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CAD-CAM implant abutments - A solution for the odds - A case report

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Abstract

Lowering the fabrication time and costs involved in conventional methods of implant crown fabrication are goals being constantly pursued.

Consequently, computer-aided design and computer-aided manufacturing technologies have evolved considerably offering improved and predictable outcomes. The treatment of patients with missing or non - restorable teeth with fixed prosthesis successfully can be challenging at times, it is noted as one of the finest services rendered to dental patients. The anterior single-tooth implant presents many restorative challenges. Several abutments have been developed in the pursuit of the Esthetic and functional solutions. This article describes a technique for a custom abutment. This abutment is copy-milled from titanium in an anatomic form and provides the flexibility to create Esthetic

restoration for the deeply placed anterior single-tooth implant.

A component that has a milled platform interface will be a more accurate fit than a component that has been cast.

This case report describes the prosthetic rehabilitation of a deeply placed implant using CAD-CAM milled titanium abutment in which stock abutments did not fulfil the requirement. A custom-made titanium abutment was milled through CAD-CAM for deeply placed titanium implant because of the lack of availability of bone in the maxillary anterior region, followed by rehabilitation with a cement-retained PFM crown.

Keywords: CAD-CAM, custom abutments, deeply placed implant, implant abutments, implant-abutment connection, implant superstructure, milled titanium abutments, prosthodontics

Case description

A 55-year-old male patient in good general health (ASA-I) presents himself to the Department of Prosthodontics, Vyas Dental College and Hospital, Jodhpur, for prosthetic rehabilitation of an implant (Adin Touareg™ S, Adin Implant Systems, Israel) in his maxillary anterior region that he reported to be placed 3-months back. A careful evaluation of the case and execution of diagnostic radiographic examination was done (Fig. 1). During treatment planning for restorative options, sub-optimal implant position was observed. In the given situation, following options were presented to the patient

- Complete surgical removal of malposed implant followed by grafting and a second implant placement at a later date
- Prosthodontic management by fabricating customized implant abutment.

Patient did not opt for any surgical procedures but was ready to proceed with the treatment option provided latter. A treatment plan was developed to overcome the two complex obstacles including deep seating and buccally angulated implant that prevented prosthetic restoration with a standard abutment, which incorporated the use of a customized CAD-CAM milled titanium abutment followed by cement-retained PFM prosthesis.

Procedure

- Implant head was exposed at second stage surgery under local anaesthesia (Lignox 2% A, Warren, Indoco). The cover screw was retrieved. Depth of gingival collar was noted to be 8 mm, and the maximum height of healing abutment available in used implant system is 6 mm only, which was not sufficient as it was getting submerged in gingival tissues, hence, closed tray transfer was used rather than using healing abutment (Figures 2a and 2b). The patient recalled after 2-weeks for the implant impressions (Figure 3).
- The closed tray impression coping was replaced with an open-tray transfer coping (Figures 4a and 4b). A radiograph was taken along the long axis of the implant to ensure that the impression coping was seated entirely into the hex of the implant.
- Monophase (Aquasil Ultra+, Dentsply Sirona) addition silicone impression material was loaded in an acrylic custom tray to make full arch implant impression.
- The hex driver was used to loosen the guide screw within the impression post. Impression tray was retrieved along with transfer coping, impression was checked for any voids (Figures 5a and 5b).
- Impression was dis-infected, lab analog was secured on impression coping, gingival mask was applied around the impression coping and allowed to set; pouring was done using Type IV gypsum product.
- Models were retrieved from the impression tray and were scanned using Medit T300 (Medit corp., Korea)

(Figure 6). Customised implant abutment was designed using software (Exocad Dental CAD GmbH) (Figure 7). Milling of the titanium blank was done of designed abutment (Figure 8).

- The milled titanium abutment was placed intraorally and verified radiographically (Figures 9a and 9b).
- The abutment was screwed to the required torque of 25 N-cm. The access channel was sealed using a cotton pellet.
- Luting GIC (Glass Ionomer FX, Shofu, Japan) was loaded in the prosthesis and was secured over the abutment with fingertip pressure, allowing sufficient time for the cement to attain the initial set (Figures 10a, 10b and 11).
- Excess cement was from the cervical area of the prosthesis.
- The occlusion was verified.

Post-cementation instructions were given to the patient.

Discussion

Restoration of an anterior tooth with a dental implant has become an alternative to conventional prosthodontic treatment.[1] A study demonstrated that a single implant has a survival rate of 97.9% after the first year and 96.3% after 5 years.[2] The success rate of a single implant is high but is not without complications, these may include

screw loosening, unfavourable implant angulation, gingival inflammation, and poor esthetics.[3-7] In the past decade, many abutments have been examined and, multiple solutions have been proposed to overcome these complications.

Some criteria for a single-tooth, transmucosal abutment include anti-rotational capability, titanium construction, ability for mechanical alteration, a machined fit to the implant body, and retrievability, and they have been clinically proven.[8] Examples of abutments proposed for the external hex-headed, screw type implant include the single-tooth restoration (STR) abutment, the UCLA abutment or non-segmented abutment,[9] the DIA anatomic abutment system (Steri-oss, Inc., Yorba Linda, Calif.),[4] the Cera One abutment (Nobel pharma USA, Inc., Chicago, 111),[3] and the conical abutment with a nonrotating gold cylinder.[10] Each one of these abutments has been used in attempts to resolve the stated complications, however, none of the abutments has met all the criteria.

