

RESTORATION OF POSTERIOR EDENTULOUS SPACES AFTER MAXILLARY MOLAR INTRUSION WITH FIXED APPLIANCES (CASE REPORT) *

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Abstract

This case report includes the mini screw supported intrusion of the extruded teeth due to the absence of its antagonist and fixed prosthetic rehabilitation supported with osseointegrated implants.

Four mini-screws with 2 mm diameter and 10 mm length were placed in buccal and palatal regions of extruded molars in both left and right sides. The 4 mm intrusion was achieved with Ni-Ti closed spring and elastomeric chain in each side. After the intrusions of the extruded antagonist molars, dental implants were placed in edentulous areas. After 3 months of healing period, fixed prosthetic restorations were made.

As the benefit of orthodontic intrusion of extruded molars, no endodontic treatment was needed in order to gain enough vertical space for prosthetic restoration of antagonist edentulous area and the masticatory function was successfully given to the patient.

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Introduction

The overeruption of maxillary molars usually results from early loss of antagonistic teeth. The elongated dentoalveolar process may cause problems of occlusal interferences and functional disturbances and may result in great difficulty during prosthetic reconstruction. To provide prosthodontic treatment of the missing teeth, these overerupted teeth need to be intruded, but molar intrusion is difficult in adults.^{1,2}

Prosthodontic treatment replaces missing

teeth and restores occlusal surfaces for improved masticatory function, esthetics, and phonetics. Partial edentulous jaw includes various forms and may be accompanied with displaced or deformed remaining teeth and surrounding tissues. When these deformities are severe, orthognathic correction can often facilitate prosthodontic treatment. Other surgical interventions include placement of osseointegrated dental implants and autotransplantation of teeth.³

Generally, several conventional options are available to increase occlusal clearance. Coronal reduction often requires crown restorations at the expense of tooth vitality. Another alternative raised by Schoeman and Subramanian⁴ is a posterior segmental osteotomy of the maxilla to impact the elongated segment, but patients must undergo the risk of general anesthesia and high cost associated with this procedure.

Recent reports have demonstrated the clinical efficiency of mini-implants in providing sufficient anchorage against orthodontic forces.^{5,6}

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The advantages of using mini-implant as orthodontic anchorage include ease of application, minimal patient compliance needed, and the ability to immediately load after initial wound healing.⁷ The surgical procedure for inserting or removing the miniscrew is simple, with minimal unfavorable complications. In contrast, miniplates require flap surgery often done by oral surgeons.

The mini screw implants are used for various proposes in dentistry, including space clousure or space open, open bite treatment and uprighting of posterior teeth. We aimed to place implant supported prosthodontic restorations to mandibular posterior segments by intruding upper molars extruded due to early loss of lower mandibular molars with mini screws.

CASE REPORT

A 36 year old women was referred from prosthodontic department because her right first-second molars and left second molar had overerupted. (Figures 1,2) Mandibular right-left first and second molars, maxillary right first molar and canine had been lost ten years ago. Maxillary right, left central and left lateral restored had been fixed crown bridge restoration. The patient wanted to have the mandibular right-left posterior area restored with prosthodontic implants. However, because of the extruded maxillary left second molar and right first-second molars, less than 1 mm of vertical space was available, making proper restoration difficult. After consulting with the patient and the prosthodontic department, we planned intrusion of the maxillary left first molar and right first-second molars.



Figure 1. Pre treatment intraoral photograph

(Right side).



Figure 2. Pre treatment intraoral photograph (Left side).

Clinical Procedure

The procedure for implanting a mini-screw is as follows. First, anesthetic applied the implant side. After checking the shape and location of the roots on panoramic and periapical x-rays, the implant site marked on the gingiva by making an indentation with a periodontal probe. After checking the position of the mucogingival junction from the buccal side, implant the mini-screw (in the attached gingiva, whenever possible). When the screw is placed on the palatal side of the maxilla, determine the length needed by measuring the soft tissue thickness in the area. To ensure retention and avoid fracture, use a screw with a diameter of 2 mm (Dewimed, Medizintechnik GmbH, Tuttingen, Germany). Use a contra-angle screwdriver and the self-tapping method to implant the screw; a steady implantation technique is important. To facilitate soft tissue healing, begin loading 5 days after the implantation. Light force (10-20 g per tooth) is recommended for the intrusion of the anterior teeth, but a heavier force (150-200 g per tooth) is needed to intrude posterior teeth. To verify the position between the mini-screw and the proximal roots, take periapical x-rays, changing the position of the cone mesiodistally. Use periodic periapical or panoramic radiographs to check for root resorption.

