Restoration of Failing Maxillary Implant-Supported Fixed Prosthesis With Cross Arch Splinted Unilateral Zygomatic Implant: A Clinical Report

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Management of one or more failing distal implants in an implant supported fixed prosthesis in a completely edentulous maxilla creates a challenging situation. Restoring immediate function with additional implants in such a situation can be a challenge considering the loss of supporting bone, need for grafting, age, and the patient's desire for immediate fixed dental prosthesis. This clinical report describes a situation where a zygomatic implant has been placed unilaterally and splinted with osseointegrated conventional implants by an immediate fixed provisional restoration.

Key Words: dental implant failure, immediate loading, zygomatic implant, edentulous maxilla

INTRODUCTION

Restoration of completely edentulous maxillae with an implant-supported fixed prosthesis has a predictable outcome with a long-term success rate.[1–7] However, a higher failure rate has been reported for implant treatment in edentulous maxillae compared with mandibles,[8,9] and its pattern is more common before loading and during the first year of function.[10–15] These failures can be attributed factors including lack of bone support and/or poor bone quality, heavy smoking, peri-implantitis, and overloading.[14,15] Failures of one or more distal implants in a completely edentulous maxilla can jeopardize the function with fixed prosthesis.

Treatment options for such failed distal implants situation can be a removable overdenture or a fixed prosthesis with additional implants. Placement of additional implants poses an anatomic limitation because of loss of supporting bone in the failed implant site, which may need further bone augmentation procedures.[15] Some of the drawbacks associated with these procedures may be need for hospitalization, morbidity of the distant donor site,[16,17] inability to use an existing prosthesis, and delayed placement of implants for the graft consolidation time.[18] In such situations the use of zygomatic implant is an alternative solution for the management of severe loss of supporting bone.[19–21] Good stability can be achieved from the zygomatic bone because of the anchorage provided in at least 4 cortical portions.[22] Splinting with 2 or more conventional implants in the anterior maxilla provides an excellent foundation for an immediate fixed dental prosthesis.[23–25]

This clinical report describes the management of failing distal implants in a maxillary implant-supported fixed prosthesis with a zygomatic implant and an additional conventional implant to restore immediate function and esthetics.

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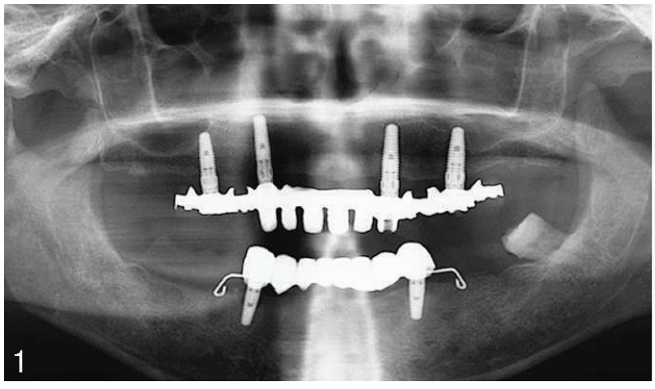
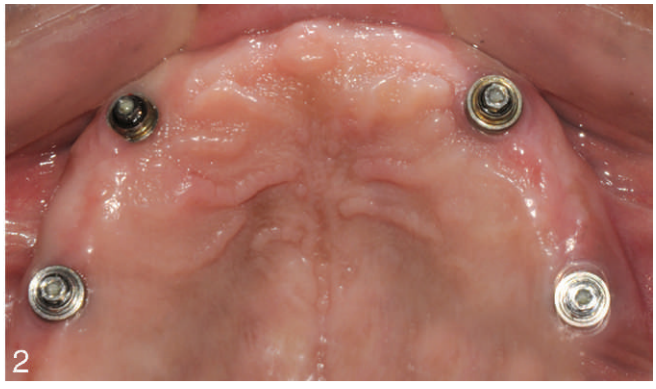
Clinical Report

