Adjunctive Orthodontic Therapy in the Prosthodontic Implant Management of the Traumatic Loss of All Maxillary Incisors: A Case Report

Peipei Wang, Min Gu*

Department of Dentistry, The Third Affiliated Hospital of Soochow University, First People's Hospital of Changzhou City, Changzhou, PR China

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ABSTRACT

Various prosthodontic methods are available to replace missing teeth, ranging from simple to complex. This case report describes the multidisciplinary management, involving periodontal, oral surgical, orthodontic, and prosthodontic disciplines, of a 30-year-old Han Chinese female who presented with missing maxillary incisor teeth and psychological depression following a road traffic accident. After occlusal leveling and acquiring sufficient anterior interocclusal space by orthodontic therapy, four endosseous dental implants were placed at the sites of the missing teeth. Five months later, following satisfactory osseointegration, metal-ceramic crowns were fabricated and cemented. The patient achieved a stable functional occlusion and was very pleased with the final esthetic results and her much improved social relationships.

Key Words: Dental implants, Missing incisor teeth, Orthodontics.

Introduction

Increasing traffic, road accidents resulting in traumatic facial and dental injuries are now commonplace. In injured persons, traumatic loss of the permanent anterior teeth, in particular, may have significant dental, esthetic, and psychological social consequences resulting in a diminished quality of life for the injured persons.

Improvements in surgical and prosthodontic procedures have increased the long-term clinical success of endosseous dental implants and associated superstructures [1], making them a popular choice for replacing missing teeth. However, successful functional and esthetic outcomes for patients, as with any dental procedure, depend on comprehensive investigations, assessments, and treatment planning [2], which often requires consultations with specialist disciplines. In many instances, adjunctive periodontal, surgical, and orthodontic treatments will be necessary before the patient's choice for dental implant-supported prostheses can be achieved [3].

Background

This case report describes the multidisciplinary management, involving periodontal, oral surgical, orthodontic, and prosthodontic disciplines, of a 30-year-old Han Chinese female who presented with missing maxillary incisor teeth and psychological depression following a road traffic accident. After occlusal leveling and acquiring sufficient anterior interocclusal space by orthodontic therapy, four endosseous dental implants were placed at the sites of the missing teeth. Five months later, following satisfactory osseointegration, metal-ceramic crowns were fabricated and cemented. The patient achieved a stable functional occlusion and was very pleased with the final esthetic results and her much improved social relationships.

Case Presentation

Diagnosis and Etiology

A 30-year-old Han Chinese female was referred by a general practitioner to the Department of Dentistry, Affiliated Third Hospital of Soochow University,and First People's Hospital of Changzhou City. Her chief complaint was her unattractive appearance and the associated psychological social distress caused by her missing maxillary incisors, the result of a road traffic accident some three months previously. Scars on her right lower lip and chin were not regarded as a significant problem. Apart from her present anxiety and depression, the patient had no other relevant medical, social, and dental histories.

Although the maxillary incisors were missing, the patient's facial profile suggested the presence previously of an anterior bimaxillary protrusion (Figure 1). Except for the facial scarring, the other extraoral examination findings and functional mandibular movements appeared essentially normal. The intraoral examination found normal hard dental and soft oral tissues and complete soft tissue healing at the extraction sites of the four maxillary incisors. Though there had been minimal previous restorative treatments, the patient's plaque control was poor, and significant recession of the attached gingivae was noted in the crowded mandibular incisor region in particular, where the labially displaced right central incisor had Class 2 mobility (Figure 2). Over-eruption of the mandibular anterior teeth had resulted in a very deep anterior overbite associated with a steep curve of Spee. An Angle Class I first molar relationship was present.