After mini-screw operation, upper left second molar was intruded with power chains (RMO Morita Corp., Chiyoda, Tokyo, Japan).(Figure 3) The magnitude of force was measured with dynamometer. The power chains were changed per week. Maxillary right side,

1mm thick stainless steel wire was bonded on the occlusal surfaces of upper left first and second molars. Force was applied via 7 mm closed Ni-Ti coil spring (G&H Wire Company, Greenwood, Ind) extending from the buccally placed mini-screw to the palatally placed mini-screw. (Figures 4,5) In both sides, 3 mm intrusion was achieved before the placement of prosthetic implants. After occlusally enough space was achieved, assisted prosthetic implants were placed surgically in both mandibular posterior segments (BioHorizons Implant Systems Inc, Birmingham, AL). During the 3 months healing period, intrusion was continued and totally 4 mm intrusion was achieved at the end of treatment. Because of vertical space was less than 4.5 mm, screwable prosthesis was selected for mandibular right implants. Fabrication abutments for mandibular right implants, castable abutments for mandibular left implants were selected. (Figure 6) The healing abutments were removed and custom and plastic abutments were adjusted and screwed. An closed-tray impression of the abutment copings was made with vinyl polysiloxane impression material (Elite H-D, Zhermack, Italy). Individual abutments that obtained from plastic abutments were adapted.

placed and secured using 35-N cm torque. The metal-ceramic restorations of mandibular left implants were cemented, the metal-ceramic restorations of mandibular right implants screwed onto the implant. Metal-ceramic restorations were placed on to abutments to verify marginal integrity, occlusal relationships, and esthetic results. For the first year after treatment, the patient was followed for routine hygiene and assessment of long-term outcome. The patient acknowledged having improved function and esthetics, and was pleased with the results. (Figures 7,8)



Figure 3. For intrusion, elastic chain applied left side.

After metal-ceramic restorations were completed, at insertion, the healing abutments were removed and custom abutments were



Figure 4: For intrusion, Ni-Ti coil spring applied right side.



Figure 5. Occlusal photographs of the applications.



Figure 6. Castable plastic abutments.



Figure 7. Post treatment intraoral photograph (Right Side).



Figure 8. Post treatment intraoral photograph (Right Side).

Discussion

When prosthodontic treatment of a missing molar has been delayed, the traditional treatment has been to reduce the crown length of

the tooth opposite the extruded tooth⁸ or to adjust the path of intrusion. Intrusion by subapical osteotomy⁹ or extraction of the extruded molar are more aggressive alternatives, but most patients today refuse to sacrifice a healthy tooth.

Anchorage control plays an important role in orthodontic mechanics. During conventional orthodontic treatment for intruding overerupted molars, it is difficult to avoid the side effect of extrusion of the anchorage teeth. Some appliances such as high-pull headgears could be used for molar intrusion, but the patient's compliance is essential.

Various implant systems have been used for orthodontic intrusion. Southard et al¹⁰ reported that molar intrusion is possible by using dental implants. Sherwood et al⁶ reported four cases with miniplate anchorage to close skeletal open bite. They reported that superimposition of panoramic tracings showed that a mean molar intrusion of 1.99 mm. Kanomi¹¹ reported an adult patient with a deep bite, which was corrected with 6 mm of lower incisor intrusion by an intrusive force from a mini-implant. Umemori et al⁵ presented a skeletal anchorage system to correct an anterior open bite. They implanted the titanium miniplates at buccal aspects of the mandibular molars and intruded the molars about 3 to 5 mm. Daimaruya et al¹² intruded the mandibular molars 3.4 mm by the intrusive force from buccal miniplate and lingual bone screw in dogs. Erverdi et al¹³ reported that the zygomatic area was on useful anchorage site for maxillary molar intrusion. A cephalometric study demonstrated the effectiveness of skeletal anchorage for intrusion of maxillary posterior teeth to correct anterior open-bite malocclusion.¹⁴ Our experience substantiates that successful intrusion of molars can be consistently achieved with mini-implants as anchorage.

