Case Report

Implants Supported Fixed Dental Prosthesis with Conventional Impression Technique – a Case Report

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Abstract

Dental implant is an alternative treatment to conventional dentures for patients who have lost their teeth. It is generally accepted that a suitable surgical technique and the passive fit of the associated prosthesis are keys to the success of the treatment. One of the most critical steps for the long-term success of implant prosthesis is to accurately and precisely perform the impression procedure. This report presented a case in which the impression was taken via a direct impression (open tray) technique using splinted impression copings with self-cured resin. Using this method, the accuracy of the definitive prosthesis was much enhanced, and the longer-lasting functional performance can be expected.

Key words: Dental implants, direct impression technique, implant impression procedure, passive fit, splinted impression copings

Introduction

Dental implant is an alternative treatment to conventional dentures for patients who have lost their teeth. It can provide long-term stability and comfort as well. An initial surgery is required to facilitate its placement of dental implants into the bone. Then in the second step a prosthesis is connected to the fixture by the screw. It is generally accepted that a suitable surgical technique and the passive fit of the associated prosthesis are keys to the success of the treatment. From a biomechanical perspective, a poor-fitted connection in-between prosthesis and the dental implant can increase stresses in the bone surrounding the dental implant which may lead to marginal bone loss. Furthermore, abutment loosening and subsequent prosthetic failure can be expected.[1]

To achieve passive adaptation of the prosthesis, obtaining a precise working model, which depends directly on if the impression is accurately taken, is very important.[2] With this issues in mind, the impression of a case presented in this report was taken via an open tray technique using splinted impression copings with self-cured resin. Therefore, the accuracy of the definitive prosthesis was found improved and the longer-lasting functional performance can be expected.

Case report

An old long-span bridge 17-xxx-13-x-11-21 of this 48-year-old female patient was dislodged from the upper right area. She denied having any systemic diseases or drug allergies. The clinical and radiographic examination showed that severe horizontal and vertical bone loss was found on teeth 13, 17 and 21. The intraoral photo showed 13,17,21 severe gingival recession, and lower dental midline was shifted to left side about 2mm. The extraoral photo showed mild concave of midface due to lost upper anterior prosthesis(Fig.1,2,3). And chronic apical periodontitis with incomplete endodontic treatment and secondary caries was noticed on tooth 24(Fig.4). Therefore, she came to the department of stomatology at NCKUH to seek for an acceptable prosthetic treatment plan for her esthetic and functional needs.

Tentative treatment plans given to the patient were included conventional removable partial dentures with extraction of tooth 13,17,21; implant-retained or -supported overdenture with extraction of tooth 13,17 and 21; implant retained fixed dental prosthesis with extraction of tooth 13,17 and 21.

Patient chose the treatment plan of implant retained fixed dental prosthesis with extraction of tooth 13, 17 and 21, and the clinical procedures were described as follows :

For the initial prosthetic treatment, remove bridge of tooth 24-25-x-27 and post-&-core of tooth 24, then fabricate provisional crown and bridge for tooth 24, 25-x-27 (Fig.5). Extracted tooth 13 and 21 with xenograft (Terudermis®) placement for soft tissue preservation and further ridge augmentation was performed. 3 weeks after the extractions of tooth 13, 17 and 21 primary impressions of upper and lower arch were taken with alginate for fabrication of upper interim denture. Upper jaw was fabricated and border molding was done for

Figure 1. The initial panoramic x-ray showed 13,17,21 advanced bone loss

Figure 2. The initial intraoral photo of frontal view

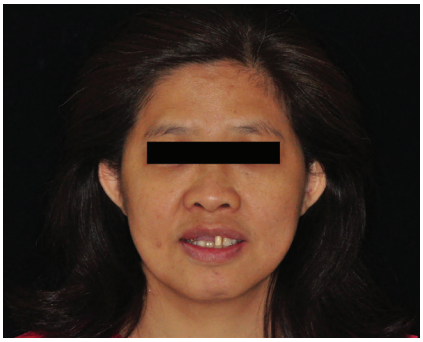

Figure 3. The initial extraoral photo of frontal view

Figure 4. The periapical film of tooth 24

performing final impression. The impression was poured to form master casts. Then occlusion rims were fabricated for recording jaw relation and tooth selection. Tooth setup trial was done to correct and verify maxillomandibular relations. Fabrication of upper interim was finally accomplished. The interim was delivered to the patient after minor adjustments and polishing (Fig.6).

