Case report:

Interdisciplinary case of multiple congenitally missing permanent teeth.

Alam MK[1], Purmal K[2], Low A[3], Pohchi A[4]

Abstract

Background: Patients presenting with congenitally missing teeth are relatively common and the aim of the dental team is to create a functional, healthy, and aesthetically acceptable dentition. The consequences of missing teeth include an abnormal occlusion or an altered facial appearance which may lead to psychological distress in some patients. ***Methods:*** The present case report describes a 23 year old patient with non-syndromic, congenitally missing permanent teeth (CMMPT). Clinical and radiographic examinations revealed agenesis of eight permanent teeth including the third molars. Following interdisciplinary treatment planning, the patient was treated with mechano therapy to correct a class III incisal relationship by space closure in the lower arch. In the upper arch, the right canine was substituted for a missing lateral incisor and space was opened for a prosthetic left lateral incisor (a mini implant). ***Results***: Active orthodontic treatment was completed in 19 months. The management of CMMPT requires an interdisciplinary approach to achieve improved occlusal function and aesthetics. ***Conclusion:*** A combined orthodontic-implant-prosthodontic treatment approach can achieve an improved functioning occlusion, and favorable aesthetics.

Keywords: congenitally missing; lateral incisor; dental implant, interdisciplinary care.

Bangladesh Journal of Medical Science Vol. 16 No. 03 July'17. Page : 467-473

Introduction: Hypodontia, defined as the absence of one or more teeth, arises from a disturbance early in the tooth formation process which affects initiation or proliferation of the tooth bud. Hypodontia is the most common dental developmental anomaly in humans. Itsprevalence has been shown to varyfrom 2.3% to 10.1%.[1] Excluding the third molars, the most frequently missing teeth are the maxillary lateral incisor, mandibular second premolar, mandibular central incisor, maxillary second premolar and mandibular lateral incisor.[2] The frequency of missing maxillary and mandibular second molars is extremely rare.[2] It is noted that missing teeth occur more frequently in females[3] and at present, the aetiology of this condition is not known.[3]

The congenital absence of one or more maxillary lateral incisors introduces an imbalance in arch length.[4] Treatment plans for patients with missing maxillary lateral incisors usuallyinvolve either space closure with canine substitution or space opening to facilitateprosthetic replacements. Placing dental implants to restore missing teeth is becoming more common in contemporary dental practice. However, there are challenges in using implants if available space is inadequate, if vertical or transverse dimension of the ridge is insufficient or if adjacent rootsconverge. These circumstances are more prevalent in cases involving congenitally missing lateral incisors in which fixed bridgetreatment alternatives entailthe unacceptable destruction of healthy tooth structure.

Treatment planning for CMMPT often presents difficulties as both aesthetic and functional aims need to be met. The absence of anterior teeth or the congenital absence of more than two teeth in the same quadrant may be an indication for orthodontic

1. Mohammad Khursheed Alam, Orthodontic Department, College of Dentistry, Al Jouf University.
2. Kathiravan Purmal, Oral surgery and Maxillofacial surgery Department, School of Dental Science, Universiti Sains Malaysia.
3. Amy Low, School of Dental Science, Universiti Sains Malaysia.
4. Abdullah Pohchi, Oral surgery and Maxillofacial surgery Department, School of Dental Science, Universiti Sains Malaysia.

Correspondence to: Dr. Mohammad Khursheed Alam**,** Associate Professor, Orthodontic Department, College of Dentistry, Al Jouf University. Sakaka, KSA. E-mail address:dralam@gmail.com, dr.mohammad.alam@judent.org

treatment[5]in an interdisciplinary approach.

Because of the high prevalence of hypodontia and its aesthetic, physiological, functional, and emotional complications (particularly during adolescence),[6] its early diagnosis is imperative to enable clinical teams to plan appropriate multidisciplinary treatment responses.[6]

Case Presentation

Diagnosis

A 23 year old female patient was diagnosed with a skeletal class I relationship with spaced maxillary and mandibular arches. A dental class III incisor relationship and a Class I molar relationship was evident along with a maxillary midline deviationof 2 mm to the right. The midline shift was caused by the CMMPT involving eight teeth (18, 12, 22, 27, 28, 38, 37 and 48). (Figures 1-3, Table 1).

