Interdisciplinary treatment of an adult with a unilateral cleft lip and palate

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ABSTRACT

The management of cleft lip and palate (CLP) requires an interdisciplinary team providing comprehensive care. The present report presents an interdisciplinary approach for the care of a cleft patient. A 17-year-old male patient presented with a a chief complaint of "unpleasant appearance of my teeth" and a history of surgical repair of unilateral CLP on the left side. He presented with Class III molar relationships, Class II canine relationships, crossbite related to maxillary right first premolar and lateral incisor, severe maxillary and mandibular crowding, maxillary anterior tooth size deficiency, congenitally missing upper left lateral incisor. Patient was treated with a pre-adjusted edgewise appliance in conjunction with extraction of multiple teeth and distalization of the lower right first molar using a temporary anchorage device. In addition, alveolar bone graft and implant were placed to restore the missing upper left lateral incisor and a final esthetic work was performed for anterior teeth. The case was finished with Class I molar and canine relationships, minimal overjet and overbite. Total treatment time was about 31 months with satisfactory results. Post-treatment evaluation after 8 months showed stable results.

Key words: Alveolar bone graft, cleft lip and palate, implant, interdisciplinary treatment, miniscrew

INTRODUCTION

Cleft lip and palate (CLP) is the most common congenital deformity of the orofacial region and is present approximately in 1 out of 700 live birth.[1] Clefts are thought to be of multifactorial etiology due to genetic and environmental factors.[2] Different dental abnormalities are usually seen in cleft patients, including mid-face deficiency, collapsed dental arches, malformation of teeth, hypodontia and supernumerary teeth.[3-6] An integral part of the treatment involves alveolar bone grafting (ABG),[7] which is generally described as primary[8] or secondary[9] based on the timing of the procedure. Primary grafting was found to adversely affect the growth of the maxilla.[10] Secondary ABG plays an important role in the stability of the expanded arches and the future replacement of the missing teeth.[11] Recently, osseointegrated implants have been used after grafting the cleft area with satisfactory results.[12-16] In addition to ABG, orthodontic treatment represents another key factor for the success of the overall treatment of cleft patients, which usually includes expansion, comprehensive fixed orthodontic treatment, face mask therapy and possible pre-surgical orthodontics in cases requiring orthognathic surgery.[17,18]

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The nature and the extent of medical and dental problems among CLP patients, dictate the need toward inter-disciplinary approach where different medical and dental specialists are involved in the treatment.

This case report describes a comprehensive dental treatment of a young adult male patient with a history of surgical repair of unilateral CLP with, a severe upper and lower crowding and missing upper lateral incisor.

DIAGNOSIS AND TREATMENT PLANNING

A 17-year-old male patient presented with a chief complaint of "unpleasant appearance of teeth." He had a history of unilateral CLP on the left side. He had lip repair done when he was 2 months old, palatal closure at age of 10 months and lip revision when he was 6 year-old.

Patient had asymmetrical face, straight profile, competent lips and retruded upper lip with a scar on the left side. He had

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an average nasolabial angle, average lower anterior facial height with normal incisor show during smiling. The upper dental midline was shifted 2 mm to the left relative to the facial midline [Figure 1].

Intraoral examination showed generalized marginal gingivitis and the scar of the repaired cleft palate and alveolus in the upper left side with no signs of oronasal fistula, generalized decalcification of the dentition [Figure 2]. Cast analysis showed that all permanent teeth were present up to the second molars except the upper left lateral incisor, which was congenitally missing. The upper arch was constricted anteriorly with 7 mm crowding (counting for the missing lateral incisor) and "omega" shaped lower arch with 16 mm of crowding. Dentally, the patent had a full cusp Class III molar relationship on the right, a quarter cusp Class III molar relationship on the left, a half cusp Class II canine relationship on the right and a full cusp Class II canine relationship. Patient had 3 mm overjet, 50% overbite and crossbite of maxillary right lateral incisor and first premolar. The lower midline was shifted 2 mm to the right in relation to the upper midline. Patient had 5.5 mm Bolton discrepancy manifested as maxillary anterior tooth size deficiency [Figure 3].

Radiographic Examination

Patient had normal morphology of the condylar head and neck with no apparent bony pathologies and normal maxillary sinus borders. All permanent teeth were present except maxillary right third molar and left lateral incisor. There was a bony defect in the area of the missing maxillary left lateral incisor [Figures 4 and 5].

