

# A MULTIDISCIPLINARY APPROACH TO SINGLE-TOOTH, IMPLANT-SUPPORTED PROSTHESES: A REPORT OF THREE CASES

*Kıvanç Akça, DDS, PhD*  
*Haldun İplikçioğlu, DDS, PhD*  
*Ela Akça, DDS, PhD*

## KEY WORDS

Preprosthetic orthodontics  
 Single-tooth implants

Dental implants and their successful long-term results have begun a new era in dentistry. In recent years, the increasing trend of using dental implants at single-tooth edentulous cases has been taken into consideration. Although treatment goals and objectives are similar for both prosthodontists and orthodontists, they rarely cooperate. Usually prosthodontists are in need of preprosthetic orthodontic preparations for younger patients. In this paper, different preprosthetic orthodontic procedures that may be required before the placement of implants at single-tooth edentulous cases are presented. In the first and second cases, decreased mesio-distal space was regained by different orthodontic treatment methods, whereas the occlusal relationship was corrected for better function in the third case.

## INTRODUCTION

**C**aries, periodontal diseases, and/or trauma are the primary reasons for tooth loss; the incidence of congenitally missing teeth is also significant.<sup>1</sup> Dental epidemiological studies have demonstrated that loss of a single tooth is prevalent in all age groups.<sup>2</sup>

The loss of the mandibular first molar tooth initiates a series of undesired teeth movements, including tipping and drifting of the adjacent teeth and supraeruption of the opposing teeth toward the space previously occupied by the mandibular first molar. The mandibular second molar is the most affected tooth under these circumstances because it bears abnormal oc-

clusal forces that could destroy the supportive tissues with the formation of a periodontal pocket on the mesial root surface. This mechanism is the cause for the formation of pathological occlusion.<sup>3</sup> Therefore, loss of a single molar or congenital absence of a premolar are cases in which both prosthodontists and orthodontists diagnose and treat patients. If there is a deficiency in arch length, the treatment choice is usually the closure of the space, although a number of conventional prosthetic alternatives are present.<sup>4,5</sup>

Removable partial dentures, fixed prosthetic restorations, and resin-bonded restorations are all common approaches for the treatment of missing single-tooth cases; however, some-

*Kıvanç Akça, DDS, PhD, is an assistant, and Haldun İplikçioğlu, DDS, PhD, is an associate professor at Hacettepe University, Faculty of Dentistry, Department of Prosthodontics, 06100 Sıhhiye-Ankara, Turkey. Correspondence should be addressed to Dr Akça, Çetin Emeç Bulvarı, 6.cadde 54/1 06450 Öveçler, Ankara—TÜRKİYE.*  
*Ela Akça, DDS, PhD, is a private practice orthodontist in Ankara, Turkey.*

