The restorative material chosen to fabricate the definitive restorations was pressed lithium disilicate (IPS e.max Press [Ivoclar Vivadent]). The lab team used a cut-back and micro layering technique to provide optimal aesthetics for our patient.

The treatment goals, as outlined, were all accomplished. Patient satisfaction was achieved with some subtle changes that further enhanced an already acceptable aesthetic result (Figures 12 and 13).

CLOSING COMMENTS

The final facial appearance and smile reflects the result of careful interdisciplinary planning and treatment during a 12-year period. This case involved careful planning and coordinated teamwork among the orthodontist, oral and maxillofacial surgeon, craniofacial surgeon, facial plastic surgeon, and the general dentist. What is clearly a most satisfying outcome is a tribute to the family, for their dedication and patience, and to the skill of all the doctors involved.

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