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CLINICAL REPORT

Minimizing the discrepancy between implant platform and alveolar bone for tilted implants with a sloped implant platform: A clinical report

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ABSTRACT

In a patient with edentulism, distally tilted implants with a novel sloped implant platform were used to minimize the discrepancy between the implant platform and alveolar bone crest and to restore complete-arch monolithic zirconia implant-supported fixed prostheses. (J Prosthet Dent 2018;119:319-24)

Alveolar ridge atrophy limits the availability of bone for dental implant placement. Options for the treatment of patients with ridge atrophy have included distal cantilever restorations,[1] short implants,[2-4] and pterygoid tuberosity or zygoma implants.[5-10] When the posterior maxilla and mandible are highly atrophic, tilted implants,[11-19] as described in the all-on-4 protocol,[14] have been used. The tilting increases the anterior-posterior spread of the implants and avoids the impingement of anatomic structures such as the mental foramen and maxillary sinus. Tilted implants may offer a biomechanical advantage and reduce the posterior cantilever.

The use of an angled abutment on a tilted implant allows for an occlusal position of the screw access opening, making it possible to obtain similar buccal and lingual thicknesses of the prosthesis material on the left and right side of the screw-access opening; this is especially important with monolithic zirconia implant-supported fixed prostheses (MZ-FPs).[20]

Maintaining 2 mm of buccal bone is required to avoid resorption of facial bone after implant placement[21]; however, one of the potential biological complications of tilting implants is the discrepancy that is often created between the implant platform and alveolar crest (Fig. 1A).

Incongruity between the bone and implant may lead to deeper pockets and/or marginal bone loss in the peri-implant areas, which may be submerged below the alveolar crest, possibly interfering with the abutment. An alternative positioning of implants may be to place a portion of the implant platform supracrestally (Fig. 1B), but this also could lead to mucosal recession around implants and exposure of the textured portions of implants. Neither of these scenarios is biologically desirable.

The application of implants with a sloped platform has been reported.[22-24] However, the authors are unaware of reports of the use of sloped platform-tilted implants. The present clinical report describes the rationale and technique for the application of tilted sloped platform implants to minimize the discrepancy between implant platform and alveolar bone (Fig. 1C).

CLINICAL REPORT

A 53-year-old woman came to the Mediterranean Prosthodontic Institute in Castellon, Spain, wearing a maxillary complete denture and a mandibular partial denture with remaining mandibular left and right second molars (Fig. 2). The patient requested a fixed prosthodontic solution, which was planned with an implant placement and immediate loading protocol. Using computer software for implant planning (Simplant; Dentsply Sirona), 4 maxillary and 4 mandibular implants were planned with tilted distal implants.

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Figure 1. A, Tilted flat platform implant in distal subcrestal position. B, Tilted flat platform implant with mesial supracrestal position. C, Tilted sloped platform implant.

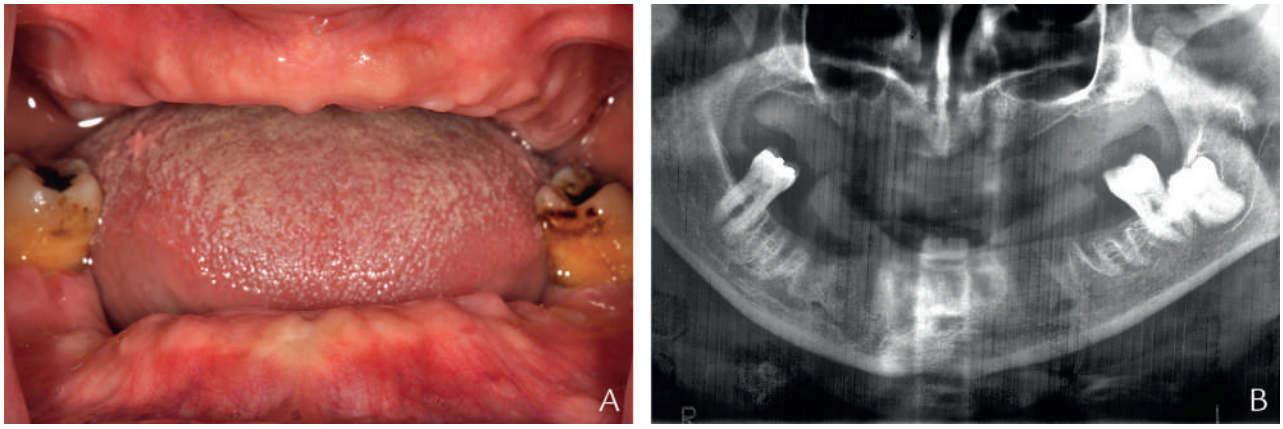

Figure 2. A, Preoperative view showing completely edentulous maxillary arch and partially edentulous mandibular arch. B, Panoramic radiograph revealed maxillary sinus pneumatization limiting maxillary posterior alveolar bone volume.