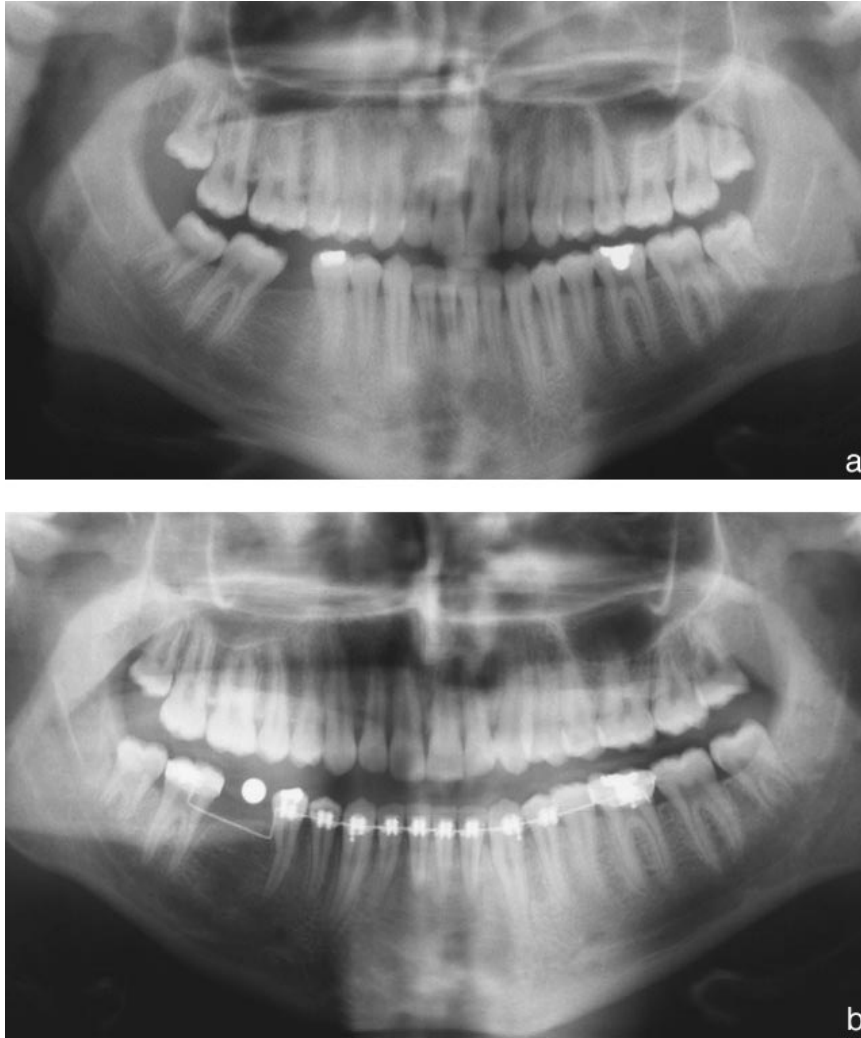


FIGURE 1. Panoramic radiography of Case 1. (a) Before orthodontic treatment and (b) after orthodontic treatment.

times autotransplantation is also a treatment alternative.<sup>6</sup>

Receiving a removable partial denture for a single-tooth loss is unacceptable for patients and may cause several problems related to tissues. In addition to accepting the risk of pulp damages, in younger patients intact teeth surfaces usually are sacrificed while preparing the teeth for fixed restorations. On the other hand, adhesive restorations are not widely accepted as permanent restorations at posterior edentulous cases.

It is evident that there is not a treatment choice that thoroughly corresponds to the demands of caries-free young patients. Successful short-term

outcomes reported by a limited number of studies encourage clinicians to use dental implants for single-tooth missing cases.<sup>7-11</sup>

Usually the orthodontist enters the implant team in cases where the jaw is accompanied with severely displaced

or deformed remaining teeth, such as hypodontia and oligodontia.<sup>12,13</sup> On the other hand, preprosthetic orthodontic preparations, which would facilitate the appropriate conditions for some specific cases, are mostly overshadowed in dental implantology.

Preprosthetic orthodontic teeth movements include uprighting of tilted molars, closure of minor spaces, obtaining a better occlusal relationship, correction of cross bites, intrusion of supraerupted molars, and extrusion of roots.

The mesiodistal space that would receive the single-tooth implant treatment should be at least 6 mm for a suitable dental implant at posterior segments, and appropriate intermaxillary relation is favorable for single-tooth implant prosthesis. When these basic requirements are not present, orthodontic preparations should take place initially.

The aim of this paper is to discuss the required preprosthetic orthodontic preparations by presenting three different clinical approaches to single-tooth, implant-supported prosthesis.

#### PATIENT PRESENTATIONS

##### *Case 1: Uprighting of a tilted molar*

G.B.S. was an 18-year-old man with a missing mandibular right first molar. Clinically, it was observed that the second molar tilted mesially to the space previously occupied by the first molar, causing a decrease in mesio-distal distance of 3.5 mm. The adjacent teeth were caries-free. The occlusal relationship was corrupted on the left side. It was decided that the missing mandib-

FIGURE 2. (a) Implant-supported crown before removal of the brackets. (b) Implant-supported crown after removal of the brackets.

FIGURE 3. A spring-activated orthodontic apparatus is made for Case 2.

FIGURE 4. Diastema between the first premolar and the canine (a) before orthodontic treatment and (b) after orthodontic treatment.

FIGURE 5. (a) Properly placed 13- × 3.8-mm implant. (b) Implant-supported cemented crown.

FIGURE 6. Corrupted occlusal relationship in Case 3.

FIGURE 7. (a) A 10- × 4.25-mm implant placed after the orthodontic treatment. (b) Screw-retained, single-tooth implant supported crown.



2a



2b



3



4a



4b



5a



5b



6



7a



7b

ular first molar would be replaced by single-tooth implant prosthesis. The aim of orthodontic treatment in this case was to regain the lost space by uprighting the tilted second molar. A 5.5-mm space was gained by fixed orthodontic treatment within 4 months. As a result, with the formerly available 3.5 mm the total mesio-distal space was increased to 9 mm (Fig 1). A 16-mm long and 4.25-mm in diameter screw implant (MIS, Israel) was placed. After 4 months, the implant was exposed to the oral cavity. After the gingival tissues had healed properly, a screw-retained, single-tooth restoration was constructed (Fig 2).

