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Case Report

Case studies on local orthodontic traction by minis-implants before implant rehabilitation

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Abstract: Objective: Dentition defect with malocclusion is a common occurrence in the clinical work. To restore proper occlusion, preprosthetic corrections of these malposed teeth are often indispensible. The use of orthodontic mini-implants as temporary anchorage devices provides a plausible treatment for those patients with local problems. The aim of this study was to present two cases using local orthodontic traction in conjunction with mini-implants to provide necessary conditions for implant rehabilitation in three dimensional space. Clinical consideration: Two cases who had dentition defect with malocclusion were included in the present study. As both of them rejected crown reduction or orthodontics treatment, local orthodontic traction by mini-implants was used to restore normal space for implant rehabilitation in three dimensions. Careful mechanics analysis and personalized mechanical device were under consideration. The results showed that the biological responses of the corrected teeth and the surrounding bony structures appeared normal and acceptable. Moreover the patients achieved an ideal local occlusion with a short treatment time. Conclusion: In conclusion local orthodontic traction by mini-implants was a less-invasive and short-term method with favorable effects and less necessary occlusal adjustments.

Keywords: Malposed teeth, local orthodontic traction, mini-implant

Introduction

Dentition defect with malocclusion is a common occurrence in the clinical work [1]. Implant rehabilitation is one of the most ideal treatments for those patients. However because of the existence of malocclusion, such as over-eruption of antagonist teeth, inclination of the adjacent teeth, teeth twist, crossbite and so on [2], many dentists have found that single implant rehabilitation often can not obtain satisfactory aesthetic and functional results, or even unable to complete the rehabilitation. Howeve with the development of multidisciplinary combination treatment mode, implant rehabilitation after necessary orthodontic treatment provides an effective treatment method for those patients.

Conventional orthodontic procedures need a full arch correction. Although this can restore normal freeway space and acquire good occlusion, the longer treatment period often make patients unacceptable, especially for those with local problems. The use of orthodontic mini-implants as temporary anchorage devices provides an alternative treatment for those who cannot accept conventional orthodontics [3]. In this paper, we presented two cases using local orthodontic traction to provide necessary conditions for implant prosthesis in three dimensional space.

Case 1

Diagnosis and treatment objectives

The patient, female, aged 51 years, consulted the implant rehabilitation for her missing teeth on the right side resulted from caries. Clinical examination (**Figure 1**) revealed that the upper right second premolar and the lower right second molar, and both the upper and lower left second molars were missing. The freeway space on the right side was only 0.5 mm due to the overeruption of upper molars. The space between the upper right first premolar and first molar was 4.5 mm because of the inclination of

Figure 1. Pretreatment intraoral photographs. A. Right occlusal view. B. Front occlusal view. C. Left occlusal view.

Figure 2. Pretreatment panoramic radiograph.

Figure 3. Occlusal view of intrusion of overeruted molars.

Figure 4. Occlusal view of the narrowed space in the upper rightsecond premolar.

Figure 5. Buccal view of the local orthodontic traction appliance.

the first molar. There was about 1.5 mm space between the upper central incisors. The molar relationship was Angle Class II on the right side due to the inclination of the upper right first molar and Angle Class I on the left side. Overjet and overbite were 2.0 mm and 4 mm, respectively. Both clinical examination and panoramic radiograph (**Figure 2**) showed that there was mild-to-moderate absorption of alveolar bone of her most teeth.

Diagnoses of this patient were as follows: dentition defect, mild malocclusion and periodontitis. Her left molars had masticatory function while the right side lose this function. Considering the complain of this patient was to restore her losing teeth on the right side by implantation, our treatment targets were to make implant rehabilitation for her right missing teeth and provide adequate freeway space before rehabilitation.

Treatment alternatives

The dentists planed dental implants to restore the right upper second premolar and the lower

Figure 6. Posttreatment intraoral photographs.

second molar. To acquire adequate freeway space, the dentist presented three plans for this patient. ① Crown reduction of the upper right first and second molars. This was a quickly achieved method but had a limitation of destroying her healthy teeth. ② Orthodontic treatment. This method could achieved nearly perfect occlusion but need a long time. ③ Local orthodontic traction by mini-implants. It could recover normal space for implantation and only improve her local occlusion. The patient chose the third plan that was using local orthodontic traction by temporary anchorage devices to correct overerupted and inclined molars.

