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Case Report

Single Implant Placement for Missing Maxillary Right First Premolar Using a Palatal-Facing Sloped-Platform Implant in A Sloped Ridge: A Clinical Report

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Abstract

Standard flat platform dental implants are used in single edentulous areas, and, sometimes, the bone crest develops a slope because of buccal bone loss. A sloped implant can be used in such cases so that the implant platform matches the shape of the ridge. The bone's level and shape could help determine the implant's position, but the margin of the planned crown dictates this; therefore, the bone, implant, and crown must have a specific relationship to obtain an optimal restoration. This clinical report describes the use of a sloped dental implant with the slope facing the palatal region owing to the anatomy of the buccal bone and maintaining the proper biological width for restoring the maxillary right first premolar. At the 5-year follow-up, we found that the implant had caused no complications.

Keywords: Single Implant; Maxillary Right; First Premolar; Palatal-Facing; Sloped-Platform

Introduction

Establishing healthy peri-implant tissue is critical for determining the long-term function and aesthetics of implant-supported restorations [1]. However, owing to anatomical defects, the morphology of the alveolar bone can be irregular around the implant site [2]. Implant platforms of different shapes, including flat, scalloped, and sloped shapes, have been introduced in recent years to ensure favorable results [3]. Multiple clinical trials and reviews have shown reliable outcomes with standard flat platform implants [4-6]. However, constant vertical alveolar bone loss results in a sloped ridge. Sloped-platform implants are the optimal choice in such cases [7].

The use of sloped platform implants on bone sites with a sloped configuration from the lingual to the buccal surface results in the establishment of marginal bone levels at different vertical positions in the lingual and buccal aspects of the implants [2]. Further, animal studies that used implants with sloped platforms instead of the ones with flat platforms showed that the former provide favorable outcomes with regard to preserving the bone levels despite discrepancies during the time of implantation [8].

Numerous studies have shown that sloped implants provide reliable and favorable results for bone and soft tissue preservation. These are used at sites with irregular bone levels for both single crowns and complete arches when the implant slope matches the marginal bone [9-12]. Although sloped implants have generally been used with a slope configuration from the lingual to the buccal side, other possible slope configurations, such as mesial slope, for complete arch restorations using four implants with posteriorly tilted implants have shown positive outcomes [12-14]. Furthermore, when the biomechanical aspects of sloped implants were reviewed with finite element analysis, they were found to have achieved similar outcomes as traditional implants by significantly reducing mechanical forces around the bone for both single crown and complete arch restorations on four implants [14,15,17-21]. Other implant options, such as scalloped implants, have been used; however, they have failed to reliably and consistently preserve bone and soft tissue [3,16].

Short implants have shown similar results to those of conventional implants [22,23]. Regardless of the slope configuration, implants should be placed approximately 3 mm apical (3A) from the clinical crown margin (CCM) of the planned crown to maintain the space for biological width and leave approximately 2 mm (2B) of buccal bone to avoid its resorption–the 3A-2B rule [1].

To the best of our knowledge, there are no previous reports on the use of sloped implants with a palatal slope. This clinical report describes the use of a sloped implant platform with a palatal-facing slope to match the anatomy of the ridge in a patient who required the restoration of the maxillary right first premolar and presents the 5-year follow-up data.

Clinical Report

A 39-year-old woman visited the Mediterranean Prosthodontic Institute in Castellon, Spain, and requested a fixed solution for an edentulous space at the location of the maxillary right first premolar (Figure 1). A screw-retained implant-supported crown solution was proposed. Digital photography, periapical radiographs, and articulated casts were used to analyze the case. An irreversible hydrocolloid impression material (Cavex CA37; Cavex, Haarlem, The Netherlands) was used to obtain preliminary impressions of both the maxilla and mandible. Maxillary and mandibular diagnostic casts were prepared using Type IV dental stone (T.C. 15; Techim Group, Milan, Italy) and mounted on a semi-adjustable articulator. A wax-up of the maxillary right first premolar was performed. The occlusal surface and CCM of the newly planned restoration were determined using references from the adjacent, opposite, and contralateral dentitions.

Figure 1: The initial clinical situation of a single edentulous space.