The family pedigree consisted of 9 individuals from 2 generationsshowing an autosomal recessive inheritance (Figure 4). After discussing possible options, the patient agreed to undergo orthodontic-implant prosthodontic treatment in an effort to restore function and aesthetics.

Treatment objectives

The treatment aims were:

(1) To close the spaces in the mandibular arch and to correct the class III incisor relationship.

(2) To close the space in the region of the maxillary right lateral incisor with canine substitution and to regain space in the region of the maxillary left lateral incisor to correct the maxillary spacing, the dental midline and prepare for an implant supported restoration.

(3) To achieve an acceptable occlusion,and

(4) To restore aesthetics.

Orthodontic treatment

The orthodontic fixed appliance was bonded and banded on the upper and lower teeth using the MBT 0.022 inch Preadjusted Edgewise Appliance. The maxillary and mandibular teeth were levelled with continuous archwires, starting with 0.012-inch nickel-titanium and progressing to a 0.017 × 0.025-inch stainless steel wire. Spaces in the lower arch closed completely resulting in a positive overjet. Space in the right maxillary arch was closed with the aim of substituting the canine for the missing lateral incisor. This enabled the correction of the upper midline and opened up space for a maxillary left lateral incisor.

Cone beam computed tomography (CBCT) and preliminary impressions were taken for diagnostic evaluation. The edentulous space was measured as 7 mm from the distal of tooth 21 to the mesial of 23. Bone density was measured in the CBCT scan prior to implant insertion (Figure 5, 6 and Table 2).

Mini Implant insertion

After the administration of local anesthetic, the proposed site was marked with a round bur, withoutflap reflection and a Lance drill was used to create a holeto the appropriate depth. This was followed bya 2 mm diameter twist drill to a depth of 15mm (full depth). The speed for both drills was set to 800 rpm with maximum torque. Copious irrigation of normal saline was used. The countersink bur of 2.5mm diameter was used to shape the ridge crest to permit the correct position of the cortical block. Via a hand piece connector the implant was attached and placed in the osteotomy site. Using a hand piece speed of 25 rpm applying torque of 35 N cm. A one piece reduced diameter Intermezzo mini implant (MEGAGEN, Korea) was used (Figure 7). The paper is about the management of hypodontia and not the procedural steps in implant placement. For temporisation, a comfort cap was placed on the abutment (Figure 7). Composite resin was placed on the comfort cap and modelled to the shape of a lateral incisor. This restoration was shaped to be free of occlusal interferences in centric, and eccentric mandibular movements. A periapical radiograph was taken to ensure that the implant was positioned a minimum of 1.5mm from the roots of adjacent teeth. The implant was clinically and radiographically evaluated for osseointegration and absence of soft-tissue complications. After a period of 3 months to ensure osteointegration, the temporary crown was replaced with a metal fused to ceramic crown (Figure 8). A proper emergence profile had been developed by the provisional restoration.

The orthodontic therapy lasted for 12 months and was stabilised and finished with bonded rigid wires. The orthodontic appliances were removed and essix form of retainer was provided in both arches. Active orthodontic treatment and the implant-prosthesis was completed in 19 months. Patient cooperation in the maintenance of oral hygiene was excellent, and the examination after active orthodontic treatment revealed that the clinical status and radiographic results observed at the completion of the treatment were excellent (Figures 9-11,Table 1). The patient was completely satisfied with the results of the orthodontic-implant-prosthodontic treatment. The patient is under regular follow-up.

Discussion

The treatment of multiple congenitally missing

permanent teeth is complex and challenging. It requires careful treatment planning, communication with the patient, and coordinated interdisciplinary efforts of the orthodontist, oral maxillofacial surgeon, periodontist, prosthodontist and restorative dentist.