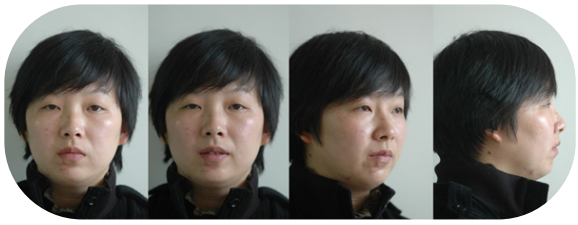

Figure 1: *Pretreatment facial photographs of a 30-year-old Han Chinese female with missing maxillary incisors and facial scarring caused by a road traffic accident.*

Figure 2: *Pretreatment intraoral photographs showing missing maxillary incisors, moderate crowding and over-eruption of the mandibular incisor teeth, and minimal restorative treatment.*

A panoral radiograph (Figure 3), and intraoral dental radiographs, showed horizontally impacted mandibular third molars and some posterior horizontal alveolar bone loss. Significant bone loss had occurred in the mandibular anterior region. Bone quality and quantity in the maxillary anterior

Corresponding author: Min Gu, Department of Dentistry, the Third Affiliated Hospital of Soochow University, First People's Hospital of Changzhou City, Changzhou, PR China, E-mail: gumin106@163.com

region was considered adequate for potential endosseous dental implants, following initial orthodontic therapy [4].

Figure 3: *Pretreatment panoral radiograph showing impacted mandibular third molars, sound tooth structure, and generalized alveolar marginal bone loss.*

Treatment Objectives and Alternatives

Long-term optimum biological, functional and esthetic dental treatment goals are best accomplished when the clinician not only has a thorough interdisciplinary knowledge of various materials and techniques but also an understanding of the perceived needs and wants of individual patients for each particular clinical situation [5].In many instances, the optimum realistic final treatment may not necessarily be the ideal long-term treatment from the practitioner's viewpoint. In the present situation, understandably, the main objective of the patient was to have her missing maxillary incisors replaced as soon as possible to relieve her psychological distress. However, also understandably, she was unaware of the short and long-term advantages and disadvantages of various treatment alternatives. Apart from the missing maxillary incisors, she also had other dental problems such as third molar tooth impactions, poor oral hygiene, periodontal disease, and mandibular anterior tooth crowding associated with severe over-eruption.

Following an explanation of the need for initial scaling and cleaning and improved oral hygiene, and the extraction of the remaining third molars and the compromised labially positioned mandibular right central incisor, several further definitive treatment options to replace the four missing maxillary incisors were discussed at length with the patient.

The first and least expensive, simplest option was a conventional cast frame removable partial denture (combined with some incisal edge reduction of the mandibular anterior teeth). However, a removable prosthesis was not acceptable to the patient. The second, more expensive option was a fixed partial denture with maxillary canine retainers. However, the patient was unhappy with the need to lose further sound tooth tissue in these vital intact canine teeth. The third and most expensive, complex option was the placement of four endosseous dental implants supporting individual artificial crowns.

For all of these options, adjunctive orthodontic treatment [6] would (a) reduce the mandibular incisor crowding and tooth misalignment, (b) reduce the steep curve of Spee by intruding the mandibular anterior teeth to reduce the deep anterior overbite [7], (c) improve the esthetic alignment and positions of the anterior existing natural teeth and the future artificial tooth crowns [8], (d) stabilize the occlusion, and (e) assist with the removal of dental plaque. For the use of dental implant-supported crowns, in particular, adjunctive orthodontic alignment and leveling of both arches were essential before the implants were placed [9], in order to achieve sufficient horizontal tooth-fixture space to avoid subsequent loss of marginal bone support at adjacent tooth surfaces [10,11]. Having considered the long-term advantages and disadvantages associated with each treatment option, including the time and costs involved, the patient decided that the dental implant-supported crowns and adjunctive orthodontic treatment would be "worth the investment in time and expense".