The cast with the wax-up crown was duplicated using the irreversible hydrocolloid impression material (Cavex CA37; Cavex, Haarlem, The Netherlands) and Type III stone (Elite model; Zhermack), and a new cast was prepared. A thermoplastic template (Temp Splint 0.5 mm; Denta Flux, Madrid, Spain) was obtained from the duplicated cast. The template was cut by underlining the CCM of the planned crown, and a lead strip, as a radiopaque marker (made of 1 mm lead strips from periapical radiograph films), was fixed with sticky wax (Kerr, Orange, CA, USA) from the zenith of the buccal CCM to the zenith of the palatal CCM of the planned crown. Cone-beam computed tomography (CBCT) was then performed using a radiologic template to determine the relationship between the planned CCM and the remaining alveolar bone.

A computer software (Simplant; Dentsply Implants, Hasselt, Belgium) was used for implant planning. Radiographic examination revealed a sloped palatal alveolar ridge at the planned site. The palatal area had an insufficient occlusal edge. Although the alveolar ridge was 8 mm from the buccal to the palatal side, allowing us to obtain the 2B [1] after osteotomy, there was a discrepancy in height at the palatal area. Hence, a sloped dental implant needed to be placed 3 mm from the CCM of the planned crown, with the slope facing the palate (Figure 2). A supracrestal full-thickness flap was raised, and the first perforation was made on the alveolar crest 4 mm from the buccal plate such that 2 mm of the buccal bone could be retained after the final osteotomy.

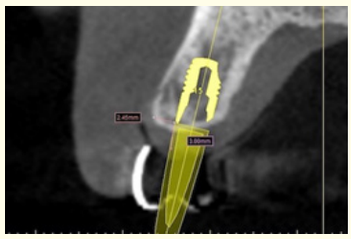

Figure 2: Edentulous alveolar ridge showing sloped side facing the palate and matching with the bone surface of the sloped implant.

Osteotomy was performed by accessing the occlusal surface of the surgical guide. An implant with a sloped platform (OsseoSpeed Profile EV 4.2 PS, 8 mm, Astra Tech; Dentsply, Mannheim, Germany) was placed [22,23] 3 mm from the CCM planned restoration,[1] with the slope facing the palatal direction to match the sloped ridge morphology and compensate for the bone discrepancy (Figure 3). A healing abutment (Healing Uni EV 4.2 Ø 4, 6 mm, Astra Tech; Dentsply, Mannheim, Germany) was screwed on to the implant. The flap was sutured using 5-0 PTFE suture (KLOSURE Suture, REGENimmune, Inc.; Woodland Hills, CA, USA) at the mesial and distal ends of the implant. Antibiotics and anti-inflammatory medications were prescribed. One week later, the sutures were removed.

Figure 3: Sloped implant at the bone level and slope facing the palatal side.

After 8 weeks, the healing abutment was removed. CBCT was performed to evaluate the level of the buccal and palatal bones (Figure 4), and an impression coping (Implant Pick-Up EV Design; Astra Tech; Dentsply, Mannheim, Germany) was screwed to the implant. An open-tray definitive implant-level impression was prepared using a polysiloxane impression material (Coltoflax; Coltène/Whaledent AG, Altstätten, Switzerland). Soft tissue was reproduced in the impression using vinyl polysiloxane (Gingifast Rigid; Zhermack, Rovigo, Italy), and Type IV stone (T.C. 15; Techim Group, Milan, Italy) was poured in the definitive cast. The ideal emergence profile and contour of the soft tissue at the level of the planned CCM were created using a laboratory bur, and the silicone was shaped until the desired shape was obtained.

The definitive maxillary cast and mandibular cast were scanned (Scanner S600 ARTI; Zirkonzahn), a virtual interim restoration was designed, and then, from a block of acrylic resin (Temp Ba-

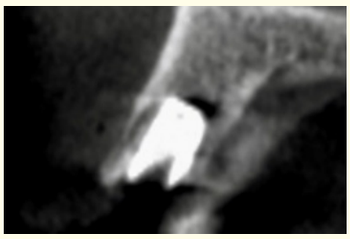

Figure 4: Radiological imaging showing the buccal and palatal bones at the implant level.

