

# Method for the Placement of Palatal Implants

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**Purpose:** Palatal implants have been used in the last 2 decades to eliminate headgear wear and to establish stationary anchorage. The aim of this investigation was to establish a method and easy protocol for palatal implant placement. **Materials and Methods:** The study comprised 8 male and 15 female patients each having a 4.5 × 8-mm stepped screw titanium implant placed in the palatal region for orthodontic purposes. A surgical template containing metal drill housing was prepared. Angulation of the drill housing was controlled according to the radiologic tracing of the maxilla transferred to a plaster cast section in the paramedian plane. Implants were placed using a noninvasive technique (incision, flap, and suture elimination) and left transmucosally to facilitate the surgical procedure and reduce operations. The paramedian region was selected so as to avoid connective tissues of the palatine suture and because it was considered to be a suitable host site for implant placement. **Results:** After 3 months of healing, all implants were osseointegrated and no implant was lost throughout the orthodontic treatment. **Discussion:** Palatal implants can be used effectively for anchorage maintenance and space-gaining procedures. **Conclusion:** Usage of a 3-dimensional surgical template eliminated faulty implant placement, reduced chair time, and minimized trauma to the tissues while enhancing osseointegration. (INT J ORAL MAXILLOFAC IMPLANTS 2002;17:95–100)

**Key words:** anchorage, Class II malocclusion, dental implants, molar distalization, molar slider, noncompliance therapy, orthodontics, palatal implant

Class II malocclusion is one of the most difficult intramaxillary deviations to treat and stationary anchorage is one of the main concerns determining the success of treatment. Conventionally, extraoral appliances are used routinely to establish maximum anchorage. However, many patients reject the headgear wear because of social and esthetic concerns.<sup>1</sup> The success of treatment depends solely on patient cooperation. In many cases, lack of cooperation results in anchorage loss and unsatisfactory treatment results. Another disadvantage of the headgear approach is the possibility of creating serious facial injuries.<sup>2,3</sup> The difficulties of headgear wear have motivated many investigators to develop intraoral molar distalization mechanics. Some investigators have used the Nance appliance to obtain anchorage

from the palate; however, in most of these studies, anchorage loss was unavoidable and reduced hygiene under the acrylic resin button created inflammation of the soft tissue.<sup>4-7</sup> In recent years, studies have been directed toward the use of osseointegrated implants as an anchorage unit.<sup>8-13</sup> Experimental biomechanical studies,<sup>14,15</sup> studies on animal models,<sup>15-20</sup> and clinical investigations<sup>21-23</sup> have shown that dental implants placed in alveolar bone were resistant to orthodontic force application. However, patients who need orthodontic treatment generally have a complete dentition, so that there are no available sites for implant placement. Thus, alternative anatomic sites are required and some investigators have used the retromolar area<sup>11,24</sup> or palatal region.<sup>25-30</sup>

Using palatal implants for orthodontic anchorage is a new area of research and investigations on this subject are limited. Palatal implant orientation, in respect to conventional dental implant applications in the maxilla, is in reverse inclination. This reverse angulation of the implant long axis can misguide the surgeon in implant positioning and create a certain difficulty during surgical placement. The aims of this study were to evaluate a noninvasive surgical protocol by short-term outcomes of the treatment, and to propose a 3-dimensional surgical template for avoiding possible mistakes during palatal implant placement.

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## MATERIALS AND METHODS

The study comprised 8 male and 15 female patients, whose ages ranged from 19.5 to 25 years, with an average age of 22.5 years. All the patients presented Class II molar and canine relationships with a normal or low angle skeletal pattern (SN/mandibular plane angle  $< 37^\circ$ ). The cases were treated with a nonextraction treatment approach and maxillary molar distalization was required to gain space. All the patients required maximum anchorage. Each case employed a stepped screw titanium implant (Frialit-2 Implant System, Synchro Screw implants, Friadent, Mannheim, Germany), with a 4.5-mm diameter by 8-mm length, placed in the palatal region for orthodontic



**Fig 1** Lateral cephalogram with maxillary template.



**Fig 2a** Lateral view of plaster cast section with a tracing, and surgical template with drill housing containing a pilot drill.

purposes. For molar distalization, a Molar Slider (patent pending) was developed by one of the authors (AK) to achieve bodily molar distalization.<sup>31</sup>