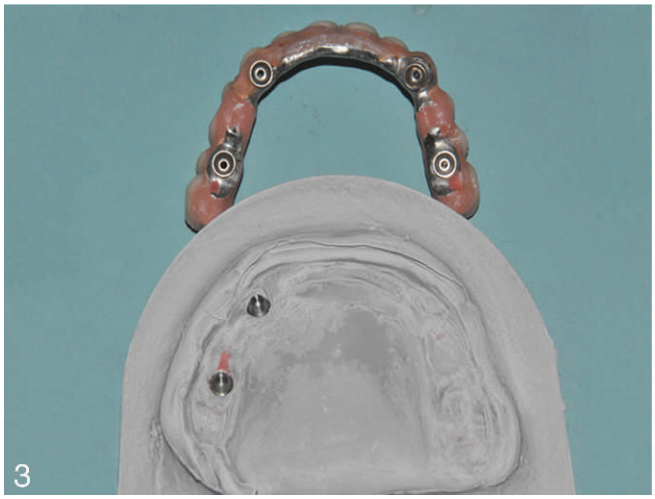
A healthy 72-year-old man reported to a private dental practice with a chief complaint of pain in the left maxillary posterior region for the past 3 months. On intraoral examination, the patient was found to have a maxillary full-arch implant-supported fixed prosthesis supported by 4 implants (Nobel Replace Tapered RP, Nobel Biocare AB, Göteborg, Sweden). It was opposed by an implant-supported fixed dental prosthesis anteriorly and a removable partial denture posteriorly. The patient reported that his maxillary implant-supported prosthesis had been in function for 2 years. Heavy occlusal contacts were noticed on the left side of the prosthesis in comparison to the right side. Radiographic examination revealed peri-implant radiolucency (Figure 1) in relation to 2 implants on the second quadrant. Upon retrieval of the prosthesis, the 2 implants exhibited mobility without any sign of inflammation of the soft tissue (Figure 2).

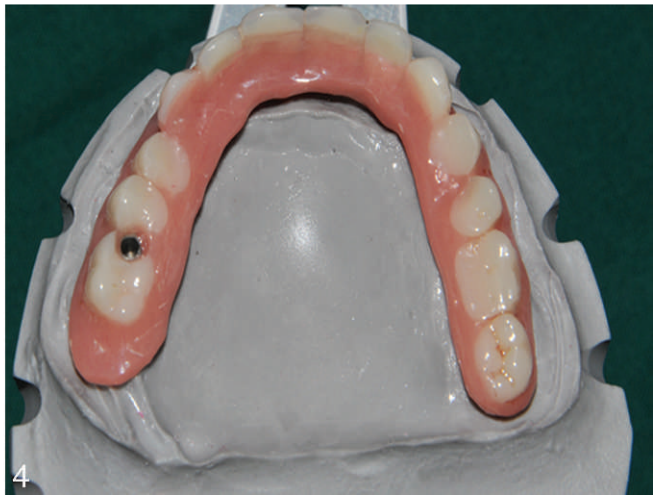
Various prosthodontic treatment options were discussed with the patient: removal of the failed implants followed by placement of 2 implants in adjacent sites, bone grafting with immediate placement followed by delayed loading, and bone grafting with delayed placement and delayed loading. Because the patient refused to wear a provisional removable prosthesis, the option of bone grafting and delayed loading was rejected. Considering the lack of adequate bone volume in the posterior maxilla, the consolidation time needed after a grafting procedure, the patient's age, and the patient's desire for an immediate fixed prosthesis, the option of placing 1 conventional and 1 zygomatic implant with immediate loading was suggested and accepted by the patient. Replacement of the existing mandibular prosthesis with a fixed partial denture supported by 4 implants was suggested.

Evaluation with a preoperative panoramic radiograph and a computerized tomography scan was









Figures 1–4. Figure 1. Pretreatment panoramic radiograph illustrating failing implants on left side of the arch. **Figure 2.** Intraoral view after retrieval of the prosthesis. **Figure 3.** Reverse fabricated maxillary working cast from the prosthesis. **Figure 4.** Provisional prosthesis on the working model.

used to plan the surgery. An immediate, functionally loaded, maxillary fixed implant-supported acrylic provisional prosthesis was planned for insertion after implant placement. Because the occlusal vertical dimension, harmony, and esthetics of the existing prosthesis were satisfactory, it was planned to use it as a guide for fabricating the provisional prosthesis.