### Case 2: Closure of minor spaces

B.S. was a 28-year-old woman with a missing mandibular left second premolar. Clinically, the mesio-distal space was lost by distal tilting and rotation of first premolar tooth. The adjacent teeth to the space were intact. The goal of orthodontic treatment in this case was to regain the required space for an implant-retained restoration by closing the space, which occurred between the first premolar and the canine. A removable orthodontic apparatus with a spring-activated vestibule arch was used for 2 months (Fig 3). A 13-mm-long and 3.8-mm in diameter implant (Core-Vent, Dentsply) was placed after the diastema between the first premolar and the canine was closed (Fig 4). Four months after the surgery, the implant was exposed to the oral cavity. After a healing period of 1 week for the gingival tissues postoperative to the secondary surgery, a cemented single-tooth restoration was built up for a better functional and aesthetic restoration (Fig 5).

### Case 3: Minor orthodontic tooth movements to obtain a better occlusal relationship

T.B. was a 21-year-old man with a missing mandibular left first molar. Clinically it was diagnosed that the maxillary first molar was displaced buccally, causing the palatal cusp to se-

verely emerge in the space of the missing first molar. The maxillary and mandibular second molar teeth met in a cusp-to-cusp relationship. The occlusal relationship was severely impaired because of the minor movements of maxillary posterior teeth (Fig 6). There was no loss in mesio-distal space on the mandibular arch. In this case the purpose of orthodontic treatment was to obtain a more stable occlusion and to regain the decreased cervico occlusal space by means of minor orthodontic teeth movements. After fixed orthodontic treatment including only the maxillary right segment, a 10-mm-long, 4.25-mm in diameter screw implant (MIS) was placed. After 4 months, the implant was exposed to the oral cavity and a screw-retained, single-tooth implant restoration was constructed (Fig 7).

#### RESULTS

Follow-up visits were scheduled every 3 months for the first year, and every 6 months for the following years. There was not any screw loosening in any case. After a 5-year follow-up period, the implants survived satisfactorily.

In Case 1, 1 mm marginal bone loss was observed radiologically within the first year. The prosthesis was removed, it was observed that the implant was not mobile. However, the gingiva surrounding the cervical part of the implant was hyperaemic. In order to eliminate the possible pressure, the single-tooth, implant-supported prosthesis was reconstructed. The patient was motivated for better hygiene. No more bone loss was observed during routine follow-up visits.

In Case 2, the provisionally cemented, implant-supported crown was removed every year. The abutment screw never loosened and no marginal bone loss was seen at control periapical radiographs.

In Case 3, a corrected occlusal relationship protected the implant-supported prosthesis from abnormal offset loads. It was observed from the peri-

apical radiographs that there was no bone loss.

#### DISCUSSION

The short-term results of single-tooth implants indicating high survival rates have increased the use of dental implants for single-tooth missing cases. There are a limited number of studies about required orthodontic treatment prior to prosthesis reconstruction, none of which were related to single-tooth implant applications.<sup>14,15</sup>

Trauma-related teeth loss usually occurs at the anterior segment of the jaws. In these cases, major aesthetic problems arose, as well as functional problems. It was shown that existing oral conditions could be improved by orthodontic treatment before implant placement.<sup>16</sup> In this study it was hypothesized that a similar approach could be applied for missing single posterior-tooth cases. The role of orthodontic preparations should not be underestimated. On the contrary, for some cases the orthodontist should be included in the implant team without any hesitation.

Shellart *et al*<sup>17</sup> presented the treatment of a case with missing bilateral mandibular first molar teeth. The bilateral third and second molar teeth were tilted mesially together into the space previously occupied by the first molar tooth. The third molar teeth were extracted. After the placement of the implants into the space of the first molar teeth, second molar teeth that had tilted mesially were uprighted by anchoring from the implants. The prosthesis was then constructed.

Roberts *et al*<sup>18</sup> applied different treatment to a similar case. They used implants as anchoring units to move the second molar teeth thoroughly into the space in order to close it.