For the guided bone regeneration treatment, surgeon used BioOss and auto-bone graft, which were placed over tooth 13-16 area. FDBA and BioOss were applied at tooth 11 area. Ti mesh and several tag screws were used for bone augmentation. Two weeks later, the sutures were removed and the patient was advised to come for follow-up.

Impression for fabricating upper surgical stent was taken after upper right area bone augmentation 10 months later. Then surgical stent try-in was arranged and dental CBCT was also checked (Fig.7,8). Four implants were placed over tooth 17-21 area. The diameters and lengths of used implants were listed as blow (Brand: Tapered groovy, NOBEL REPLACE) : Tooth 13: 3.5x10mm, Tooth 21: 3.5x10mm, Tooth 15: 4.3x10mm, Tooth 16: 4.3x8mm. Ti mesh was used for bone augmentation with BioOss bone graft. (Fig.9). Two weeks later, the sutures were removed and the patient was advised to come for follow-up.

After six months of implant placement, second-stage surgery was performed. Implant site 13, 15, 16 and 21 were surgically exposed, and healing collars were placed on the implants. Xenograft (Terudermis®) was also placed for soft tissue thickening. Two weeks later, the sutures were removed and the patient was advised to come for keratinized gingiva (KG) augmentation. Three months after 2nd stage surgery, we found the insufficient of KG around implants (Fig.10). Therefore, we performed another surgery for KG augmentation. The free gingival graft was harvested from the upper left palate. The size of the graft was about 2.0–3.0 mm in thickness and 30.0 mm in length. The graft was placed at the buccal site of implants 13,15 and 16.