Cephalometrically, the patient had skeletal Class I relationship, average mandibular plane angle, normal lower facial height, retroclined and retruded upper and lower incisors and retruded upper lip relative to E-line [Figure 6 and Table 1].

Treatment Objectives

The main goals of the treatment were: To correct the arch forms, resolve crowding, achieve class I molar and canine relationships with adequate intercuspation and correction of midlines, and to augment the defected bone via alveolar bone graft to restore the missing upper left lateral incisor with a dental implant and finally to restore the esthetic appearance of anterior teeth.

TREATMENT PLAN

Treatment steps included the following: Extraction of maxillary

Figure 1: Pre-treatment extraoral photographs

Figure 2: Pre-treatment intraoral photographs

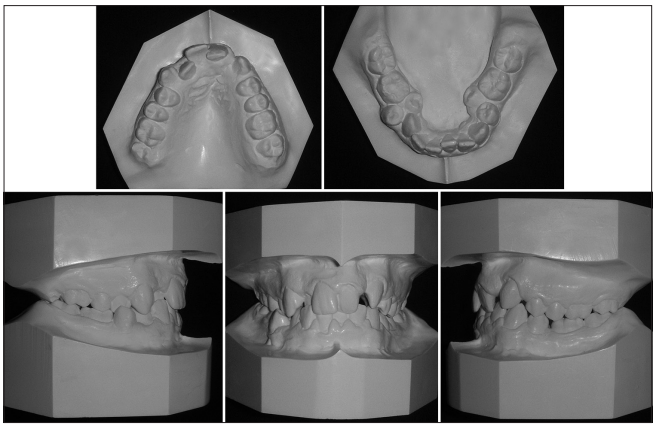


Figure 3: Pre-treatment study model

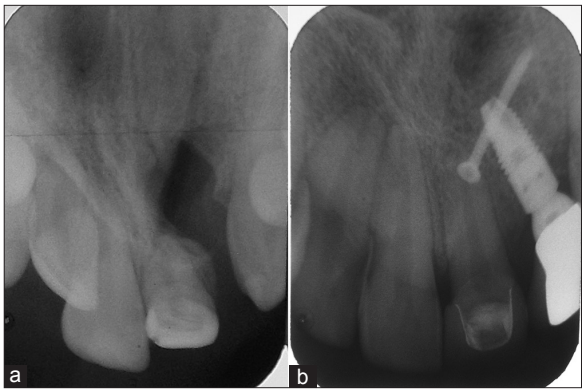


Figure 5: (a) Pre-treatment preiapical radiograph of alveolar defect, (b) Post-treatment preiapical radiograph of the implant

Table 1: Pre- and post-treatment cephalometric readings

Measurement	Norms	Pre-treatment	Post-treatment
SNA	82±2°	87°	87°
SNB	80±2°	84°	84°
ANB	2±2°	3°	3°
Wits mm	−1/0±2	0.5	0.5
SN-Pog	80±3°	83°	83°
NA-A Pog	0±5.1°	4°	4°
SN-MP	32±5.1°	34°	35°
ANS-Me/N-Me %	55±3	58	57
U1-L1	131±5°	170.5°	151°
U1-SN	104±2°	85°	98°
U1-PP	110±6°	83°	100°
U1-NA (mm)	22±5° (4±3)	3° (0.5)	20° (2)
L1-NB (mm)	25±6° (4±2)	9° (1)	12.5° (3)
L1-MP	93±6°	77°	83°
Upper lips to E-line mm	−4±2	−7	−6
Lower lips to E-line mm	−2±2	−1	0
Naso-labial angle	90-110°	96°	95°

SNA – Sella-Nasion-A point angle; SNB – Sella-Nasion-B point angle; ANB – A point-Nasion-B point angle; SN – Sella-Nasion; NA-A – Nasion-A point:A pont Pogonion angle; SN-MP – Sella-Nasion-Mandibular plane angle; ANS – Anterior Nasal spine; PP – Palatal plane; NA – Nasion-A point; NB – Nasion-B point; MP – Mandibular plane

first premolars, mandibular left second premolar and the right first premolars, the use of temporary anchorage device (TAD)