Today's mini screws are widely using for molar teeth intrusion. In contrast to traditional orthodontics, the molar intrusion facilitated with the mini-implants causes minimum extrusion of the adjacent teeth. Incorporation of mini-implants can achieve a significant amount of maxillary molar intrusion and is an excellent alternative to traditional method.^{6,15,16}

Regarding the optimum force for intrusion, Burstone¹⁷ suggested 20 g of force for intruding anterior tooth, and Gianelly and Goldman¹⁸ recommended 15 to 50 g of force for small teeth. For molar intrusion, Umemori et al¹⁹

recommended an initial force of 500 g. Kalra et al²⁰ suggested about 90 g per tooth for molar intrusion in growing children, and Melson and Fiorelli²¹ used about 50 g buccolingually to intrude maxillary molars in adult patients. Considering the number and the surface area of posterior tooth roots, it is reasonable to apply intrusion forces 2 or 3 times greater than those applied on anterior teeth. In our study, we used 200 to 300 g of intrusion force on maxillary posterior teeth with 3 roots and obtained 0.5 to 1 mm of continuous intrusion per month without notable root resorption or vitality problems. However, further research is needed to provide a biological basis for these figures.

Fixed, removable partial, cantilever and implant supported prosthodontic restorations are frequently used for the prosthetic replacement of missing teeth.²² Bone quality, surgical procedure, the localization of implant, abutment and cementation are some of the factors affecting the success of implant supported prosthodontic restoration.²³ Precise fit between an implant body and an abutment and between an implant abutment and a superstructure are important factors in determining the long-term success of implant-supported restorations. Thus, when these fits are poor, tensile, compressive, and bending forces may be introduced into an implant-supported restoration and may result with loosening of the prosthesis or abutment screws, distortion or breakage of the restoration, microfractures in the bone surrounding the implant, or fracture of the implant body. As a result, they may induce loss of osseointegration.^{24,25}

Cement retention is well-documented in the dental literature that several factors influence the amount of retention in cement-retained restorations, whether they exist on natural teeth or implant abutments.²⁶ These factors are (1) taper or parallelism, (2) surface area and height, (3) surface finish or roughness, and (4) type of cement. Taper greatly influences the amount of retention that can be generated in a cement-retained prosthesis. Jorgensen²⁶ established that a 6-degree taper is ideal in crown preparations. He also determined the relative amount of retention for other tapers on prepared teeth and established an inverse relationship between taper and retention. His data show that a 15-degree taper provides approximately one third of the retention of the ideal 6-degree taper, and a

25-degree taper provides approximately 25% or one quarter of the retention generated by the ideal taper.

Screw retention of implant-supported prostheses was validated by studies of the Branemark system.^{24,27} Screws may be used to attach abutments to implants and prostheses to abutments. It is important that all screws should be torqued to the manufacturer's specifications. Screws designed for different purposes have different mechanical properties because of their size, design, and metallurgic composition. Screws should be tightened to 50% to 75% of their yield strength to provide optimum clamping force.²⁸ The torque that is applied to the screw is converted into tensile force in the screw (preload), and while under tension the screw holds the two components together (the prosthesis to the abutment or the abutment to the implant).²⁸ Fulcrums or pivot points are created at the edge where the abutment or casting meets the head of the implant

In a situation where there is an accurate fit between the head of the implant and the abutment, a continuum of pivot points is created around the circumference. In this stable situation, vertical occlusal forces that occur over the prosthetic head of the implant will produce vertical loading and will not stress the screw or cause screw loosening. This does not apply when inaccurate castings are screwed into implants and gaps are created.

Conclusions

By simply implanting mini-screws and controlling the direction and amount of force, successful molar intrusion can be obtained, satisfying both the patient and the dentist.

Declaration of Interest

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