Results

Treatment Progress

Comprehensive orthodontic treatment commenced after satisfactory oral hygiene had been achieved and the initial dental treatments had been completed. Oral hygiene was maintained with professional tooth cleaning every two months during subsequent treatments [12]. Immediately after extracting the right mandibular central incisor, pre-adjusted edgewise appliances with standard 0.022-in slot self-ligating brackets (Quick, Forestadent GmbH, Pforzheim, Germany) were placed. The leveling process started with a 0.014-in nickel-titanium archwire in the mandibular arch. Approximately two months later, appliances were placed in the maxillary arch. The sequence of archwires placed during the treatment procedures is shown in Table 1. Elastic line (3 M Unitek, Monrovia, CA, USA) was applied to align the roots of the mandibular incisors more parallel to one other. Finally, 0.017 × 0.025-in and 0.018 × 0.025-in stainless steel archwires were placed in the mandibular arch and maxillary arch, respectively. Light depressive forces were applied carefully when intruding the anterior mandibular teeth [13]. Triquetral elastics (3 M Unitek) were used to encourage extrusion of the posterior teeth to adjust the inter-arch occlusal contacts.

Table 1: *Archwire sequence during active orthodontic treatment, Ni-Ti: Nickel-Titanium; SS: Stainless Steel.*

Archwire sequence during active orthodontic treatment		
Dental arch	**Procedure**	**Archwire**
Mandibular	Leveling	0.014-in Ni-Ti
		0.016-in Ni-Ti
		0.018-in Ni-Ti
	Incisor intrusion	0.018-in SS and 0.017 × 0.025-in Utility
	Finishing	0.017 × 0.025-in SS
Maxillary	Leveling	0.014-in Ni-Ti
		0.016-in Ni-Ti
		0.018-in Ni-Ti
		0.018 × 0.025-in Utility
	Finishing	0.018 × 0.025-in SS
Mean ± SD	Mean ± SD	Mean ± SD

Generally speaking, in the absence of infection associated with an extracted tooth, the clinician may place a dental implant at the site 3-6 months after tooth extraction [14], or preferably immediately to avoid much of the usual bone resorption that follows extraction [15,16]. For the 30-year-old female patient, four Standard Plus Regular Neck (InstitutStraumann AG, Basel, Switzerland) endosseous implants 12 mm long and either 4.1 mm or 3.3 mm diameter were inserted at the maxillary incisor extraction sites seven months after the original traumatic loss of these teeth, and four months after orthodontic therapy commenced [17].

After uneventful healing at the implant sites over five months, during which time an anterior prosthesis was worn, the edgewise appliances were removed (Figure 4), and four metal-ceramic crowns were fabricated and cemented (Figure

5). The patient was then instructed to wear mandibular and maxillary removable orthodontic retainers for at least six hours each day, which was to be continued for up to two years.

Figure 4: *Intraoral photographs taken after the completion of active orthodontic treatment and maxillary incisor dental implant osseointegration.*

Figure 5: *Post-treatment intraoral photographs showing satisfactory occlusal relations and cemented maxillary incisor implant-supported metal-ceramic crowns. A small triangular gingival embrasure space remains between two mandibular incisors.*

The patient was very happy with her final post-treatment functional and esthetic results. Dental implant-supported metal-ceramic restorations were a satisfactory restorative treatment option for replacing the traumatically lost maxillary anterior teeth [18],and standardized periapical radiographs of the four implants taken three and seven months after beginning the orthodontic retention phase showed satisfactory osseointegration (Figure 6). Combined orthodontic and restorative treatments for this patient led to an improved frontal and profile facial appearance due to the more optimal repositioning of the mandibular incisors and the artificial maxillary incisor crowns, which allowed a less-strained lip closure [19,20]. A normal anterior overbite and overjet were achieved, though a small mandibular midline deviation and a small triangular gingival embrasure space between two mandibular incisors remained. The occlusion was stable in the retention phase after seven months. The gingival condition of the patient improved during her treatment, and the amount of gingival recession associated with the mandibular anterior teeth remained unchanged after orthodontic therapy.

