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CASE REPORT

Maxillary Molar Intrusion using Mini-implants to gain vertical Space in the Antagonist Arch for Rehabilitation with Implant Prosthesis: An Interdisciplinary Approach

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ABSTRACT

Long-term edentulism leads to the encroachment of the space by the antagonist teeth, which interfere with the occlusion, function, and most importantly the vertical space required for replacement of the teeth. Dental implant therapy has taken over conventional fixed dental prosthesis as a treatment option since the last few decades. Minimum biomechanical requirement for the height of the implant prosthesis makes it imperative for the clinician to modify the height of the opposing tooth. Overcoming the conventional technique of tooth reduction, use of temporary anchorage devices like mini-implants, for tooth intrusion, provides a minimally invasive approach. This article describes a case where mini-implants were activated using elastics for maxillary molar intrusion to create space for the implant prosthesis to replace the missing mandibular molars.

Keywords: Implants, Intrusion, Mini-implants, Temporary anchorage devices.

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INTRODUCTION

Diagnostic assessment of the available restorative space before implant placement is of prime importance to gain information for treatment planning, attachment selection, and prosthesis design prior to surgical implant placement. Inability to accurately evaluate the available restorative space will result in esthetically, functionally, and structurally compromised prostheses and patient dissatisfaction. Adequate vertical space is an important consideration in successful implant restorative therapy.[1]

After a dental extraction, the teeth in the antagonist arch start to supra-erupt over a period of time. Supra-erupted teeth encroach upon the opposing edentulous space making replacement of teeth a complicated procedure. To regain the lost vertical dimension, the supra-erupted teeth need to be intruded back in place. Among the different types of orthodontically induced tooth movements, intrusion undoubtedly features as one of the most difficult to achieve. Anchorage is one of the key factors in achieving the desired and controlled intrusion. Extraoral anchorage devices like headgears or facemasks and intermaxillary elastics, though the most effective, depend on patient compliance. Intraoral anchorage devices, such as transpalatal arch and lingual arch do not require patient compliance, but they do not provide absolute anchorage. Within this context, mini-implants also known as "temporary anchorage devices" offer an effective skeletal anchorage, which has become an invaluable asset to orthodontists since it renders the intrusion of both anterior and posterior teeth an increasingly streamlined procedure from a mechanical standpoint.[2]

It is the purpose of this article, therefore, to describe and demonstrate clinically the way in which mini-implant can be utilized as an anchorage device to promote intrusion to achieve biomechanically sufficient vertical restorative space.

CASE REPORT

A 57-year-old female presented with a chief complaint of missing teeth in the lower left back region and inability to chew food from that side of the mouth. The missing teeth (36, 37) were extracted 5 years back due to dental caries and were never replaced. Intraoral examination (Fig. 1), radiographs (Fig. 2), and ridge mapping using bone calipers revealed adequate bone height and width for ideal implant placement.

On clinical examination, it was observed that the patient had class I malocclusion. The maxillary first molar (26) had supra-erupted in the lower edentulous area. The vertical space between the mandibular ridge crest and buccal cusp of maxillary first molar was merely 2 mm

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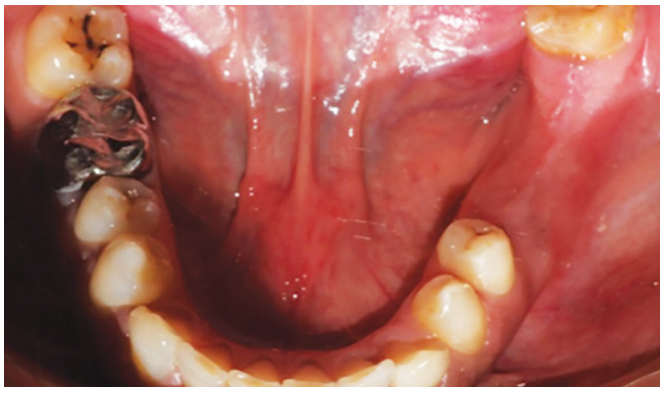