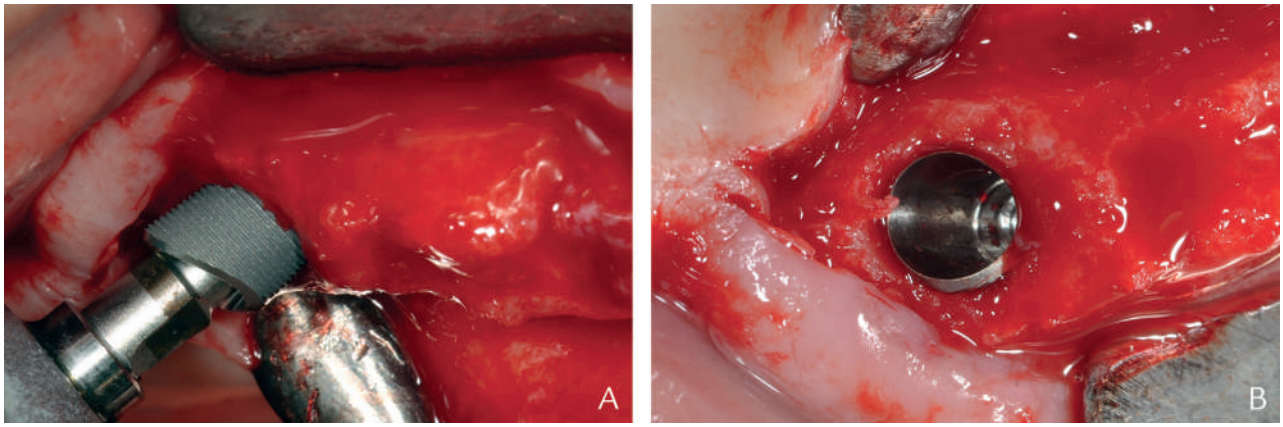

Figure 3. A, Sloped platform implants tilted in maxilla approximately 45 degrees anteriorly. B, Immediate postinstallation of maxillary posterior implant revealed mesial orientation of slopes of tilted implants.

A supracrestal full-thickness flap was raised using the existing maxillary prosthesis as a surgical guide. Drilling was performed to place the anterior implants with the access behind the incisal edge, and the posterior implants were tilted approximately 45 degrees in relation with the anterior implants (Fig. 3A).

Resorption was prevented by ensuring that 2 mm of buccal bone was present after osteotomy.[21] Two anterior implants, 4 mm in diameter and 6 mm long (OsseoSpeed TX 4.0 S, 6 mm, Astra Tech; Dentsply Sirona), were placed at the level of the 2 maxillary central incisors, and 2 sloped, tilted implants, 4.5 mm in diameter and 11 mm