### Radiologic Evaluation and Implant Positioning

Lateral cephalograms with maxillary templates were obtained (Fig 1). The acrylic resin template contained a spherical metal marker at the highest point of the palate. The purpose of using these templates was to calculate magnification of the radiograph to assess the exact bony dimensions, as well as to create a reference point sagittally for identifying the location of the drilling site for implant placement. After radiologic evaluation of the palatal bone morphology, a path for implant placement with its long axis passing superior to the incisor root tip, toward the anterior nasal spine, was determined. In the transverse plane, the implant was not placed directly into the mid palatal suture, which consisted of connective tissue. Rather, the lateral side of the palatal suture (paramedian region) was chosen as the implant bed to increase bony retention. There was enough bone volume to place an implant in a triangle between the nasal cavity, incisor roots, and palate. But the above-mentioned anatomic structures were close to each other. Thus, there was also a penetration or damage risk to these anatomic structures while placing an implant. To avoid such risk, there was need to use a surgical template, which could be used to guide the path determined by radiologic evaluation. The plaster cast used for template preparation was cut along the paramedian line passing through the mesial aspect of the central incisor. On the lateral cephalogram, the radiographic view of the maxilla and central incisor was traced on tracing paper and then cut along the pencil line and carried to the paramedian section of the plaster cast. A drill insertion hole was prepared in the acrylic resin template using a 2.5-mm-diameter stainless steel bur. A cylindrical metal housing 7 mm in



**Fig 2b** Surgical template in the horizontal plane. Notice the inclination of the drill through the paramedian region. Drill housing was fixed by pink acrylic resin.

length and 2.1 mm in diameter containing a pilot drill was placed into the implant access hole. The drill housing was fixed by orthodontic acrylic resin according to the desired implant inclination on the plaster model section. In the transverse plane, approximately 1 mm of distance from the palatine suture and in the sagittal plane palate–nasal spine path was preserved to avoid root tip and nasal cavity perforations. Thus, a 3-dimensional surgical template for accurate implant angulation was obtained (Figs 2a and 2b).

### Surgical Method

After mouthrinsing for 1 minute with 0.2% chlorhexidine gluconate (Klorhex, Döğsan, Ankara, Turkey), the palatal region was anesthetized using local anesthesia (Ultracain D-S, Hoechst Marion Roussel, Istanbul, Turkey), and a 3-dimensional surgical template was placed into the mouth to mark the implant location (Fig 3). A pilot drill was applied through the metal housing in the template (Fig 4a). After that, mucosa was removed using a punch drill, and the standard surgical protocol for placing the chosen implant system was followed (Fig 4b). Drilling was carried out at 1,000 rpm and under internal and external sterile saline cooling. Drills with 8-mm-long stoppers were used in the following order: a pilot drill of 2.0 mm-diameter, a twist drill of 3.0-mm diameter, and a 4.5-mm diameter spade drill. The implant axis was adjusted between 45 degrees to 60 degrees to the occlusal plane, toward the ANS. Care was taken to place the implant at a minimum 3 to 4 mm above the apex of the incisors. Implants were placed transmucosally, to avoid the second surgery, and facilitate impression and laboratory procedures (Figs 5a to 5c). To avoid postoperative pain and swelling, piroksikam of 40 mg per day (Felden Flash, Pfizer, Istanbul, Turkey) was administered for 3 days. Patients used a chlorhexidine

mouthrinse twice a day for 2 weeks. Implants were not loaded with force for a minimum of 3 months.

### Laboratory Procedures

After the healing period, impressions were made using a conventional technique for transferring the impression post and molar bands (in the necessary cases premolar bands) to a plaster cast. An orthodontic abutment (Friadent, Mannheim, Germany) was fixed to the implant analog on the plaster. With a 1.5-mm-diameter, stainless steel rigid wires were soldered to the molar bands and connected to the implant abutment, which had a vertical slot for wire insertion.

### Clinical Procedure

The orthodontic abutment was fixed on the palatal implant. Orthodontic bands, including the anchorage wires, were cemented to the first molars using glass-ionomer light-cure cement. The fastening screw of the orthodontic abutment was placed and tightened to increase stability. The orthodontic treatment for molar distalization was initiated and the Molar Slider was cemented (Fig 6).



**Fig 3** Three-dimensional surgical template placed into the mouth to mark the place of implant.



**Fig 4a** A pilot drill applied through the metal housing in the template.



**Fig 4b** Mucosa removal by punch drill.





**Fig 5a** Implant placement.



**Fig 5b** Implant neck above the mucosal level after removal of implant carrier.



**Fig 6** Molar Slider cemented to teeth and connected to the palatal implant for molar distalization.

**Fig 5c** (Left) Lateral cephalometric view of the palatal implant.

### Follow-up

Cephalograms were obtained after a healing period of 3 months to detect the presence of any radiolucent area in peri-implant bone. Percussion by metal probe was made to evaluate implant mobility. Peri-implant soft tissue health at each recall was recorded using the modified plaque index<sup>32</sup> (mPI) and modified sulcus bleeding index<sup>32</sup> (mSBI).