Fig. 1: Preoperative intraoral mandibular occlusal view

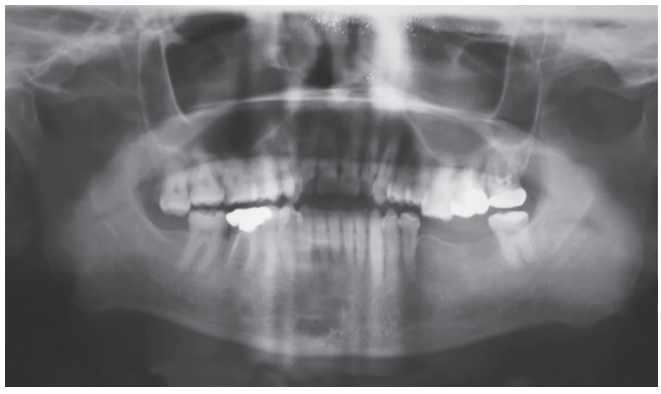


Fig. 2: Preoperative orthopantomogram

Fig. 3: A 2 mm vertical space between the mandibular ridge crest and buccal cusp of maxillary first molar

Fig. 4: Postimplant placement with healing abutments

(Fig. 3), making intrusion of 26 mandatory in order to be able to replace the missing teeth with implant prosthesis. Facebow record was made and the patient was guided in centric relation by bilateral manipulation, and bite record was made using bite registration silicone. The vertical space was measured after mounting the models in centric relation on a semiadjustible articulator. The treatment plan included placement of two implants in the 36 and 37 regions with simultaneous intrusion of the 26 using mini-implants, followed by conventional loading.

Implant Placement in the Mandible

Radiographic examination and bone sounding using bone calipers was done in the region of implant placement. Adequate bone height and width along with soft tissue dimension of 2.5 mm was facilitated for the flapless placement of the implants in the 36 and 37 regions. Punch cuts were made in the soft tissue using rotary tissue punch of 4 mm diameter. This was followed by osteotomy with increasing diameter of drills and two implants of sizes 3.75 × 11.5 mm were placed (ADIN Touareg dental implant systems, Afula, Israel). Healing abutments of 4.5 mm diameter and 3 mm height were attached and the implants were allowed to osseointegrate for 3 months before they were occlusally loaded (delayed occlusal loading protocol)[3] (Fig. 4).

Mini-implant Placement in the Maxilla

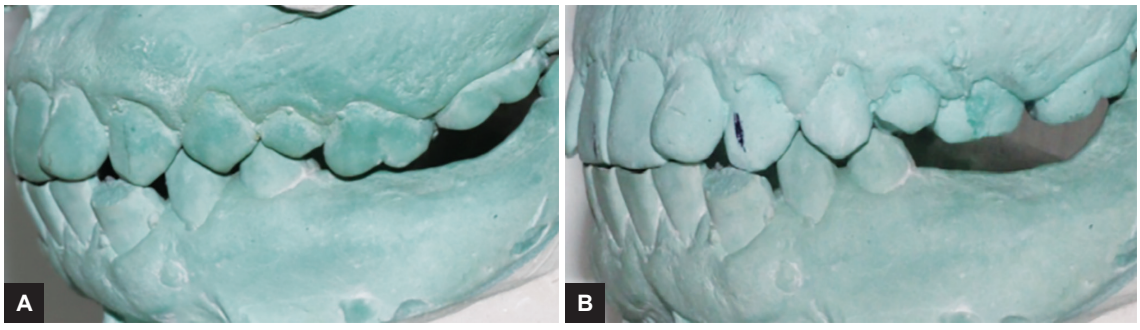
Simultaneously, orthodontic mini-implants were planned for the intrusion of the molar in the opposing arch. Safe distance was calculated mesiodistally between adjacent teeth radiographically at the widest distance between the two teeth. Buccolingual thickness and cortical bone thickness were also obtained to determine the dimensions of the required implants.[4] Orthodontic mini-implants with sizes 1.5 × 11.6 mm were placed (Aarhus mini-implants, Denmark), one in the buccal and one in the palatal region of the 26 (Fig. 5). The mini-implants had a ball attachment on its head, which were engaged with the elastics that ran diagonally across the occlusal surface of the tooth (Fig. 6). The patient was recalled after every 2 weeks to evaluate the intrusion of the molar and also for the progressive change of elastics.

Loading of Implants

Three months after mini-implant placement, a considerable intrusion of the molar was achieved with an increase in vertical space from 2 to 4 mm for the prosthesis over the implants in the mandible, which was measured after mounting the postintrusion models in centric relation on a semiadjustible articulator (Figs 7A and B).