Figure 5. The upper right edentulous ridge s/p 13,17,21 extraction

Figure 6. The upper interim delivery

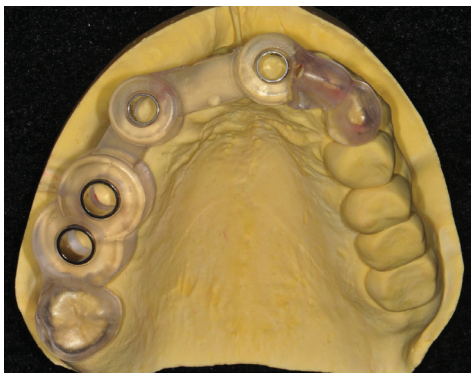

Figure 7. The CT guided surgical stent on the working cast

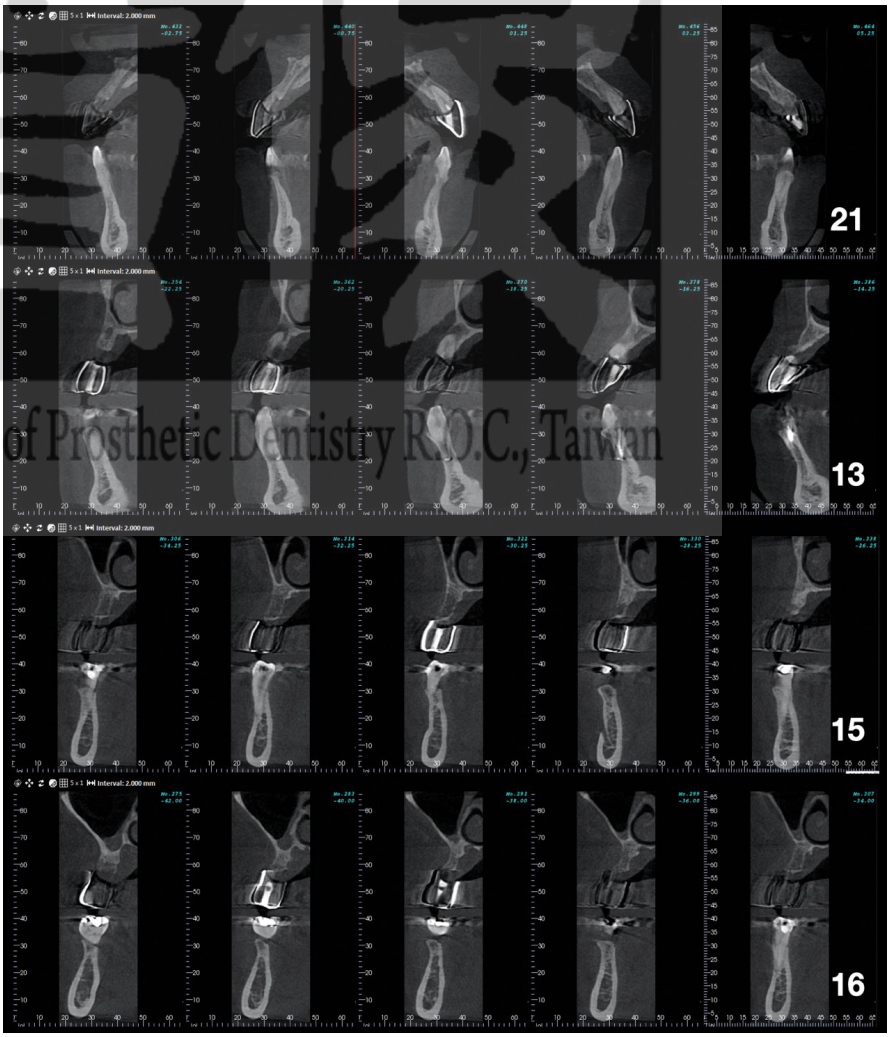

Figure 8. The CT images of teeth 21,13,15,16

After three months later, an increase in keratinized tissue was observed over the area of implants of 13,15 and 16, which makes the area more suitable for definitive prosthesis fabrication.

For the definitive prosthetic treatment, final impression for fabricating crown 24 and bridge 25-x-27 was taken using polyvinyl siloxane impression material after finishing endodontic treatment of tooth 24 and 25 and installing casting post for tooth 24. Impressions were poured and master casts were made. Zirconia crown 24 and bridge 25-x-27 were delivered to the patient after try in and adjustment.

Impression copings were placed on the implants, which were splinted with self-cured resin (Fig.11,12), and transferred impression technique was taken using polyvinyl siloxane impression material (Open-tray technique) (Fig.13). Impression was poured, and master cast was made (Fig.14). The temporary implant supported FDPs was fabricated after mounting on semi-adjustable articulator, then it was tried intraorally to ensure the implants' position and their passive fit (Fig.15). Scanning and planning for zirconia framework fabrication was done using CAD-CAM techniques. An try-in appointment of the zirconia framework was done to ensure the passive fitting on the master cast and intraorally. Radiograph was taken to evaluate the fit between bar frameworks and implant interface via one-screw test (Fig.16). Then bisque of definitive prosthesis was tried gingival contour was checked for veneering pink porcelain on 11-15,21 implanted teeth. Finally, upper hybrid denture was delivered to the patient after adjustment (Fig.17,18,19). Patient was advised to the routine follow-up after 1 year and re-checked the panoramic film to evaluate the fit between the definitive prosthesis and implant interface. (Fig.20).

