Replacement of Missing Maxillary Central Incisor with an Osseointegrated Implant-supported Prosthesis from an Orthodontic Perspective: A Multidisciplinary Approach

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ABSTRACT
Over the last few decades, dentistry has brought in many new modalities of treatment for replacement of missing teeth. Treatment modalities for patients with missing teeth usually involve either space reopening and replacement or closure of the resultant space. The traditional option of using three-unit bridges for replacement of a single tooth involves loss of healthy tooth structure of two adjacent teeth and is a very aggressive treatment option. Osseointegrated implants have proven successful conservative alternatives to bridges for replacement of missing teeth without any loss of tooth structure. Optimal results can be achieved when an implant is placed between two natural teeth with healthy periodontium. This case report presents the management of a patient with missing maxillary right central incisor for whom the treatment of choice was placement of an osseointegrated implant supported prosthesis after regaining space to achieve a desirable esthetic result.

Keywords: Implant, Missing teeth, Space reopening.


INTRODUCTION
Missing incisors are an esthetic problem and ‘Beauty lies in the eye of the beholder’; therefore treatment planning always poses a challenge to the clinician. The teeth may be missing either congenitally or due to decay or trauma, as was in the present case. Treatment planning for patients with missing teeth usually involves either space reopening or space closure.1,2 Each of these approaches has its own advantages and disadvantages.

The traditional option of using three-unit bridges for replacement of a single tooth involves removal of healthy tooth structure of two adjacent teeth and is a very aggressive treatment option. The required amount of space needed for replacing missing incisors is determined by two factors. The first is the mesiodistal width of the adjacent anterior teeth and the second factor is occlusion.3 The prosthodontic options after orthodontically creating space for replacing missing teeth are traditional fixed partial dentures, resin-bonded fixed partial dentures, removable partial dentures and osseointegrated implant-supported prostheses. Osseointegrated implants are currently the most biologically conservative option for replacing missing teeth.

The primary issues associated with closing resultant space due to tooth loss include potential difficulty in complete space closure, minor reopening of space after treatment and potential esthetic concerns associated with the size, shape and color of the teeth.

The problems associated with opening space for tooth replacement include difficulty in gaining sufficient space to accommodate an implant supported tooth, retaining the space and adjacent tooth positions for several years until the patient is mature enough to allow implant placement, and the costs associated with replacing missing teeth.

When implants are part of the treatment plan, the amount of space that needs to be opened depends on the size of the implant. The minimum interdental space needed for a 4 mm implant that provides optimal gingival health and sufficient bony support is around 7 mm. Creating adequate space for the corresponding implant size should not be the only criteria; bone thickness in the area of the missing tooth should also be evaluated. This case report discusses the management of a missing maxillary central incisor with regaining of lost space and restoration afterwards with an osseointegrated implant and a ceramic crown.

CASE REPORT
A 22-year-old male patient with no relevant medical history reported to the clinic with the chief complaint of a missing central incisor which was lost due to trauma a year back. As his expectations of cosmetic results were
high, he was explained the various treatment options along with interdisciplinary interaction in order to replace the missing maxillary central incisor. He refused to have his teeth prepared for a three-unit bridge, or wear a removable partial denture and instead opted for an implant-supported prosthesis. Space was insufficient for the placement of implant-supported prosthesis due to migration of adjacent teeth, so it was decided to orthodontically create space.

Diagnostic records taken included a detailed history, clinical examination, study model, radiographs (orthopantomogram and a lateral cephalogram) as well as standard extraoral and intraoral photographs.

Extraoral examination revealed a class I skeletal relation with an orthognathic profile (Figs 1 and 2). Intraorally, the patient had Angle’s class I molar and class I canine relation on both sides and normal overjet and overbite (Figs 3 and 4). The patient’s dental health was good except for the right upper central incisor which was lost due to trauma. There was chipping of the incisal edge of the left upper central incisor as well as slight extrusion of the right upper lateral incisor. Since the right upper lateral incisor was extruded slightly, a vitality test was done for the tooth which gave positive results. There was only 4.5 mm space present for replacement of the missing right upper central incisor, therefore therapeutic intervention was warranted to create adequate space for replacement of the missing incisor.

Panoramic radiograph examination confirmed the presence of all the permanent teeth except for the maxillary right upper central incisor (Fig. 5). Cephalometric evaluation revealed normal inclination of the upper and lower incisors with respect to their skeletal bases (Fig. 6).

**TREATMENT OBJECTIVES**

- Creation of adequate space for right upper central incisor replacement by orthodontic intervention.
- Achieve root parallelism between the roots of teeth adjacent to the missing tooth.
- Maintain Class I molar and canine relation and proper occlusion.
- Placement of implant prior to debonding the appliance.
- Maintain the implant for at least 3 months with the appliance in place.
- Debonding and placement of the crown over the implant.