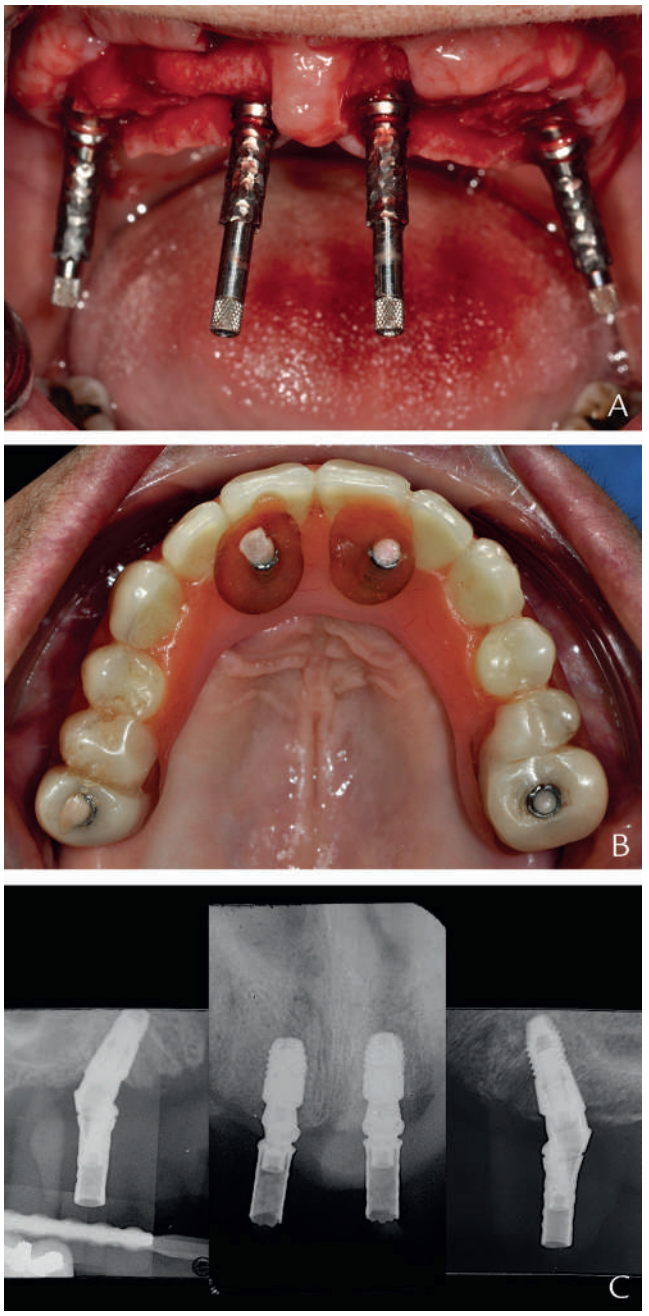

Figure 4. A, Interim cylinders on abutments. B, Interim maxillary prosthesis with screw access openings in palatal and occlusal positions. C, Distally tilted maxillary implants installed so that their slopes were congruent with contour of alveolar bone crest.

long (OsseoSpeed TX Profile 4.5, 11 mm, Astra Tech; Dentsply Sirona) (Fig. 1C), were placed at the level of both maxillary second molars.

The slopes of the tilted implants were positioned facing mesially to ensure that the full shape of the coronal portion of the sloped implants matched the flattened bone surface (Fig. 3B). Then, 2 straight abutments (45 degree UniAbutment 3.5/4.0-2 mm, Astra Tech; Dentsply Sirona) and 2 angled abutments (Angled Abutment 4.5/5.0-2 mm, Astra Tech; Dentsply Sirona) for screw-retained prostheses, both 2 mm in height, were screwed into the implants.

Angled abutments attached to the tilted implants were rotated on the implants through all 12 positions until parallelism between the 4 abutments was achieved. Four interim titanium cylinders (Temporary Cylinder, Uni 45 degree and Temporary Cylinder, Angled, Astra Tech; Dentsply Sirona) with previously made external mechanical lines of retention were screwed onto the abutments (Fig. 4A), and then the soft tissue was sutured with 3-0 silk (stoma-silk; Stoma). A rubber dam (Dental Dam; Medicaline, Intl Ventur, SA) was perforated and placed intraorally.

The prosthesis was positioned and evaluated for adequate fit in the posterior areas and for free space around the interim cylinders. Once the prosthesis was in the desired position, a light-polymerizing resin (Triad Gel, Clear Pink; Dentsply Sirona) was applied to the free space between the cylinders and acrylic resin and then light polymerized. The prosthesis was then unscrewed, more material was added, the cantilever was removed, and a convex prosthesis tissue junction was developed. The prosthesis was polished with pumice (Kerr Corp) and then disinfected in 0.12% chlorhexidine gluconate (chlorhexidine Lacer; Lacer). The prosthesis was hand tightened, and the screw access openings were covered with silicone putty (Coltoflax; Coltène) (Fig. 4B).

The occlusion was evaluated for bilateral contacts, canine guidance, and avoidance of interference in lateral movements. Periapical radiographs were made using a film holder, with the parallel technique. The marginal bone level was assessed on the day of immediate loading (Fig. 4C) and annually with the MZ-FPs.

After 2 weeks, 4 mandibular implants were placed. Two anterior implants, 4 mm in diameter and 11 mm long (OsseoSpeed TX 4.0 S, 11 mm, Astra Tech; Dentsply Sirona), were placed in the positions of the mandibular left and right laterals incisors, and 2 sloped implants, 4.5 mm in diameter and 13 mm long (OsseoSpeed TX Profile 4.5, 13 mm, Astra Tech; Dentsply Sirona) and tilted 30 degrees, were placed in the positions of the first left and right mandibular premolars (Fig. 5A); the same immediate loading protocol as described for the maxilla was performed (Fig. 5B).