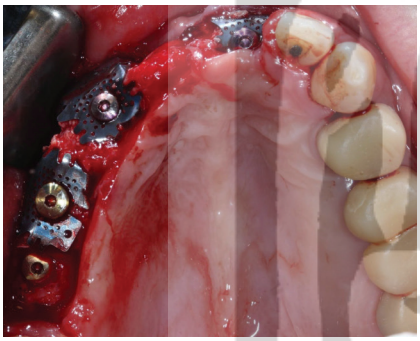

Figure 9. The implants placement over 13,15,16,21 area

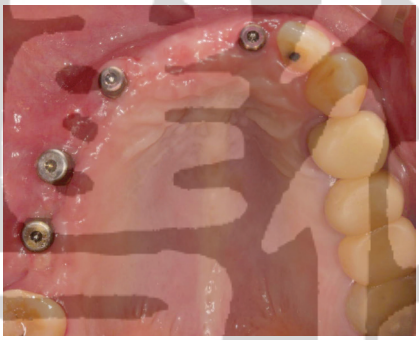

Figure 10. The 2nd stage implants surgery over 13,15,16,21 area

Figure 11. The verification jig fabrication

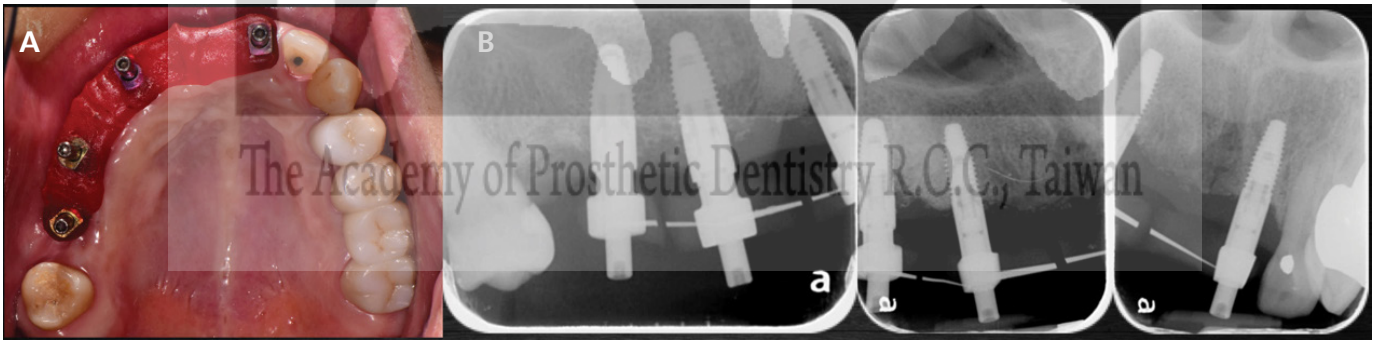

Figure 12. Splinting the 13,15,16,21 impression copings with self-cured resin material. (a) occlusal intraoral view; (b) periapical film

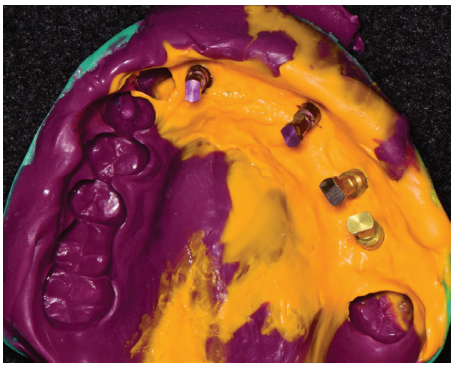

Figure 13. Open tray impression technique with PVS impression material

Figure 14. The upper master cast

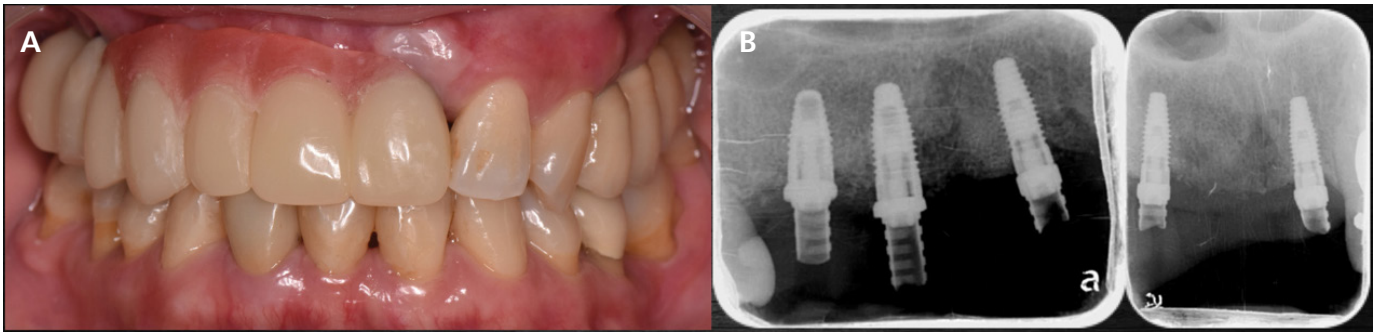

Figure 15. The frontal view after temporary implant supported FDPs delivery. (a) frontal intraoral view; (b) periapical film