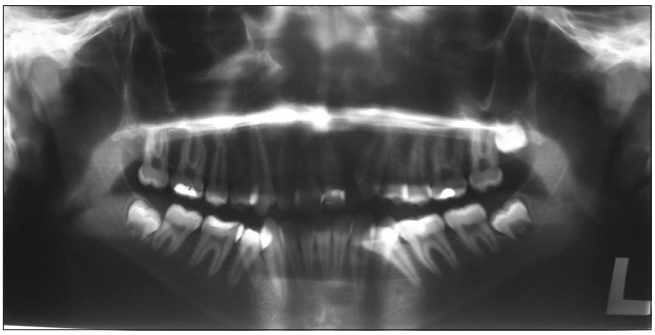


Figure 4: Pre-treatment panoramic radiograph

Figure 6: Pre-treatment lateral cephalometric radiograph

to distalize mandibular right first molar to resolve the crowding, leveling and alignment, creation of adequate space for ABG in cleft area and a dental implant supported crown to replace the missing maxillary left lateral incisor and composite buildup of upper incisors and canines to correct the anterior tooth size deficiency.

TREATMENT ALTERNATIVE

Extraction of the mandibular first molars can be considered as an alternative treatment option for the mandibular arch; to resolve crowding in addition to the use of TAD to retract displaced mandibular premolars and to protract mandibular second molars, which is time consuming.

TREATMENT PROGRESS

Diagnostic wax up was used to plan the final occlusion, the required spaces that needed to be created to correct the tooth size discrepancy [Figure 7a and b].

After extractions, the patient received a preadjusted edgewise appliance (0.022-inch, Roth prescription, Gemini Metal Brackets, 3M Unitek, Monrovia, CA, USA). Leveling and

alignment was accomplished with a series of NiTi and stainless steel (S.S.) archwires.

TAD (OrthoEasy-Pin system, Forestadent, Pforzheim, Germany) 1.7 mm in diameter and 6 mm in length with a slot head (0.022-inch), was placed in the mandibular arch between the lower right canine and lateral incisor. A 0.019 × 0.025-inch S.S. archwire was bonded to the miniscrews using flowable composite with the other end inserted in the molar auxiliary tube. Active open coil spring (3M Unitek, Monrovia, CA, USA) was inserted between the first molar and the minscrew. Crimpable hooks were used to activate the coil spring. Once adequate space was created, the miniscrew was removed [Figure 8a and b].

The space of the upper left lateral incisor was opened using open coil spring; ABG was performed using an iliac bone graft. The upper canines were retracted using elastomeric chains that were changed every 3 weeks. Molar and canine relationships were corrected; anterior spaces were redistributed to allow the restorative dentist correcting the tooth size discrepancy by a composite build-up of maxillary right canine, lateral incisor, central incisor, left canine and crowning of upper left central incisor. Patient was referred to the periodontist where a dental implant (3.0 mm × 11 mm; Astra Tech, Dentsply, Molndal, Sweden) was placed with simultaneous bone grafting and absorbable membrane (BioMend collagen membrane, Zimmer Dental) to correct the buccal bone concavity. After 4 months; the case was debonded, with upper and lower Essix retainers for retention. Composite restorations of maxillary anterior teeth were done and placement of the healing abutment in the area of missing maxillary left lateral incisor; the final crown was cemented after 4 week period to allow the soft-tissue healing.

Finally, upper and lower wraparound removable retainers and lower fixed retainer from canine to canine were used for retention.

RESULTS

The occlusal radiographs and conebeam CT orthogonal slicing at 22.2 mm depth showed the bone defect in the cleft side before the ABG, and the intact bone after [Figure 9a and b].

The post-treatment records showed that the treatment objectives were achieved [Figure 10a-d].

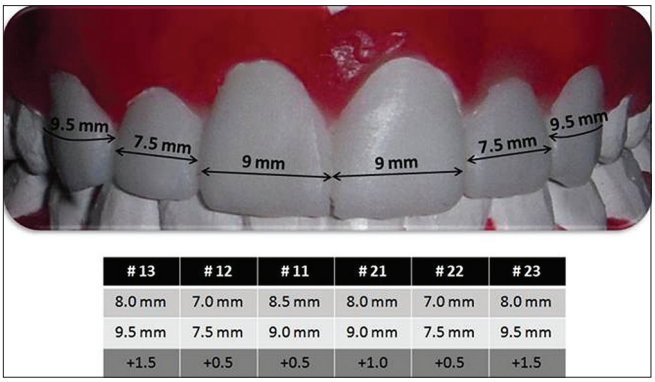
The case was finished with ideal overbite and overjet. The arches were well-coordinated. The maxillary and mandibular dental midlines were coincident with the facial midline. The Bolton discrepancy was corrected and the missing upper left lateral incisor was restored with a dental implant supported crown.