Orthodontists are often facing the dilemma in a class III patient to close or not to close spacing in the maxillary arch? Since maxillary lateral incisors are often congenitally missing,[2] replacement of these teeth raises several important treatment planning concerns. An interdisciplinary treatment approach in patients with multiple missing teeth is necessary to provide the best treatment. While there are many options, ranging from orthodontic space closure to restorative or implant based solutions, all have advantages and disadvantages. The two accepted treatment options for a genic maxillary lateral incisors are either space closure with canine substitution or space opening with prosthetic replacement (single-tooth implants, and tooth-supported restorations).[7,8]

There are two types of restorative treatment alternatives: a single-tooth implant and a tooth-supported restoration.[9] Among tooth supported restorations there are a resin bonded fixed partial denture (FPD), a cantilevered FPD, and a conventional full-coverage FPD.[9] It is important for the orthodontist to know the final restorative treatment plan to position the adjacent teeth properly and facilitate the final restoration. The success of these restorative options depends on its uses in its correct situation. The aim of choice should be the least invasive that satisfies the expected esthetic and functional outcomes. Hence, the most common treatment alternative is the single-tooth implant. The main advantage of this type of restoration is conservation of tooth structure. It leaves the adjacent teeth intact. The orthodontist's role is to provide the sufficient coronal and apical spacing which is important for imminent restorative dentistry and implant placement.[9]The advent of osseointegrated implants has increased the popularity of prostheticspace-opening.[9]At present, the recommended procedures for prosthetic replacement are a single-tooth implant or a fibre-reinforced resin bonded bridge with a ceramic overlay. It is critical during orthodontic treatment to create the correct amount of space and ideal angulation of neighbouring teeth and to leave the alveolar ridge in anideal statefor implant placement.[10] If anterior space is closed, the orthodontist must prevent any detrimental alterations to the occlusion or facial profile.

Adjacent teeth may needto be repositioned orthodontically to create adequate space for an implant. Implants do not require modification of the existing natural dentition and are therefore the most conservative of the prosthodontic options for replacing missing teeth.[11-13] For implant success, bone density in the anterior maxillary region should be + 500 to + 800 (<850) in Hounsfield units (HU).[14] The presented case demonstrated that bone density inthe region of interest was within the optimal range after orthodontic movement to create adequate space. Implants can also maintain the alveolar ridge height, enhance occlusal function and provide optimal aesthetics.[11,15] Long-term studies have shown that the success rate of the osseo-integrated implants is almost 100%.[16-18]

A one piece reduced diameter Intermezzo mini implant was used in the present study. The diameter selected was 2.5mm and length 15mm. The implant has a resorbable blast media (RBM) surface which provided fast osteointegration and supported stability of the final restoration. This surface treatment was designed to roughen the implant surface without leaving the residual embedded blast particles in the treated substrate. To achieve the desired roughening, the implant is blasted with suitable particles of hydroxyapatite and then subsequently dissolved from the surface with a defined passivation treatment.[19] The result was a rougher implant surfacecompared with a traditional acid-etch treatment surface which provided a greater surface area for osteointegration, improved retention characteristics, increased biological fixation and the maximisation of implant to bone contact.[19]The one-piece implant has been considered more suitable for the reduced diameter implants. Moreover, the incorporation of anabutment as part of the implant does not createa gap between the implant body and abutment connection. This avoids bone loss over time.[20]

Adequate space must be ensured between the crowns and roots of abutment teeth for the placement of a single-tooth implant. The quantity and quality of alveolar bone must be assessed before implant placement is considered.[21] If there is insufficient alveolar bone, ridge augmentation may be necessary.[21] It is essential to ensure that there is adequate space for the implant between the adjacent roots.[9]

Placing dental implants to restore missing teethis becoming more common in contemporary dental practice. However there are some challenges in using implants if there is inadequate interdental space, reduced vertical or transverse dimension of the ridge or converging roots. This is more evident

in congenitally missing lateral incisor. Other options like fixed bridge entails destruction of virgin tooth adjacent to the edentulous area.