Summary

Many forces can be exerted on the abutment and crown that can affect long term success of the prosthetics. Rotational forces are well known to affect single units. The intimate connection of the abutment head to the implants platform greatly influences this. The less intimate the fit, the more micromotion between the components and the greater the micro motion that will lead to either screw loosening or screw breakage. Thus, a component that has a milled platform interface will be a more accurate fit than a component that has been cast. This case report describes the prosthetic rehabilitation of a deeply placed implant using CAD/CAM milled titanium abutment.

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Legend Figures

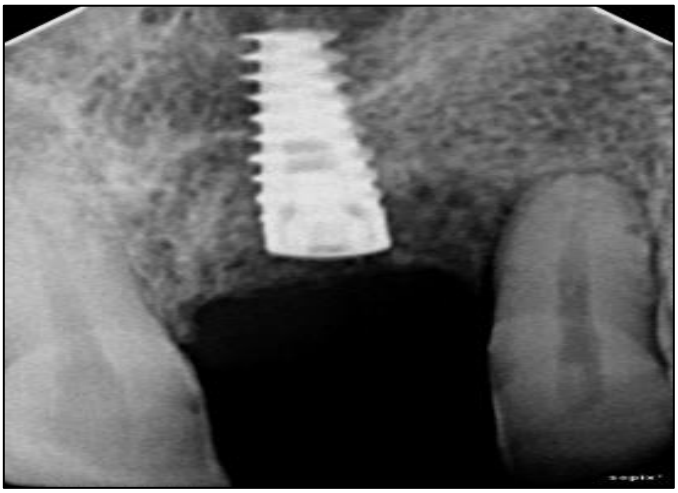

Figure 1: Pre-operative radiograph.

Figure 2a: Closed tray transfer coping used as healing abutment (labial view).

Figure 2b: Closed tray transfer coping used as healing abutment (lateral view)

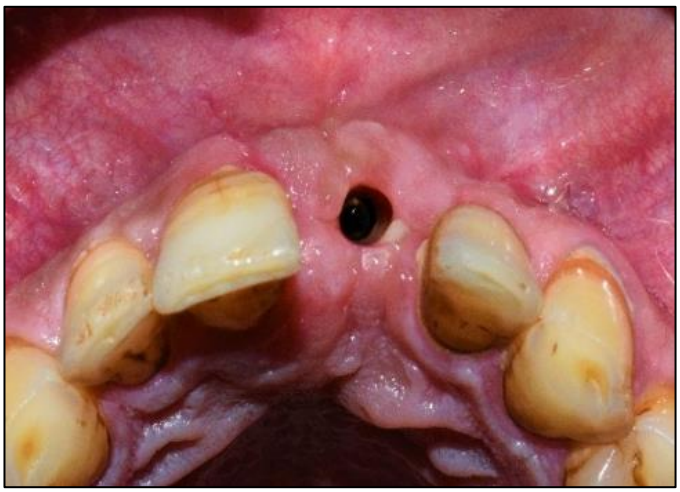

Figure 3: Peri-implant gingival collar formed after 2-weeks.

Figure 4a: Open-tray transfer coping seated on implant head (labial view)

Figure 4b: Open-tray transfer coping seated on implant head (lateral view)

Figure 5a: Implant-level impression made using mono phase impression material in custom-made acrylic impre ssion tray

Figure 5b: Impression checked for any voids.

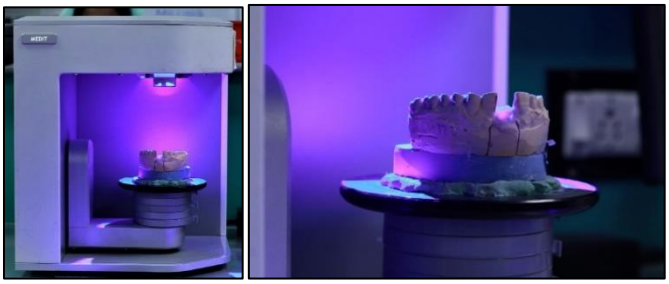

Figure 6: Gypsum model scanned using Medit T300

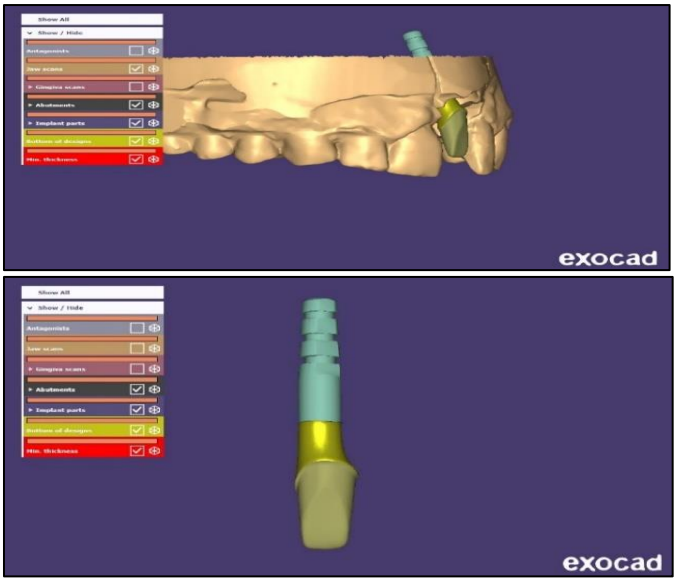

Figure 7: customized implant-abutment designing done using Exocad software.

Figure 8: Milled titanium abutment with its prosthetic screw.

Figure 9a: CAD-CAM milled titanium abutment intra orally.

Figure 9b: Radiographic verification done for checking fit of CAD-CAM milled titanium abutment.

Figure 10a: Porcelain-fused to metal crown intraorally.

Figure 11: Extra-oral photograph post-cementation of the implant prosthesis #21.