

Complete maxillary implant prosthodontic rehabilitation utilising a CAD/CAM fixed prosthesis

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_Endosseous implant treatment has been widely reported as a highly predictable treatment modality with a low percentage of clinical complications. Prudent clinical judgement and careful consideration of the risks and benefits of various treatment options are essential for the treatment planning and long-term success of prosthodontic treatment.¹

Traditional implant prostheses are commonly fabricated using acrylic resin teeth supported by a metal framework. Significant space is designed at the tissue surface of the prosthesis to enhance oral hygiene maintenance. However, application of this prosthetic design in the maxillary arch is occasionally aesthetically inadequate and speech may be compromised.

Conventional porcelain-fused-to-metal-restorations require the placement of labial restoration margins below the free gingival margin in order to mask the hue and value transition between the sub-gingival implant sub-structures and the supra-gingival crown restorations. From a periodontal point of view, sub-gingival placement of restoration margins

is related to adverse periodontal tissue response.²⁻⁵ As a result, restoration margins are best placed coronally from the free gingival margin.^{4,5}

Porcelain-fused-to-metal restorations are commonly used in the posterior teeth because of their well-documented long-term clinical track record.⁶⁻¹³ CAD/CAM ceramic-based materials are prescribed nowadays, owing to their demonstrated promising physical properties^{14,15} and clinical longevity.¹⁶

This article describes the clinical application of high-strength zirconium oxide restorations in the prosthodontic management of an edentulous maxilla with a failing implant prosthesis.

_Clinical report

A 62-year-old female with an implant-supported maxillary prosthesis was evaluated at the Specialist Dental Group in Singapore. She presented clinically with a maxillary fixed complete denture supported by six endosseous implants (NobelReplace, Tapered Groovy, Nobel Biocare). The prosthesis had acrylic

Fig. 1 Pre-treatment intra-oral frontal view: A large space was noted between the intaglio surface of the prosthesis and the maxillary tissue, and there was significant tissue resorption on the labial surface of the implant over the maxillary right canine area. The patient was asymptomatic.

Fig. 2 Full thickness flap revealed the advanced bone loss on the labial surface of the implant. In spite of the tissue damage, this implant was clinically firm.

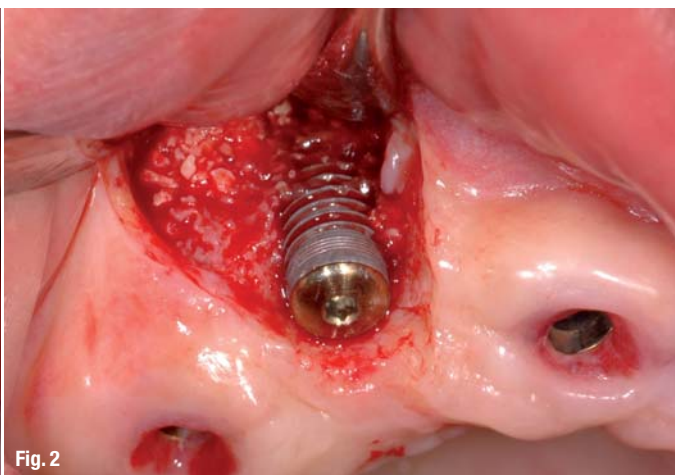




Fig. 3



Fig. 4

resin teeth supported by a gold alloy metal framework. The implant at the patient's maxillary right canine area was exposed. No symptoms were reported by the patient (Fig. 1).

An occlusal examination revealed a stable maximal inter-cuspatation position with insignificant centric relation to maximal inter-cuspatation slide at the teeth level. A canine-guided occlusal scheme was noted. No para-functional habits were reported. Sub-optimal maxillary lip support was noted. A significant amount of dead space was identified between the intaglio surface of the prosthesis and the maxillary soft tissue.

Upon removal of the maxillary prosthesis, all the maxillary implants were found to be osseointegrated. The patient desired to correct the failing implant, restore lip support, masticatory function and facial aesthetics.

The overall treatment plan included removal of the implant at the maxillary right canine area, replacement of a new implant at the maxillary right canine region and fabrication of a full-arch, zirconium oxide-based ceramic restoration in the maxilla.

Under local anaesthesia, the implant at the maxillary right canine area was removed surgically (Fig. 2) and a new 13 mm-long regular platform implant was placed (NobelReplace, Tapered Groovy). The new implant was submerged and primary wound closure achieved. Her existing prosthesis was re-inserted during the healing period to serve as a provisional prosthesis. Once osseointegration was achieved a few months later, the new implant was exposed and the maxilla was ready for prosthodontic rehabilitation after a few weeks of soft-tissue healing.