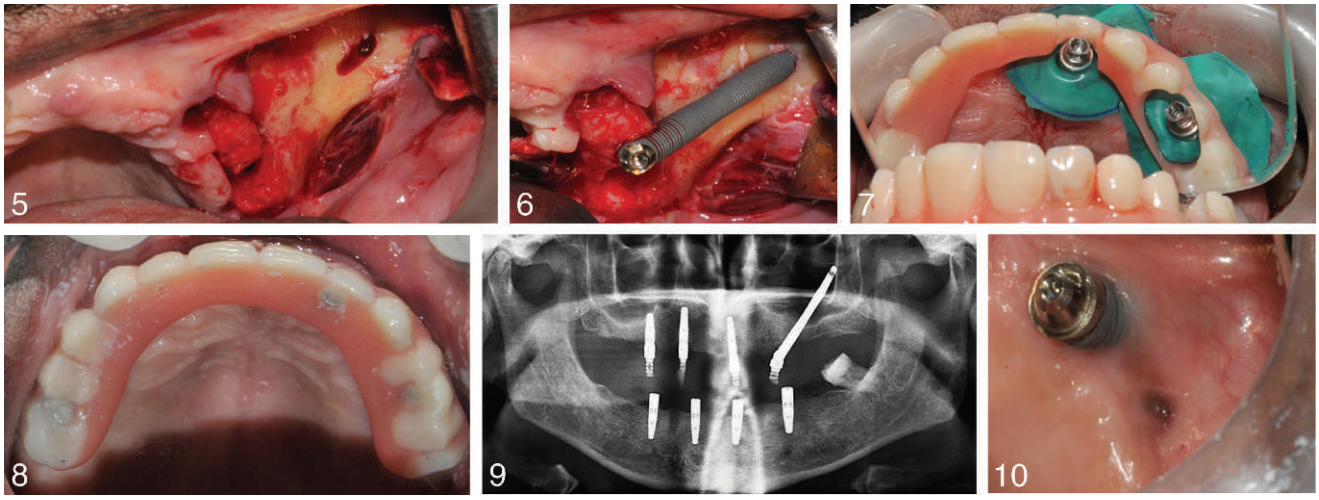
A maxillary working cast was obtained by connecting a multiunit abutment replica (Nobel Biocare AB) on the right side of the existing prosthesis and pouring the cast with type IV stone (Figure 3). A mandibular cast was obtained from an irreversible hydrocolloid impression (Tropicalgin, Zhermack, Badia Polesine, Italy). A face-bow transfer was made, and the casts were mounted in a semi-adjustable articulator (Artex, Amann Girrbach GmbH, Pforzheim, Germany) using an interocclusal record. The prosthesis was removed from the cast, and multiunit temporary copings (Nobel Biocare AB) were connected to the abutment replicas. Teeth arrangement was completed with a silicone index of the existing prosthesis and processed with autopolymerizing acrylic resin (ProBase Cold, Ivoclar Vivadent AG, Schaan, Lichtenstein) (Figure 4).

Under nasotracheal intubation, general anesthesia was administered, and 2% lignocaine with adrenaline was infiltrated into the left buccal vestibule. Crestal, anterior, and posterior vestibular releasing incisions were made, and the mucoperiosteal flap was elevated to expose the alveolar crest, the lateral wall of the maxillary sinus, and the inferior rim of the zygomatic arch. A retractor was used to ensure good visibility of the zygomatic bone. Failed implants in relation to #11 and #14 regions were removed. An acrylic provisional prosthesis was connected to the right-side implants to identify a prosthetically favorable position for the conventional and zygomatic implants to be placed. To reduce the posterior cantilever of implant-supported fixed prosthesis and to allow an additional anterior conventional implant, osteotomy for zygomatic implant was made as posterior as possible. Maxillary bone was prepared to gain access to the inferior edge of zygoma (Figure 5). During the sequential osteotomy preparation, the surgeon's thumb was positioned at the external surface of the upper edge of the zygoma to feel the preparation of the external cortical bone. A 40-mm zygomatic implant (Branemark System Zygoma TiUnite Implants, Nobel Biocare AB) was placed using the extra sinus technique after assessment of length with a depth indicator. Implant emergence was at the junction of #13 and #14. An insertion torque more than 45 Ncm was achieved during the placement. Subsequently, a 4.3-mm $\times$ 13-mm implant (Nobel Replace Tapered RP, Nobel Biocare AB) was placed in the #10 region following the standard osteotomy protocol (Figure 6). The surgical wound was closed and sutured.