Treatment progress

In order to shorten the treatment time, titanium nails were firstly implanted in the sites of the upper right second premolar and the lower right second molar. At the same time, miniscrews (1.6×11 mm, Cibei, China) which were as temporary anchorage, were implanted into buccal and palatal alveolar bone respectively between the upper right first and second molars. The distance from miniscrews to gingival margin was 10 mm away. The first target of our treatment was to intrude the overerupted molars. In order to achieve this, two lingual buttons to the buccal surface and one to the lingual surface was adhered in each overerupted molar. The intrusion of molars was achieved by a power chain linking miniscrews and lingual buttons (**Figure 3**). The intrusion force was about 150 g. The power chain was changed every four weeks. After four months, the upper right first and second molars were intruded 4.5 mm while the space in the upper right second premolar was narrowed to 3 mm (**Figure 4**). So our next consideration was to push the upper right first and second molars distally and restore the normal space of the upper right second premolar. Orthodontic brackets (Shinya, China) were bonded on the upper right canine, first premolar and first molar. Then a segmental stainless steel (0.018×0.025 inch) archwire with a personalized hook was engaged into the bracket slots. The hook was linked to the miniscrew by a power chain. Moreover, coil spring was put in the area of the upper right second premolar to expand the space (**Figure 5**). The power chain and coil spring were changed every four weeks. Three months later, the space between first premolar in upper right and molar was expanded to 5 mm. Then crown rehabilitations of the right upper second premolar and lower second molar were prepared.

Treatment results

The freeway space was increased 4.5 mm after four months and the space between the upper right first premolar and molar was expanded 2 mm after another three months. After crown rehabilitation of the right upper first premolar and the lower second molar, the upper curve was get back to normal and the patient obtained ideal occlusion on the right side (**Figure 6**).

Case 2

Diagnosis and treatment objectives

The patient, female, aged 48 years, consulted the implant rehabilitation for her missing molar in the left side. Clinical examination (**Figure 7**) presented tetracycline stained teeth in her mouth. The upper left second molar had a baccoversion more than half tooth and the lower left second molar was missing. The lower teeth centerline deviated 1.5 mm to right and the lower dentition was mild crowding. The molar relationship was Angle Class I on both right and left sides. Overjet and overbite were 2.0 mm and 3.0 mm, respectively. Periodontal condition of this patient was satisfying.

In this case, if single implant rehabilitation was performed on this patient, she could not achieve ideal molar occlusion on her left side or even might end up in failure of implantation because of the malposition of upper left second molar. Thus correction of the dislocated the upper left second molar has become an essential procedure before the implant prosthesis.

Figure 7. Pretreatment intraoral photographs. A. Upper occlusal view. B. Left buccal view. C. Lower occlusal view.

Figure 8. Occlusal view of the local orthodontic traction appliance.

Figure 9. Occlusal view of the local orthodontic traction appliance: another miniscrew was installed.

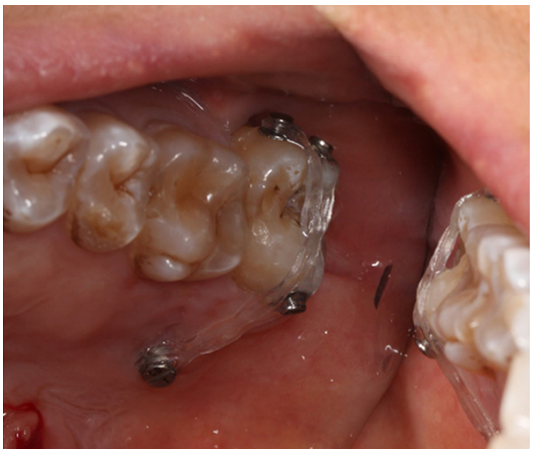

Figure 10. Occlusal view of orthodontic intrusion of the upper left second molar with mini-implants.