Six implant-level impression copings (Nobel-Replace) were placed onto the maxillary implants. High-viscosity, vinyl polysiloxane material (Aquasil Ultra Heavy, DENTSPLY DeTrey) was carefully injected around all the impression copings. A stock tray loaded with putty material (Aquasil Putty, DENTSPLY DeTrey) was seated over the entire maxillary arch to make the definitive impression. A jaw-relation record at the treatment vertical dimension was made with a vinyl polysiloxane material (Regisil PB, DENTSPLY DeTrey). The maxillary and mandibular definitive casts were mounted arbitrarily in the centre of a semi-adjustable articulator (Hanau Wide-vue, Teledyne Waterpik) using average settings.^{17,18} The custom zirconium oxide

Fig. 3 Maxillary prosthesis after the application of tooth-coloured porcelain: Excessive crown length was noted at this stage.

Fig. 4 Completed maxillary prosthesis with gingival-coloured porcelain applied to provide adequate lip support: Excessive crown height was reduced.

Fig. 5 Anterior view showing the CAD/CAM-fabricated full-ceramic implant abutments at the approximated vertical dimension of occlusion.

Fig. 6 Occlusal view of the maxillary arch before insertion of the maxillary prosthesis: Favourable anterior-posterior spread allowed the replacement of posterior teeth with distal cantilevering.



Fig. 5



Fig. 6



Fig. 7

Fig. 7 Completed maxillary implant-supported prosthesis; note the placement of the supra-gingival margins.

abutments with gold-alloy fitting surface (Procera, Nobel Biocare) were CAD/CAM fabricated according to the prosthesis design.

The development of the planned definitive maxillary restoration was carried out using a CAD/CAM process. The maxillary definitive cast with the custom full-ceramic abutments (Fig. 3) were scanned (Zeno Scan, Wieland Dental+Technik), and the prosthesis framework was designed using a software program (D700, 3Shape). The framework was milled in zirconium-base material (Zeno Zr Bridge, Wieland Dental+Technik) with a milling machine (Zeno 4030 M1, Wieland Dental+Technik). The prosthesis framework was sintered according to the manufacturer's recommendations. Subsequently, overlaying low-fusing, tooth-coloured porcelain material (IPS e.max, Ivoclar Vivadent) was manually applied onto the exterior to create proper anatomic form (Fig. 4). Low-fusing, gingival-coloured porcelain material (IPS e.max) was applied to create proper lip support (Fig. 5).

During the delivery clinical session, the old prosthesis was removed and the new custom abutments were torqued to 32 Ncm (Fig. 5). The new prosthesis was tried-in to verify colour, occlusion, lip support, teeth form, and comfort. Upon confirmation of the patient's acceptance, the implant abutments were sealed in gutta-percha (Fig. 6) and the prosthesis was cemented in resin-modified glass-ionomer luting agent (RelyX Unicem, ESPE).

The patient was evaluated two weeks post-operatively. Anterior guided occlusal schemes were verified intra-orally before and after prosthesis cementation (Fig. 7). The patient reported no discomfort and she had been functioning well with the new restorations. No abnormal clinical signs were noted.

Discussion

Osseo-integration is a well-documented and predictable clinical treatment option. On the other hand,

management of implant failure is also a clinical reality. In this clinical report, the failure of one implant at a crucial location indicated the need for re-fabrication of the whole implant prosthesis.

As the patient desired a high level of aesthetics, full-ceramic restorations were selected. By prescribing tooth-coloured ceramic abutments and full-ceramic restorations, prosthesis margins were made at the gingival level and gingival retraction procedures were eliminated during impression and prosthesis insertion.

Full-arch prosthodontic rehabilitation using fixed prostheses usually requires longer-term provisional restoration in order to facilitate a predictable treatment outcome. In this patient, the existing maxillary prosthesis served as a long-term provisional restoration for verifying her adaptability and multiple professional clinical adjustments of provisional restorations was not required. This treatment sequence increased the margin of safety in the execution of the definitive full-ceramic restoration. Intra-oral verification of the new treatment occlusal scheme and detailed *in situ* clinical adjustment of the restorations on the day of prostheses insertion still formed the essential foundation for proper treatment execution. In any major prosthodontic treatment, the patient should be informed of the potential financial and time implications should the need for re-fabrication of the restorations arise.

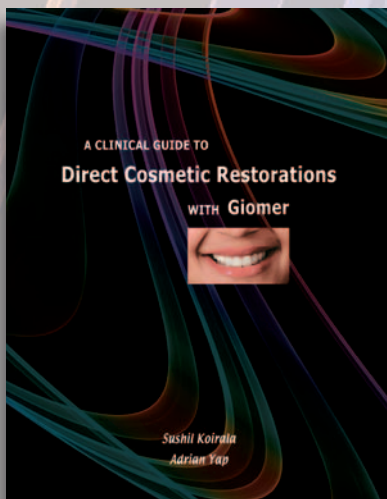
Conclusion

The functional management of an edentulous maxilla using a full-ceramic implant-supported maxillary prosthesis has been reported. New CAD/CAM-based restorative materials were used in treating this case. The use of high-strength full-ceramic restorations enhances overall aesthetic predictability and long-term functional outcome.

Editorial note: A complete list of references is available from the publisher.

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