The primary objective of orthodontic treatment in class III incisor relationship along with congenitally missing lateral incisor is to minimize and consolidate edentulous spaces. Orthodontist need to concern about the facial profile appearance too. Complete space closure may worsen class III incisor relationship and pleasant face profile. Closing the space orthodontically with the maxillary canine substituting for the missing lateral incisor and camouflaging the canine to copycat the appearance of a lateral incisor is favorable. The difficulty with the canine substitution method is achieving an acceptable esthetic outcome, because of the inherent size, shape, and shade differences between the maxillary canine and lateral incisors. In our case no modification of upper right canine was done.[23] As the patient was extremely happy with the outcome, and the appliances were removed. This article presents orthodontic-implant-prosthodontic approach that was applied for restoration of function and appearance. Advanced orthodontic-implant-prosthodontic treatment may result not only in the restoration of function to the congenitally involved missing dentition but also a marked improvement in aesthetics. This article also demonstrates the value of a multidisciplinary approach in therapeutic treatment and restoration of a congenitally involved missing dentition to achieve long-lasting functional and esthetic results.

Conclusion

This article demonstrates the value of interdisciplinary approach in therapeutic treatment and restoration of CMMPT to achieve long-lasting functional and esthetic results.

Consent

Written informed consent was obtained from the patient for publication of this report and any accompanying images.

Competing interests: None Declared.

Acknowledgments: None Declared.

Table 1. Pre- and Post-treatment cephalometric analysis.

Variable	Pretreatment (^{0})	Posttreatment(^{0})
SNA	88	88
SNB	85	85
ANB	3	3
Maxillary incisor to maxillary plane angle	104.5	104.5
Mandibular incisor to mandibular plane angle	86	82
Interincisal angle	138	142
Maxillary-mandibular angle	26	29.5
Facial Proportion	62 %	62.1 %

Table 2. Mean bone density values around the existing alveolar bone in Hounsfield Unit (HU)

	Mesial	Distal	Buccal	Palatal
Apical	545	525	530	605
Middle	528	514	513	523
Coronal	512	583	501	588

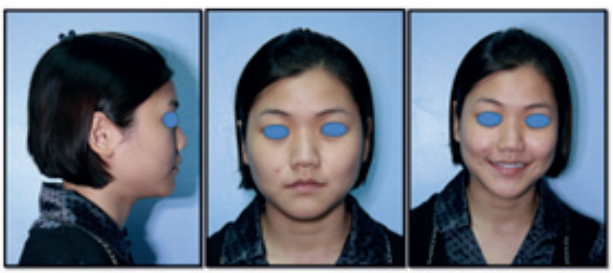

Figure 1. Pre-treatment facial photograph.

Figure 2. Pre-treatment intraoral photograph

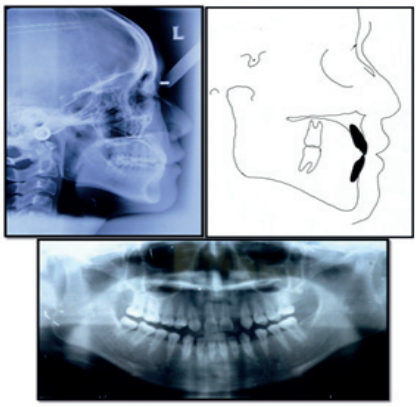

Figure 3. Pre Orthodontic treatment lateral cephalogram, lateral Cephalogram tracing and orthopantomogram (OPG).

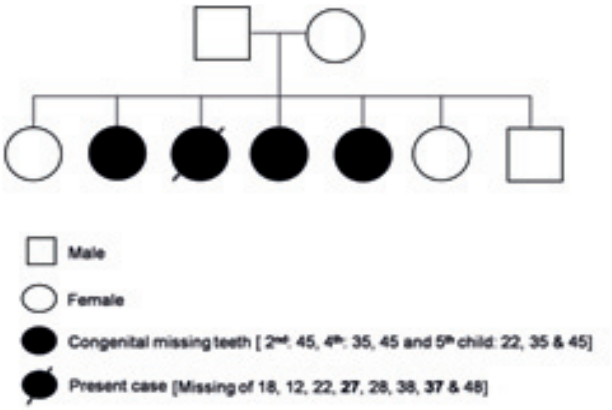

Figure 4. The pedigree of the present comprised of 9 individuals from 2 generations.