These clinical reports were not actually orthodontic preparations, as implants were placed and used before and within the orthodontic treatment. However, it has been demonstrated that the available inappropriate conditions were corrected for optimal im-

plant placement by orthodontic preparations, as in the cases presented in this study.<sup>19</sup> The reports show that required minor changes could be obtained ideally without any implant anchorage. Therefore, if necessary, preprosthetic orthodontic preparations should be performed for the optimal placement of implants.

It should be pointed out that this study did not aim to present a retrospective evaluation of single-tooth implants, but to show cases that were thought to be hopeless for implant placement could be reconditioned by orthodontic preparations.

#### SUMMARY

Implant supported prosthesis has become a serious alternative to conventional prosthesis. In recent years single tooth implant applications are becoming of great interest to dental practitioners. In many cases the use of implant placement is limited unless required preprosthetic preparations be performed. In these cases in order to optimize the oral conditions for implant placement, preprosthetic orthodontic preparations can be performed.

#### REFERENCES

1. Ekfeldt A, Carlsson GE, Börjesson G. Clinical evaluation of single-tooth restoration supported by osseointegrated implants: a retrospective study. *Int J Oral Maxillofac Implant.* 1994;9:179-183.
2. Battistuzzi RB, Kayser A, Peer P. Tooth loss and remaining occlusion in a Dutch population. *J Oral Rehabil.* 1987;59:50-66.
3. Shillingburg HT, Hobo S, Whitsett LD, *et al.* *Fundamentals of Fixed Prosthodontics*, 3rd ed. Chicago: Quintessence Publishing; 1997:85.
4. Hom BM, Turley PK. The effects of space closure of the mandibular first molar area in adults. *Am J Orthod Dentofacial Orthop.* 1984;86:457-469.
5. Joondeph DR, McNeill RW. Congenitally absent second premolars: an interceptive approach. *Am J Orthod Dentofacial Orthop.* 1971;59:50-66.

6. Winstanely RB. Prosthodontic treatment of patients with hypodontia. *J Prosthet Dent.* 1984;52:687-691.
7. Laney WR, Jemt T, Harris D, Henry PJ, Krogh PHJ, Polizzi G. Osseointegrated implants for single-tooth replacement: progress report from a multicenter prospective study after 3 years. *Int J Oral Maxillofac Implant.* 1994;9:49-54.
8. Levine RA, Clem DS, Wilson TG, Higginbottom F, Saunders SL. A multicenter retrospective analysis of the ITI implant system used for single-tooth replacements: preliminary results of 6 or more months of loading. *Int J Oral Maxillofac Implant.* 1994;12:237-242.
9. Malevez C, Hermans M, Daelemans P. Marginal bone levels at Brånemark system implants used for single tooth restoration: the influence of implant design and anatomical region. *Clin Oral Implant Res.* 1996;7:162-169.
10. Walther W, Klemke J, Wörle M, Heners M. Implant-supported single-tooth replacements: risk of implant and prosthesis failure. *J Oral Implantol.* 1996;22:236-239.
11. Schmitt A, Zarb GA. The longitudinal clinical effectiveness of osseointegrated dental implants for single-tooth replacement. *Int J Prosthodont.* 1993;6:197-202.
12. Durstberger G, Celar A, Watzek G. Implant-surgical and prosthetic rehabilitation of patients with multiple dental aplasia: a clinical report. *Int J Oral Maxillofac Implant.* 1999;14:417-423.
13. Hibi H, Ueda M. Occlusal restoration with surgical interventions-osteotomy, implant surgery, and tooth transplantation: a clinical report. *J Prosthet Dent.* 1997;78:236-240.
14. Miller TE. Orthodontic and restorative procedures for retained deciduous teeth in adults. *J Prosthet Dent.* 1995;73:501-509.
15. Valerón JF, Velázquez JF. Implants in the orthodontic and prosthetic rehabilitation of an adult patient: a case report. *Int J Oral Maxillofac Implant.* 1996;11:534-538.
16. Prosterman P, Prosterman L, Fisher R, Gornitsky M. The use of implants for orthodontic correction of an open bite. *Am J Orthod Dentofacial Orthop.* 1995;107:245-250.
17. Shellart WC, Moawad M, Lake P. Case report: implants as anchorage for molar uprighting and intrusion. *Angle Orthod.* 1996;3:169-172.
18. Roberts WE, Nelson CL, Goodacre CJ. Rigid implant anchorage to close a mandibular first molar extraction site. *J Clin Orthod.* 1994;28:693-704.
19. Carano A, Testa M, Siciliani G. The distal jet for uprighting lower molars. *J Clin Orthod.* 1996;30:707-710.