After 6 weeks, abutment-level impressions were made, and the same restorative protocol described by Rojas-Vizcaya[20] was carried out for a double complete-arch MZ-FP, which was partially cut back for veneering

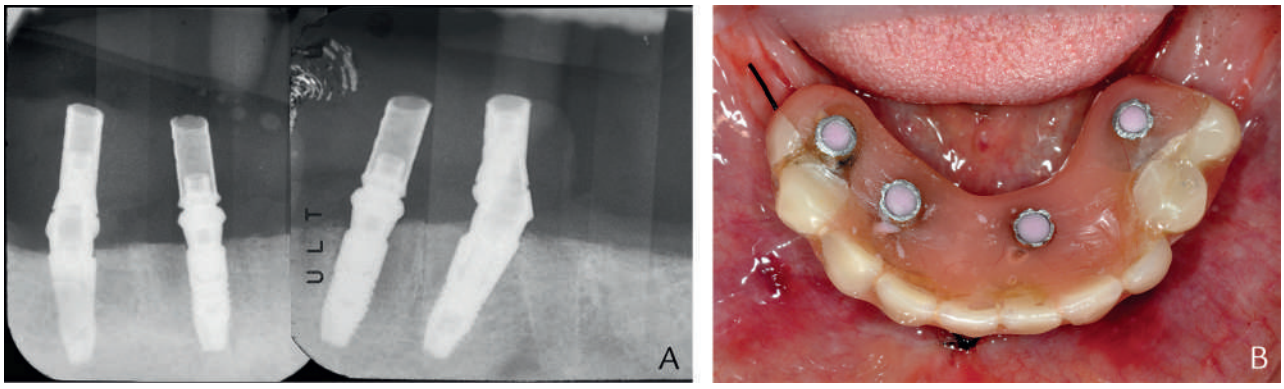

Figure 5. A, Posterior tilting of mandibular implants attempted to avoid impingement on mental nerve. B, Interim mandibular prosthesis with screw-access openings in lingual and occlusal positions.

ceramic (Prettau; Zirkonzahn) in the anterior zone (Fig. 6).

After 3 years in service, the bone has remained stable at the level of all implants (Fig. 7), and the double complete-arch MZ-FPs show no fracture of the zirconia structure or chipping of the ceramic (Fig. 8).

DISCUSSION

A complete-arch immediate rehabilitation by means of axial and tilted implants has been previously reported.[11-19] In a prospective study, Agliardi et al[18] reported an implant survival of 98.36% for the maxilla and 99.73% for the mandible at 1-year follow-up with 204 implants in the maxilla and 292 in the mandible. Marginal bone loss was 0.9 ±0.7 mm in the maxilla and 1.2 ±0.9 mm in the mandible, and no differences were found in marginal bone loss between axial and tilted implants.

In a clinical study, Maló et al[19] reported a cumulative survival rate of 97.3% at 5 years of follow-up with 189 implants, 166 in the maxilla and 23 in the mandible. Ninety-six of the implants were tilted, and 93 were placed in axial positions. The average marginal bone levels registered were 1.45 mm (SD=±0.83 mm) after 3 years and 1.72 mm (SD=±1.04 mm) after 5 years.

In the present clinical report, the bone remained stable at the level of all implants after 3 years, but no comparisons were possible because the authors are unaware of reports with this protocol using sloped tilted implants. All of the implants were placed slightly subcrestally and following the contour of the alveolar ridge at baseline, and all remained subcrestal throughout the follow-up period. Crestal remodeling occurred which reduced the magnitude of the alveolar bone crest. However, no threads of the implants were exposed and no marginal bone loss occurred.

The implant system used has a dodecagonal (double-hexagon) internal conical connection. The connected abutment engaged the internal hexagon on the intaglio side. The exposed portions of the angled abutments had tapered walls to draw the components together. Titanium cylinders were inserted into the prosthesis. The intaglio of the titanium cylinders had internal tapered walls that were complementary to that of the abutments.

Figure 6. Clinical image after treatment showing monolithic zirconia implant-supported fixed prostheses for both maxilla and mandible.

Placing tilted implants with a flat platform may require a surgical modification of the distal bone to avoid interferences with the abutment and to reduce the risk of pocket formation. Different degrees of rotation are possible to obtain a desirable relation between bone and flat platform implant or to improve primary stability. The length of the osteotomy is verified in its mesial portion.

SUMMARY

The need to reduce distal bone is lowered or eliminated by using the sloped, tilted implant. However, to obtain the mesial position of the slope, if extra degrees of rotation are needed, it is necessary to rotate a further 360 degrees to obtain the same mesial position of the slope. Verification of the length of the osteotomy is made in

Figure 7. Intraoral radiographs 3 years postoperatively showing stability of marginal bone. All implant platforms remained subcrestal showing no radiographic evidence of exposed implant threads.

Figure 8. A, Maxillary monolithic zirconia implant-supported fixed prosthesis with screw-access openings in palatal and occlusal surfaces. B, Mandibular monolithic implant-supported fixed prosthesis with screw access openings in lingual and occlusal surfaces.

both its mesial and distal portion, but if the mesial length is not the same length as that of the implant on the slope side, extra drilling will be needed until the mesial measurement of the osteotomy matches with the corresponding portion of the implant. Prospective randomized controlled clinical trials will be required to evaluate the clinical outcome of this clinical protocol.

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