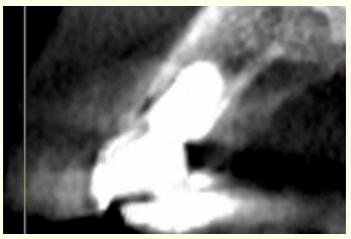

Figure 7: CBCT imaging showing the buccal and palatal bones at the implant level after 5 years in service.

sic; Zirkonzahn), acrylic resin provisional restoration was milled using a milling unit (Milling unit M5; Zirkonzahn). The provisional restoration was disinfected using 0.12% chlorhexidine gluconate (chlorhexidine Lacer; Lacer) and tightened manually. The temporary crown was screwed onto the implant, occlusion was evaluated, and interproximal contacts were checked. The screw access opening was covered with Teflon tape and hard-body silicone (Coltoflax; Coltène). Tooth shade A3 was selected using the VITA shade guide (VITA Classical A1-D4® Shade Guide; VITA Zahnfabrik) at the same visit.

A definitive monolithic zirconia (Prettau; Zirkonzahn) screw-retained single crown was prepared in the laboratory. The interim prosthesis was removed, the definitive screw-retained crown was screwed at 25 Ncm, and then the screw access hole was partially filled with Teflon and covered with composite (Figure 5). A periapical radiograph was obtained to verify the fit and marginal bone level. At the 5-year follow-up, periapical radiography showed that the interproximal bone remained at the implant level (Figure 6), and CBCT showed that the buccal and palatal bone levels had remained stable (Figure 7).

Figure 5: Maxillary right first premolar monolithic zirconia screw-retained single crown after 5 years in service.

Figure 6: Radiological imaging showing the marginal bone at the implant level.

Discussion

Implant sites are not always devoid of interferences. Multiple factors, including anatomical discrepancies, sloped ridges, and tissue conditions should be considered during implantation. Bone level heights can vary around the implant site, and flat-platform implants may not correct these bone-level discrepancies [7].

In many previous studies, sloped implants have been used in cases of buccolingual bone level discrepancies; the implants are usually placed with the slope facing the buccal aspect [2,17-31]. The sloped implants have been found to maintain marginal bone levels [8-12] and improve the width of keratinized mucosa over time [13]. Regarding the biomechanical behavior, both standard flat platform implants and sloped platform implants showed similar stress distribution and stress value outcomes [16,19]. Other implant options, such as scalloped implants, have been used for similar reasons, so as to adapt the implant platform to the bone morphology; however, these options lead to higher marginal bone loss than flat platform implants [3,6,21]. Other cases of the use of tilted sloped implants for complete arch restorations supported by four implants in the posterior mandible with the slope facing in the mesial direction have been reported [14].

In line with the 3A-2B principle, [1] 2 mm of buccal bone thickness must be maintained (2 B) to avoid resorption, but if the buccal bone were reduced in height to the level of the palatal bone to place a flat platform implant, the 3 mm distance from the planned CCM to the implant level (3A), corresponding to the space for biologic width, would be increased, resulting in a longer clinical crown in the apical direction. Since the short implants give similar results to the conventional ones, an 8mm implant was placed [22,23] which, if necessary, can be treated for peri-implantitis. If required to remove it, it would be easier and would leave a smaller defect. In our patient, after 5 years, the buccal bone and soft tissue remained stable. Prospective randomized controlled clinical trials are required to evaluate the clinical outcomes of the implant described in this clinical report.

Summary and Conclusion

In a patient with the absence of the maxillary right first premolar who presented a palatal bone deficiency, it was decided not to reduce the buccal bone and to place an implant with a regular

flat platform as this would increase the existing distance of 3 mm between the buccal margin of the planned crown and the level of the buccal bone, creating an apically elongated crown. Therefore, a sloped implant was placed with the slop facing palatal to adapt to the anatomy of the remaining bone crest and maintain the existing 3 mm distance corresponding to the biological width and thus obtain a symmetrical clinical crown with the remaining teeth, keeping the bone and soft tissues stable after more than five years in service.

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