Final cephalometric radiograph showed insignificant changes except for the proclination of the upper and lower incisors [Table 1 and Figure 11].

Superimposition shows mesial movement of the upper first molar 4 mm, proclination of upper incisors, distal movement of lower first molar 2 mm and proclination of lower incisors [Figure 12].

DISCUSSION

CLP team which consists of different medical professionals is



# 13	# 12	# 11	# 21	# 22	# 23
8.0 mm	7.0 mm	8.5 mm	8.0 mm	7.0 mm	8.0 mm
9.5 mm	7.5 mm	9.0 mm	9.0 mm	7.5 mm	9.5 mm
+1.5	+0.5	+0.5	+1.0	+0.5	+1.5

Figure 7a: Diagnostic wax-up

Figure 7b: Diagnostic wax-up

Figure 8a: Distalization of the lower first molar using temporary anchorage device

Figure 8b: Distalization of the lower first molar using temporary anchorage device

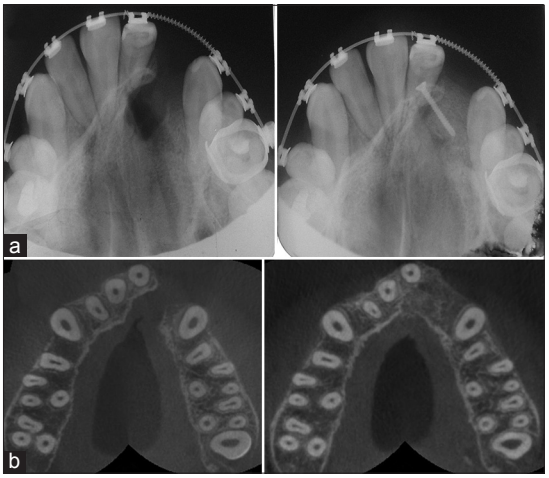


Figure 9: (a) Occlusal radiograph of alveolar defect before/after grafting. (b) Cone beam view before/after bone grafting

essential to achievetreatment outcome. In our case, the team involved in the treatment was from different dental specialties as all other medical problems were managed before the start of orthodontic treatment and the absence of fully integrated CLP team at the center which provides the treatment to the patient.

Maxillary deficiency in the transverse plane of space often accompanies the cleft palate, and maxillary arch expansion is almost always a part of the general treatment protocol in the management of the unilateral cleft palate.[17] In our patient, maxillary arch was not constricted and archwires were enough to correct the maxillary arch form.

ABG is considered as an integral part of the management of CLP since alveolar defects affect about 75%[19,20] of the patients. Bone grafting was performed after orthodontic space opening of the cleft site, and autogenous bone graft from the iliac crest bone was used with an open approach. Bone from the iliac crest is easy to access and large quantities of cancellous bone containing osteogenic cells that can support osteogenesis in the early days of healing can be harvested. Two studies concluded that harvesting bone from the iliac crest bone appears to be well tolerated by patients, has few complications, two teams can operate simultaneously which reduces operating time, gives aesthetically acceptable scars at the donor site and the hospital stay is a mean of three days.[21,22] Iliac crest remains the most popular donor site, being favored by 87% of European and 83% of North- American teams.[23,24] Although the patient had received autogenous bone graft to