### RESULTS

After the 3-month healing period, neither any peri-implant radiolucent layers nor any forms of implant mobility were detected. Thus, implants were considered to be osseointegrated and were loaded with orthodontic forces. Oral hygiene treatment was administered as necessary at each session. Both the mPI

and mSBI scores were zero for 21 implants and 1 for 2 implants. Those are low scores indicating no plaque accumulation and bleeding for 21 implants and very little for 2 implants; thus, no inflammation was seen in peri-implant soft tissues. No implants were lost throughout the orthodontic treatment. No anchorage loss has been seen while distalizing the molars with the Molar Slider.

### DISCUSSION

The use of palatal implants has become a treatment alternative in the last 2 decades.<sup>25-30</sup> The esthetic and social concerns of headgear wear for molar distalization and the anchorage loss with the application of intraoral molar distalization mechanics has stimulated many investigators to use palatal implants as

anchorage. This treatment option can be criticized as necessitating surgery for a transient implant. But the benefits of this treatment alternative in comparison with conventional treatment using headgear or intraoral appliances are significant. The major advantage of using palatal implants is the preservation of anchorage while moving the molars distally. Class II patients who required maximum anchorage were treated effectively with the application of palatal implants. The results of the present study showed that the implants were stable after the application of orthodontic force and there was no anchorage loss in the anterior segment. When a noninvasive placement technique (elimination of incision, flap, and sutures) is combined with 1-stage surgery, the surgical approach is simplified and well-tolerated by patients. In the present study group, patient acceptance of the surgery was positive and postoperative pain and discomfort symptoms were negligible.

Use of the conventional surgical procedure *ad modum Brånemark* was applied by Bernhardt and coworkers<sup>33</sup> in the placement of palatal implants. This conventional implant surgery requires a full-thickness flap with considerable extension to visualize the operation field. For implant placement in alveolar bone, this requirement is helpful for detecting possible dehiscences or fenestrations around the implant, and to facilitate intraoperative decisions concerning implant angulation and diameter. With regard to palatal implants, the surgical procedure can be simplified by elimination of the incision, flap-raising, and sutures, because the operation field in the palate is a quasi-flat surface and there is no risk of creating bony defects around the implant. Thus, a punch drill can perforate mucosa overlying the decided implant site. This can decrease operation time, postoperative complications, edema, and pain. As the palatal mucosa is highly keratinized, peri-implant soft tissue conditions are favorable, creating a firm connective tissue sealing. Thus, there is little risk in leaving the implant to heal transmucosally. Transmucosal palatal implants cannot be disturbed by chewing forces and are not preloaded because of their central localization.

In the present study, the implant neck was not totally embedded to the cortical level, but rather at the mucosal level to achieve 1-stage advantages. The findings of another 1-stage orthodontic implant system study also confirmed these results.<sup>29,30</sup> At the conclusion of orthodontic treatment, surgical attempts can be made to cover the implant using punched mucosa or sliding flaps. In the present study, implants were removed with reverse torque using extracting forceps, and implant sockets were left to heal without further treatment.

Major difficulties of the treatment involve the nonconventional angulation in implant positioning, which can misguide the surgeon and reverse inclination of the impression posts toward the pharynx that makes a normally easy screwing procedure a time consuming step. Primary stability is a prerequisite in implant dentistry. In the present study, lateral angling of the implant was performed to avoid placement into the connective tissues of palatine suture and to obtain more bony retention, as shown in the study of Mombelli and associates.<sup>32</sup> This angling also facilitates visualization and handling of the handpiece.

To eliminate mistakes in radiologic evaluation of pertinent anatomic structures, the usage of a template is mandatory. Because of cephalometric radiograph magnification, metallic markers were used and they served as a dimensional reference to assess the exact dimensions on the radiography, in addition to selecting the correct size implant. The same template can also be used for treatment planning on the plaster cast and as a surgical template during surgery to facilitate implant bed preparation. In preparation of the surgical template, attention was paid to placing the drill housing from the palate toward the nasal spine. Drill housing was angled at about 30 degrees in the frontal plane. The purpose of placing the implant with this inclination was to have adequate bone volume around the implant. Tracing of the maxilla enabled this procedure and the risk of surgical penetration to the nasal cavity was also avoided. The use of surgical templates in this study reduced operation time, increased the precision of implant angulation, eliminated improper implant positioning, avoided anatomic structure damage, and thus confirmed the results of other authors who have described the utility of surgical templates.<sup>34,35</sup>

## CONCLUSION

Contemporary orthodontic treatment requires minimum treatment time and maximum treatment efficiency with minimum patient cooperation. Palatal implants can be used effectively for anchorage maintenance and space gaining procedures in orthodontics. No cooperation was required (no headgear), except good oral hygiene. Noninvasive techniques ease the surgical procedure and reduce operation time. The paramedian region was proven to be a suitable implant site for orthodontic purposes. Transmucosal placement eliminated second-stage surgery. Usage of a 3-dimensional surgical template eliminated faulty implant placement and simplified intraoperative decisions concerning correct inclination of the implant long axis.

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