Figure 6: *Intraoral radiographs taken 12 months after dental implant placement showing good marginal bone heights around the implants and adjacent maxillary canines.*

Discussion

The traumatic loss of all maxillary incisors in this 30-year-old female patient prevented her from smiling, socializing, and communicating effectively with other employees at her workplace. Consequently, she was very depressed when first seen in the Department of Orthodontics. The traumatic loss of her permanent maxillary incisor teeth was a significant psychological event [5], and she wanted the prosthodontic tooth replacements to simulate the natural teeth as closely as possible. This was best accomplished by using intraosseous dental implant-supported artificial crowns.

Fortunately, the patient had no medical contraindications, her remaining teeth were in sound condition, there was generally only a small amount of posterior marginal bone loss from the periodontal disease [21], and the alveolar bone at the proposed implant sites was of adequate quantity and quality. However, the very deep anterior overbite and steep curve of Spee, together with the anterior mandibular crowding present, meant that orthodontic therapy was required before the prosthodontic treatment could be undertaken. Consultations and treatment were also obtained from a periodontist and an oral surgeon.

The effectiveness of the prosthodontic treatment for this patient was enhanced by first leveling and aligning both arches, eliminating moderate crowding of the mandibular anterior teeth after extraction of the right central incisor, and intruding the mandibular anterior teeth. The active orthodontic therapy was performed carefully and slowly, especially when intruding the mandibular teeth, where there had also been a previous marginal bone loss from periodontal disease [22].

At the last recall period, excellent osseointegration of all maxillary incisor implants had been achieved after 10 years (Figures 7-10), which is in agreement with other reports [23,24]. The patient was very happy with the completed treatment and having regained her social confidence.

Figure 7: *Facial photographs 10 years after treatment, the latest follow-up on Jan 17th, 2019.*

Figure 8: *Intraoral photographs 10 years after treatment, the latest follow-up on Jan 17th, 2019.*

Figure 9: *Panoral radiograph 10 years after treatment, the latest follow-up on Jan 17th, 2019.*

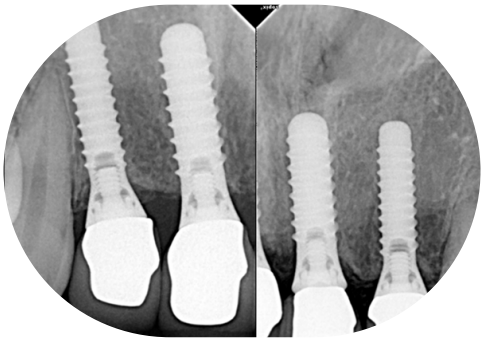

Figure 10: *Intraoral radiographs of dental implants 10 years after treatment, the latest follow-up on Jan 17th, 2019.*

Conclusion

In conclusion, this case report of a 30-year-old Han Chinese female who suffered from depression emphasizes the importance of an interdisciplinary approach when replacing traumatically lost maxillary incisors, with dental implant-supported artificial crowns. Because of limited vertical space, which was associated with a deep anterior overbite caused by over-eruption of the mandibular anterior teeth, orthodontic therapy was required before the prosthodontic treatment could begin. The presence also of active periodontal disease [25], mandibular incisor crowding, and impacted third molars required consultations and treatments by other specialists and a strictly supervised oral hygiene program during orthodontic therapy [26]. Significant improvements in periodontal health, function, and esthetics were achieved, resulting in a very happy and more socially confident patient.

The Novelty of the Study

1. This case report describes the multidisciplinary management, involving periodontal, oral surgical, orthodontic, and prosthodontic disciplines, of a 30-year-old Han Chinese female who presented with missing maxillary incisor teeth and psychological depression following a road traffic accident.

2. Periodontal treatment throughout treatment.

3. Evaluation of alveolar bone mass before and after treatment.

Declaration

Funding Source

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Conflict of Interests

There are no commercial or other associations that may pose a conflict of interest.

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