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**Fig. 1:** Pretreatment extraoral frontal photograph  
**Fig. 2:** Pretreatment extraoral profile photograph  
**Fig. 3:** Pretreatment intraoral frontal photograph  
**Fig. 4:** Pretreatment intraoral right lateral photograph
As there was no anteroposterior arch discrepancy, the focus of treatment was to create adequate space for the missing tooth to replace it. Orthodontic treatment with preadjusted edgewise appliance was advised for the patient. The orthodontic appliance used in the present case was American Orthodontics Low Profile McLaughlin Bennett Trevisi bracket with 0.022” slot.

TREATMENT PROGRESS

American Orthodontics Low Profile McLaughlin Bennett Trevisi brackets with 0.022” slot were bonded to all the teeth in the upper and lower dental arches. The brackets were positioned vertically according to the MBT recommendations.4-6

Since the patient had no upper or lower crowding, the initial alignment was performed with 0.014” Copper NiTi (Ormco, Glendora, CA, USA) arch wires and subsequently 0.016” × 0.022” Copper NiTi (Armco, Glendora, CA, USA) arch wires were placed in the bracket slots. Leveling was achieved with 0.017” × 0.025” Copper NiTi wires. Thereafter 0.017” × 0.025” stainless steel (SS) wires were inserted along with an open coil spring to create adequate space for replacement of the missing incisor (Fig. 7). After adequate space was created, patient was scheduled for placement of the osseointegrated implant. A regular diameter 4 × 13 mm dental implant was placed (Figs 8 and 9). After 4 months, a repeat X-ray confirmed stability of the implant and the appliance was debonded (Figs 10 and 11). Initially, an Essix retainer was given to maintain the space prior to placement of the pontic. Before the final crown placement, the patient was slotted for restoration of the chipped maxillary left central incisor as well as gingival contouring of the extruded maxillary right lateral incisor which was intruded orthodontically. Within 10 days of debonding, the permanent crown was placed over the implant.

At this stage, a Hawley’s retainer was placed in the upper and lower dental arches. The Hawley’s retainer was prescribed for a period of 6 months full time and a further 6 months night time wear.

TREATMENT RESULTS

The final result when analyzed clinically and radiographically showed that the treatment attained all functional and esthetic goals (Figs 12 to 17). This enhanced his facial esthetics which was his major concern at the start of treatment.

DISCUSSION

Missing teeth can be replaced with dentures, bridges (adhesive or conventional), or implants, which are the currently best treatment option.7 Replacement of teeth with implants involves an interdisciplinary team approach involving the oral surgeon, periodontist and prosthodontist. Optimal results can be achieved when an implant is placed between two natural teeth with healthy periodontium.8 The main advantage of implant-supported crowns is that it leaves the adjacent teeth intact in contrast to a fixed bridge where tooth material of the two adjacent teeth have to be reduced. This is particularly important when considering replacement of missing teeth in young patients. Orthodontics is an important
adjunct in the replacement of missing teeth for creation of space as well as correct the angulation of the roots of adjacent teeth.

The orthodontic goal for this patient was to create 9 mm space which was the width of the adjacent central incisor. Around 1.5 to 2 mm space is advised between the head of the implant and the crowns of the adjacent teeth.

After placement of the implant in the bone, we can either temporarily restore the crown or go in for a permanent restoration after waiting for a period of 4 months as was done for this patient. The main purpose of placing a provisional restoration is to guide the soft tissue to its final position. Thus, both the esthetic and functional outcome could be improved.
Implants should ideally be placed only after vertical alveolar growth has ceased. In females, growth may be completed by age 18; but males may not complete growth until their early twenties. Placing an implant before completion of growth causes a submerged tooth appearance as the implant behaves like an ankylosed tooth and results in a reduced clinical crown length. Furthermore, the remodeling associated with skeletal growth in the region of the implant placement could cause the implant to become unsupported by bone. The time of implant placement should be towards the end of orthodontic treatment. If an implant restoration is to replace the missing incisor, the thickness of the alveolus must be adequate to allow proper implant placement. Usually without the eruption of the permanent incisor, the osseous ridge in this area does not fully develop. But in the present case, since the tooth was avulsed due to trauma, there was adequate buccolingual width of the alveolar ridge. Another problem faced is inadequate space between root apices due to improper mesiodistal root angulation. A periodic periapical X-ray can indicate the progress as the orthodontist diverges the roots.

CONCLUSION

Replacement of a missing tooth with osseointegrated implant-supported prosthesis after regaining space by orthodontic treatment is an esthetically acceptable treatment option provided there is proper patient selection. From a biological standpoint of view, placing a dental implant is the most conservative approach as placing a dental implant in bone provides a functional stimulus to help preserve the remaining bone and prevent resorption as well as preserving the adjacent tooth structure.

REFERENCES