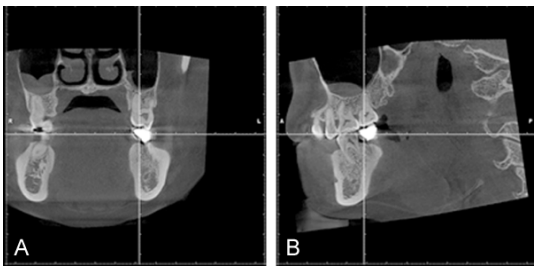

Figure 11. Cone beam CT images of the upper left second molar after treatment. A. Coronal scan of the moved tooth. B. Sagittal scan of the moved tooth.

Treatment alternatives

At first we presented a plan to her composed of implant rehabilitation for the lower left second molar and orthodontics to alleviate dental crowding and improve her whole occlusion. But the patient was satisfied with her occlusion and could not accept orthodontics because of the long treatment period. Considering her main complaint was only to restore the left posterior occlusion, we suggested to try local orthodontic traction by temporary anchorage devices to relocate the upper left second molar to its normal position before rehabilitation of the lower left second molar. The patient embraced dentists' proposal.

Treatment progress

In order to shorten the treatment time, titanium nails were firstly implanted in the area of the lower left second molar and simultaneously, miniscrew (1.6×11 mm, Cibei, China) which

Figure 12. Posttreatment intraoral photographs. A. Upper occlusal view. B. Lower occlusal view. C. Left buccal view.

were as temporary anchorage, were implanted in midpalat al suture. The position of miniscrew was slightly forward in order to reduce discomfort. A lingual button was bonded to the palatal surface of the upper left second molar. In order to pull the upper left second moslar lingual move and avoid tooth twist, a custom-made hook using a stainless steel (0.018×0.025 inch) was prepared whose one end was fixed to the miniscrew and the other end was linked to the lingual button by a power chain (**Figure 8**). The traction force was about 150 g. After two months, baccoversion of the upper left second molar had improved but the palatal cusp prolapsed. Thus intrusion of the prolapsed palatal cusp was also under our consideration. In order to accelerate the upper left second molar palatal movement and intrusion, we implanted another miniscrew in the palatal side between the roots of the upper left first and second molars. Then a power chain was used to link miniscrew with lingual button (**Figure 9**). Another two months later, the upper left second molar returned to its normal position in buccal-palatal direction but protruded from occlusal plane. So we removed the miniscrew in midpalatal suture and implanted another miniscrew 10 mm away from the distal free gingival of the upper left second molar and intruded it routinely by a power chain (**Figure 10**).

Treatment results

After five months local orthodontic traction, the upper left second molar palatally moved for 5 mm and returned to its normal position in three dimensions. Cone beam CT showed that both buccal and palatal alveolar of the upper left second molar existed and there was no root resorption of this moved tooth (**Figure 11**). After crown rehabilitation of the lower left second molar, the left molars achieved ideal occlusion (**Figure 12**).

Discussion

Dentition defect is one of the most common diseases in a dentist's clinical work. If these absent teeth do not rehabilitated immediately, it will result in overeruption of antagonist teeth, tilting of adjacent teeth and so on. These deleterious effects of losing teeth will bring difficulty for rehabilitation [4]. Thus preprosthetic corrections of these malposed teeth are often indispensible.

Although there are diverse treatments for these cases, we can classify them as follows: ① prosthodontic reduction. Although this is one of the most common methods and is achieved quickly, prosthodontic reduction should grind the healthy teeth. It is an invasive treatment requiring endodontic intervention and crown restoration at the expense of tooth vitality. ② orthodontic treatment [5]. Although this is a relative noninvasive method, traditional orthodontics usually takes a long treatment time. Besides, as for those elder or poor periodontal condition patients, conventional orthodontics may lead to teeth loosing or even aggravate periodontal disease. In recent years, with the wide use of mini-implants, more and more dentists utilized them as temporary anchorage devices for intrusion of overerupted teeth, correction of overbites or closure of open bite [6-11]. Thus, local orthodontics became available for those who needed to improve their local occlusion.

In the first case of this study, we used 2 miniscrews as temporary anchorage to intrude the overerupted molars and expand the edentulous space. In this situation, intrusion of overerupted molars should be performed first. This is because that the intrusion of molars would narrow the space of the upper right second premolar. After intruding the overerupted molars to

its normal place, restoring the natural space of upper right second premolar could be performed. This procedure can avoid teeth moving back and forth and shorten treatment time.