Figure 10a: Post-treatment extraoral photographs

Figure 10b: Post-treatment intraoral photographs

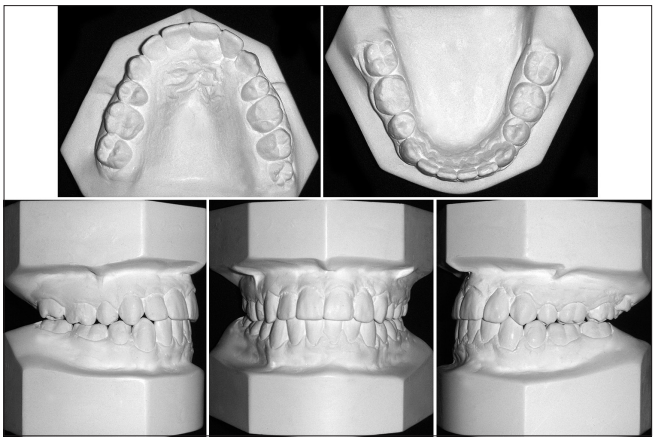


Figure 10c: Post-treatment study model

Figure 10d: Post-treatment panoramic radiograph

Figure 11: Post-treatment lateral cephalometric view

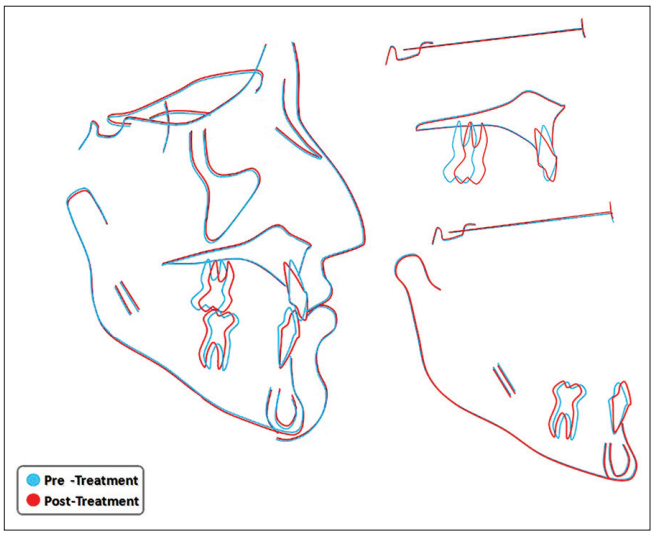


Figure 12: Cephalometric superimposition

Figure 13a: 8 months post-retention extraoral photograph

correct the alveolar defect; yet, at the time of implant placement bone graft was used again with absorbable membrane to correct the buccal bone defect.

The timing of implant placement after ABG remains controversial. Boyne[25] recommended a period between 3 and 4 months. Furthermore, Kearns *et al*.[26] recommended that dental implants should not be placed no more than 4-6 months after the graft. Although, Takahashi *et al*.[13] advised placement within 24 months after grafting. In this case, the dental implant was placed after 20 months and there was a need to correct the buccal bone defect with graft material, decreasing the period between grafting and implant placement might eliminate the need for a second grafting procedure. This practice of placing implants in grafted cleft area is not new and has been used successfully before.[12-16]

During the last two decades, miniscrews were introduced to orthodontic specialty and currently, miniscrews are successfully used on different orthodontic situations.[27-38] As the space gained through extracting the lower second premolar was not enough to relief the crowding (16 mm) and to correct

Figure 13b: 8 months post-retention intraoral photographs

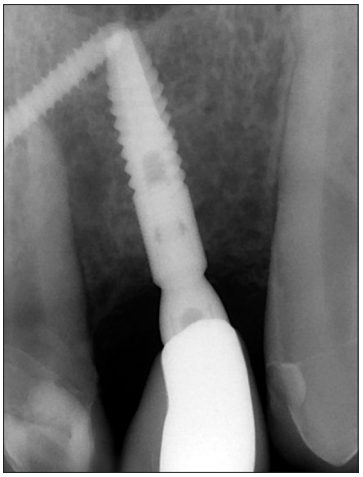


Figure 13c: Periapical radiograph of the dental implant after 8 months of retention

the severe asymmetry of mandibular arch where the right buccal segment is positioned more forward than the left one, TAD were used to control anchorage during distalization of the lower first molar and create adequate space to resolve the crowding. Absolute anchorage provided by the TADs allows the orthodontist to accurately plan tooth movement. The force on the first molar was both distal and extrusive because of the orientation of the wire extending from the miniscrew and the tooth. This could have been avoided by correcting the orientation of the wire; fortunately, the presence of deep bite helped to mask this effect.

After debonding; several upper Essix retainers were made to retain the results, after the composite build up and placing the healing abutment the old Essix retainer had to be changed with a new one; also, after cementing the final crown of the upper left lateral incisor, a new retainer was made before constructing the final wraparound retainers.

The upper left central incisor was under-torqued but this was corrected with the porcelain metal crown. The prosthetic restoration of the missing tooth involved two options; fixed partial denture (FPD) and dental implant. Implant was chosen over the FPD because of the higher success rate and not to adversely affect the adjacent teeth with preparation.

After 8 months of retention, the results have been found to be stable [Figure 13].

CONCLUSION

The interdisciplinary approach is the key factor to successfully treat cleft patients.

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