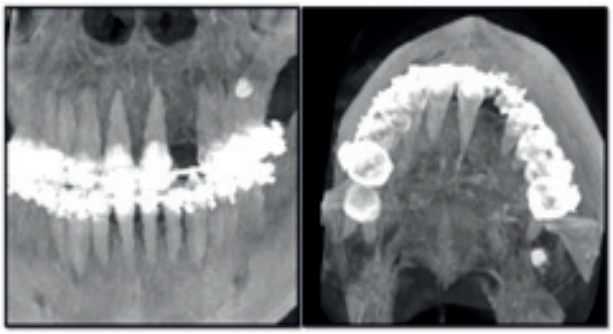

Figure 5. Cone beam computed tomography (CBCT) images prior implant placement.

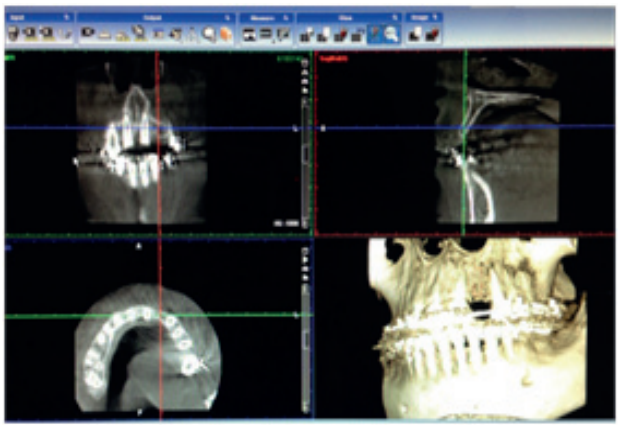

Figure 6. Bone density measurement by CBCT.

Figure 7. Step by step procedures of implant insertion followed by temporary crown.

Figure 8.Implant retained permanent crown restoration.

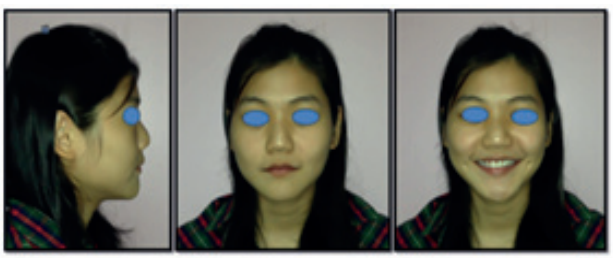

Figure 9. Post treatment facial photograph.

Figure 10. Post treatment intraoral photograph.

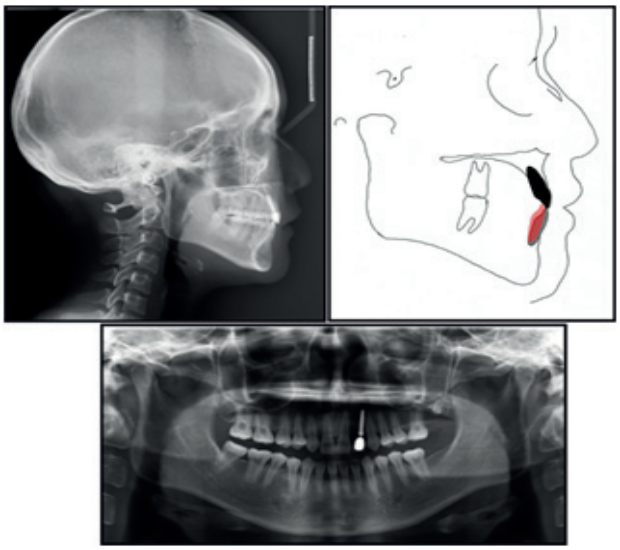

Figure 11. Post Orthodontic treatment lateral cephalogram, lateral Cephalogram tracing and orthopantomogram (OPG).