The direction of traction force should be in accordance with the orientation of tooth movement. In the second case of this study, the upper left second molar should be pulled to palate side while the miniscrew in midpalatal suture was a slightly forward. Thus the two directions were not in the same line. If the upper left second molar was linked to the miniscrew directly without a custom-made stainless steel, it would result in twist of the moving tooth or produce unwanted force to the upper left first molar. The role of the stainless steel counteracted these potential side effects by making the two directions consistent.

The stability of miniscrews is critical for the success of temporary anchorage. Some studies reported that orthodontic force can be loaded into these micro-implants only after bone healing in order to avoid bone resorption or screw loosening [12-14]. Thus patients should wait at least two weeks after installing the implants. However in the present cases, immediate loading was exerted on the miniscrews and both of them succeeded with no bone resorption or screw loosening. The reason might be that we used self-drilling miniscrews which had the advantage of no incision and less bone damage.

In this study, titanium nails were implanted in the edentulous area first followed by orthodontic correction of malposed teeth. The titanium nails need three months or more time to reach stability. It is just providing a good opportunity for local orthodontics. Thereby the treatment time was reduced to minimum.

Summary and conclusions

In conclusion, micro-implant as temporary anchorage provides an excellent approach for those who have local occlusal problems. However careful analysis and comprehensive design are essential to success.

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Disclosure of conflict of interest

None.

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References

[1] Douglass CW and Watson AJ. Future needs for fixed and removable partial dentures in the United States. J Prosthet Dent 2002; 87: 9-14.
[2] Craddock HL, Youngson CC, Manogue M and Blance A. Occlusal changes following posterior tooth loss in adults. Part 1: a study of clinical parameters associated with the extent and type of supraeruption in unopposed posterior teeth. J Prosthodont 2007; 16: 485-494.
[3] Williams M, Gurman M, Portnof JE, Gershenson P and Badner V. Use of temporary anchorage devices in regaining lost interocclusal space. Case series. N Y State Dent J 2012; 78: 31-35.
[4] Kim Y, Oh TJ, Misch CE and Wang HL. Occlusal considerations in implant therapy: clinical guidelines with biomechanical rationale. Clin Oral Implants Res 2005; 16: 26-35.
[5] Huang LH, Shotwell JL and Wang HL. Dental implants for orthodontic anchorage. Am J Orthod Dentofacial Orthop 2005; 127: 713-722.
[6] Heravi F, Bayani S, Madani AS, Radvar M and Anbiaee N. Intrusion of supra-erupted molars using miniscrews: clinical success and root resorption. Am J Orthod Dentofacial Orthop 2011; 139: S170-175.
[7] Senisik NE and Turkkahraman H. Treatment effects of intrusion arches and mini-implant systems in deepbite patients. Am J Orthod Dentofacial Orthop 2012; 141: 723-733.
[8] Kravitz ND and Kusnoto B. Posterior impaction with orthodontic miniscrews for openbite closure and improvement of facial profile. World J Orthod 2007; 8: 157-166.
[9] Drago CJ. Use of osseointegrated implants in adult orthodontic treatment: a clinical report. J Prosthet Dent 1999; 82: 504-509.
[10] Park HS, Bae SM, Kyung HM and Sung JH. Simultaneous incisor retraction and distal molar

movement with microimplant anchorage. World J Orthod 2004; 5: 164-171.
[11] Park HS, Kim JY and Kwon TG. Occlusal plane change after intrusion of maxillary posterior teeth by microimplants to avoid maxillary surgery with skeletal Class III orthognathic surgery. Am J Orthod Dentofacial Orthop 2010; 138: 631-640.
[12] Liou EJ, Pai BC and Lin JC. Do miniscrews remain stationary under orthodontic forces? Am J Orthod Dentofacial Orthop 2004; 126: 42-47.
[13] Kyung HM, Park HS, Bae SM, Sung JH and Kim IB. Development of orthodontic micro-implants for intraoral anchorage. J Clin Orthod 2003; 37: 321-328; quiz 314.
[14] Yao CC, Wu CB, Wu HY, Kok SH, Chang HF and Chen YJ. Intrusion of the overerupted upper left first and second molars by mini-implants with partial-fixed orthodontic appliances: a case report. Angle Orthod 2004; 74: 550-557.