Fig. 5: Orthodontic mini-implants placed

Fig. 6: Mini-implants activated using elastics



Figs 7A and B: Gain in vertical space from 2 to 7 mm

Fig. 8: Implants loaded with screw-retained prosthesis

Fig. 9: Prosthesis in occlusion

This is the minimum space requirement for placing a screw-retained implant prosthesis.[5] The alignment of the molar was achieved to follow the optimum curve of Spee. Closed tray and implant level impressions were made, and screw-retained prosthesis with metal occlusal surfaces were fabricated as the space created was not adequate for full ceramic prosthesis (Fig. 8). Four months after implant placement, at the cementation stage, the elastics were removed and the mini-implants were detorqued. Repeated supra-eruption of the intruded tooth was avoided due to the contact in occlusion with the opposing implant prosthesis (Fig. 9). Postcementation clinical and radiographic follow-ups (Fig. 10) were done.

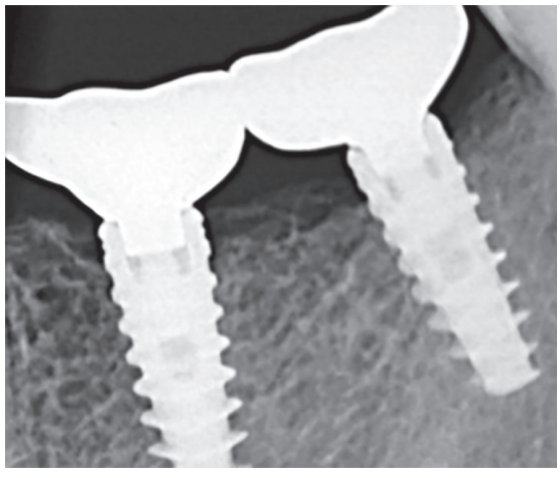


Fig. 10: One-year follow-up radiograph

DISCUSSION

Critical evaluation of the available restorative space during the diagnostic phase of implant treatment is necessary to determine the available prosthetic alternatives.[6] Attempts to fabricate prostheses with inadequate restorative space may result in physiologically inappropriate contours, structurally weak prostheses, esthetic compromise, and/or suboptimal retention and stability of the treated result.[1]

Placement of implants with a minimally invasive flapless approach has the potential to minimize crestal bone loss, soft tissue inflammation, probing depth adjacent to implants; to minimize surgical time; and most importantly to lessen the postoperative discomfort.[7] Long-term clinical observations indicate that the ideal tissue thickness is somewhere between 2.5 and 3.0 mm and that the presence of adequate soft tissue thickness greatly contributes to the maintenance of a stable periimplant soft tissue environment.[8] Hence adequate apicocoronal zone of attached soft tissue is a prerequisite for planning flapless implant surgeries. After critical evaluation of the vital structures and anatomic landmarks, this minimally invasive technique of implant placement can be followed.

A loss of dental units in the posterior region often brings about an extrusion in teeth on the antagonist arch. This extrusion not only compromises the space required for prosthetic rehabilitation but also can cause inconvenient results, such as periodontal defects and occlusal interferences during functional movements.[9] It is, thus, important to correct this problem by intruding the tooth in question.

In orthodontic treatments, adequate anchorage planning is paramount for a successful therapy. Tooth intrusion poses a considerable mechanical challenge given the difficulty in controlling undesirable movements of the anchorage units. Throughout the years, the literature has reported satisfactory results with the use of auxiliary intraoral and extraoral appliances. Nevertheless, it is not always an easy task to enlist a patient's cooperation owing to the physical discomfort and/or esthetic handicap inherent in these appliances.

In this case, mini-implants emerge as an excellent alternative to the conventional gross tooth reduction following endodontic therapy. The development of mini-implants in the last few years has enabled efficient anchorage, requiring no tooth support and no esthetic compromise whatsoever. Additionally, no patient cooperation is required.[10,11] These devices have been used with increasing frequency in cases where an inadequate vertical restorative space stands in the way of an effective prosthesis.

In situations where minimal interocclusal space exists, it may not be possible to achieve adequate retention for cement-retained restorations, because these restorations require a vertical component of at least 5 mm to provide retention and resistance form.[12] Screw-retained restorations can be attached directly to implants without an intermediate abutment, a therapy reducing the interocclusal space needed for these restorations.[13]

CONCLUSION

The vertical space should be evaluated prior to implant placement when treatment options are being considered. The purpose of this clinical report is to demonstrate a minimally invasive and effective procedure using mini-implants for increasing the available vertical restorative space to enable fabrication of functionally and esthetically pleasing restorations.

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