References

1. Silverman NE, Ackerman JL. Oligodontia: a study of its prevalence and variation in 4032 children: ASDC J Dent Child 1979;46:470-477.
2. Amini F, Rakhshan V, Babaei P. Prevalence and pattern of hypodontia in the permanent dentition of 3374 Iranian orthodontic patients. Dent Res J 2012;9:245-50.
3. Stamatiou J, Symons AL. Agenesis of the permanent lateral incisor: distribution, number and sites. J Clin Pediatr Dent 1991;15:244-246.
4. Jae HP, Dong AK, Tai K. Congenital missing maxillary lateral incisors: Treatment. Dent Today 2011;30(5):81-86.
5. Polder BJ, Van't Hof MA, Van der Linden FP, Kuijpers-Jagtman AM. A meta-analysis of the prevalence of dental agenesis of permanent teeth. Community Dent Oral Epidemiol 2004;32:217-26. https://doi.org/10.1111/j.1600-0528.2004.00158.x
6. Nunn JH, Carter NE, Gillgrass TJ, Hobson RS, Jepson NJ, Meechan JG, et al. The interdisciplinary management of hypodontia: Background and role of paediatric dentistry. Br Dent J2003;194:245-51. https://doi.org/10.1038/sj.bdj.4809925
7. Kokich VO Jr. Early management of congenitally missing teeth. SeminOrthod 2005; 11(3):146-151. https://doi.org/10.1053/j.sodo.2005.04.008
8. Sabri R. Management of missing maxillary lateral incisors. J Am Dent Assoc 1999;130 (1):80-84. https://doi.org/10.14219/jada.archive.1999.0032
9. Kokich VO Jr, Kinzer GA, Janakievski J. Congenitally missing maxillary lateral incisors: restorative replacement. Counterpoint. Am J Orthod Dentofacial Orthop 2011;139(4):435-445. https://doi.org/10.1016/j.ajodo.2011.02.004
10. Kokich VG and Spear FM. Guidelines for managing the orthodontic-restorative patient. Semin Orthod1997;3(1):3-20. https://doi.org/10.1016/S1073-8746(97)80036-9
11. Kokich VG, Kokich VO. Congenitally missing mandibular second premolars: Clinical options. Am J Orthod Dentofacial Orthop 2006;130:437-444. https://doi.org/10.1016/j.ajodo.2006.05.025
12. Rupp RP, Dillehay JK, Squire CF. Orthodontics, prosthodontics, and periodontics: a multidisciplinary approach. Gen Dent 1997; 45(3):286-9.
13. Balshi TJ. Osseointegration and orthodontics: modern treatment for congenitally missing teeth. Int J Periodontics Restorative Dent 1993; 13(6):495-5.
14. Cronin RJ, Cagna DR. An update on fixed prosthodontics. J Am Dent Assoc 1997; 128(4):425- 36. https://doi.org/10.14219/jada.archive.1997.0226
15. Norton MR, Gamble C. Bone classification: an objective scale of bone density using the computerized tomography scan. Clin Oral Implants Res 2001;12(1):79-84. https://doi.org/10.1034/j.1600-0501.2001.012001079.x
16. Millar BJ, Taylor NG. Lateral thinking: the management of missing upper lateral incisors. Br Dent J 1995;79(3):99-106. https://doi.org/10.1038/sj.bdj.4808848
17. Belser UC, Schmid B, Higginbottom F, Buser D. Outcome analysis of implant restorations located in the anterior maxilla: a review of the recent literature. Int J Oral Maxillofac Implants2004;19(Suppl):30–42.
18. Zarone F, Sorrentino R, Vaccaro F, Russo S. Prosthetic treatment of maxillary lateral incisor agenesis with osseointegrated implants: a 24-39-month prospective clinical study. Clin Oral Implants Res2006;17(1):94–101. https://doi.org/10.1111/j.1600-0501.2005.01188.x
19. Henry PJ, Laney WR, Jemt T, Harris D, Krogh PH, Polizzi G, et al. Osseointegrated implants for single-tooth replacement: a prospective 5-year multicenter study. Int J Oral Maxillofac Implants1996;11(4):450–5.
20. Gonshor A, Goreia G, Satirakis E. A prospective, multicenter, 4-year study of the ACE Surgical resorbable blast media implant.J Oral Implant. 2003;29(4):174-80. https://doi.org/10.1563/1548-1336(2003)029<0174:APMSOT>2.3.CO;2
21. Wallace SS. Significance of the 'biologic width' with respect to root-form implants. Dent Implantol Update 1994;5:25-29.
22. Shroff B, Siegel SM, Feldman S, Siegel SC. Combined orthodontic and prosthetic therapy. Special considerations. Dent Clin North Am 1996; 40(4):911-43.
23. Zachrisson BU. Improving the esthetic outcome of canine substitution for missing maxillary lateral incisors. World J Orthod 2007; 8:72-9.