A 1-mm straight multiunit abutment (Multiunit Abutment Nobel Replace RP; Nobel Biocare AB) was connected to the anterior conventional implant. A 2-mm, 17° angled multiunit abutment (Branemark System Zygoma Multiunit Abutments RP, Nobel Biocare AB) was connected to the zygomatic implant. They were tightened according to the torque values recommended by the manufacturer. Temporary copings were fixed to multiunit abutments, and a rubber dam was placed (Figure 7). Subsequently, the provisional prosthesis was connected to the osseointegrated implants on the right side, and an appropriate clearance was established around the temporary copings. An autopolymerizing resin (ProBase Cold, Ivoclar Vivadent AG, Schaan, Lichtenstein) was used to pick up the temporary copings by brush bead technique. After passive fit was verified, the prosthesis was finished in the laboratory. Occlusion was verified intraorally, and the implants were loaded immediately with the provisional prosthesis (Figure 8). After 7 months, the existing mandibular prosthesis was replaced with a fixed prosthesis supported by 4 implants. A radiograph was made after 10 months to confirm the osseointegration (Figure 9). Mild soft tissue recession was observed in relation to the buccal aspect of the zygomatic implant (Figure 10). The prosthesis was functional, signifying the success of the treatment modality using a zygomatic implant.

Discussion

Failure of one or more implants in a maxillary implant-supported fixed prosthesis is often accompanied by resorption of supporting residual alveolar bone. In such situations it can be difficult to resume use of a fixed prosthesis without considering bone-grafting procedures.[15] Conventional implants placed in grafted maxillary bone have shown a success rate of 90% or more, with delayed or



Figures 5–10. Figure 5. Osteotomy preparation of the lateral maxillary wall for the zygomatic implant. **Figure 6.** Zygomatic implant before flap closure. **Figure 7.** A rubber dam is placed to protect the tissues. **Figure 8.** Occlusal view of the provisional prosthesis. **Figure 9.** Panoramic radiograph of the implants at the 10-month follow-up. **Figure 10.** Exposed threads of the zygomatic implant.

immediate placement.[26,27] The inability to use a removable prosthesis during the graft healing and the extended treatment period can sometimes be of concern to patients.

Considering these disadvantages and the patient's desire for an immediate fixed prosthesis, the immediate-load zygomatic implant protocol was adopted in this case. Because of the density of the zygomatic bone, it was possible to achieve primary implant stability with an insertion torque higher than 45 Ncm to facilitate immediate loading. The placement of zygomatic implants using the standard technique often causes the implant heads to emerge too palatal, resulting in a large prosthesis that may interfere with phonetics, hygiene, and mechanical resistance of the prosthesis.[28–30] Considering the severe loss of alveolar bone after implant failure, the pronounced buccal concavity, and the disadvantages of the standard zygomaticus protocol, an extra sinus technique was adopted in this patient.[28–31] The engagement of the greater amount of bone with this technique offers greater initial stability during the implant placement.[31] It is also possible that instances of maxillary sinus pathology could be avoided with this surgical technique.[29]

Reported complications associated with zygomatic implants include postoperative sinusitis, oroantral fistula formation, periorbital and conjunctival hematoma or edema, lip lacerations, pain, facial edema, temporary paresthesia, epistaxis, gingival inflammation, and orbital penetration.[32] One concern with the extra sinus technique may be the long-term effect of exposed threads toward the soft tissue at the lateral aspect of the zygomatic implants, which needs to be explored.[29,30] New designs, such as the oxidized, nonthreaded implant surface for soft tissue integration, kindles interest in future research for this technique.

Summary

This clinical report has described the management of failed implants in a maxillary implant-supported fixed prosthesis by a unilateral zygomatic implant and an anterior conventional implant. A provisional prosthesis was fabricated using the existing prosthesis as a guide. Zygomatic and conventional implants were splinted with osseointegrated implants on the other side of the arch and loaded immediately. All the implants have shown successful integration with a follow-up period of 6 months.

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