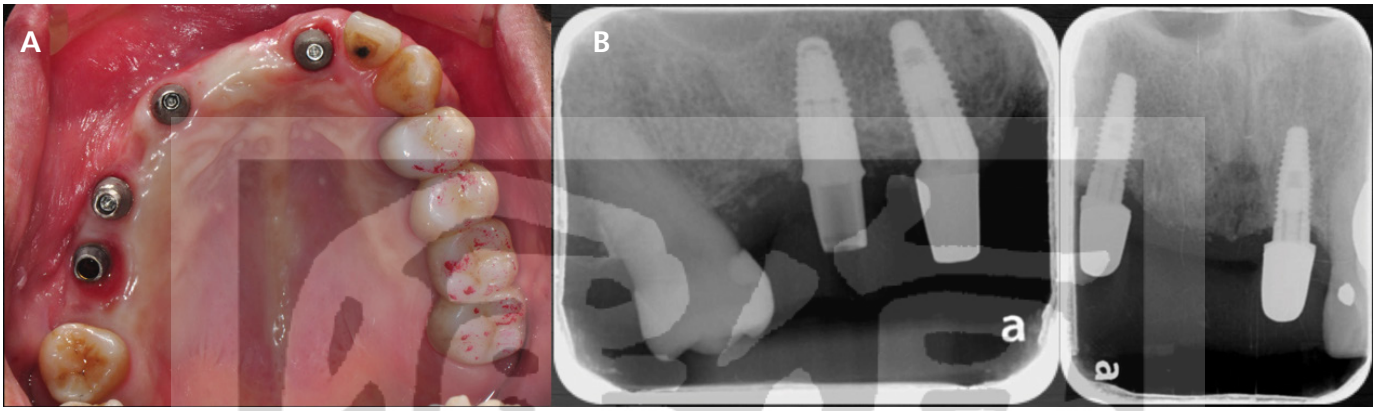

Figure 16. The 13,15,16,21 implant abutments. (a) occlusal intraoral view; (b) periapical film

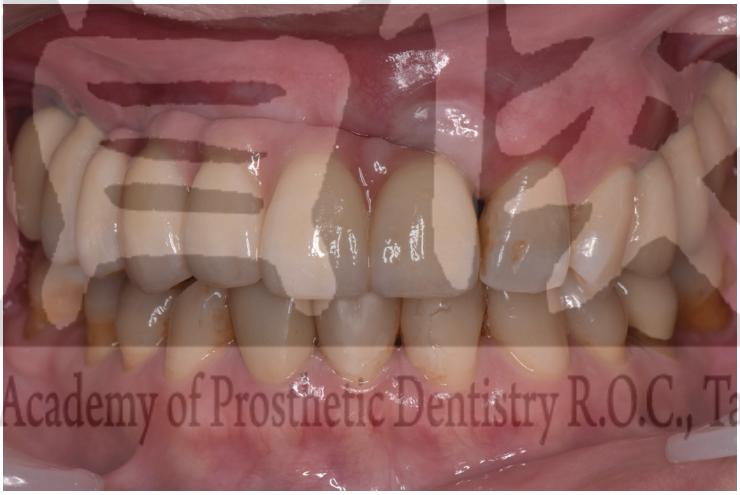

Figure 17. The intraoral frontal view after definitive implant supported FDPs delivery

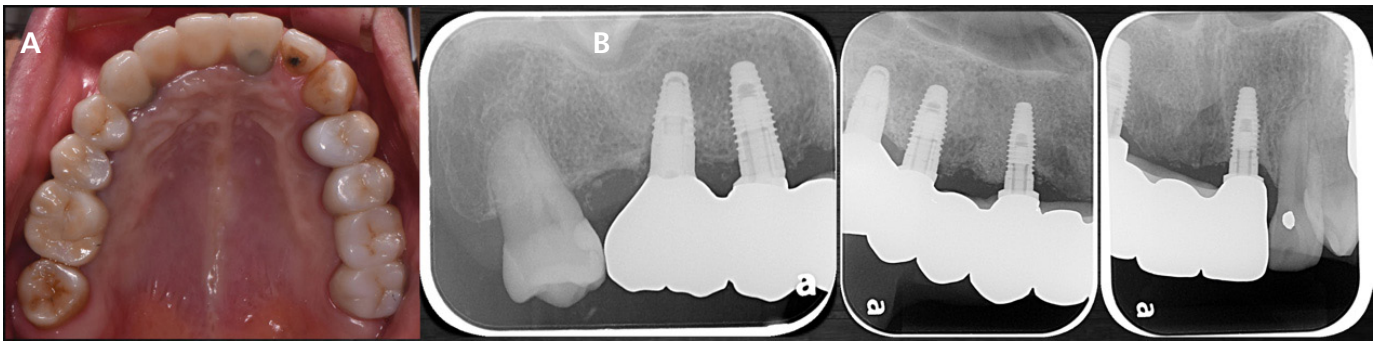

Figure 18. After definitive implant supported FDPs delivery. (a) occlusal intraoral view; (b) periapical film

Figure 19. The extraoral frontal view after definitive implant supported FDPs delivery

Figure 20. The panoramic film of definitive implant supported FDPs for 1 year follow up

Discussion

There are so many influential steps in the production of an implant-supported prosthesis which affect the fit between implants and the final prosthesis. One of the most critical steps for the long-term success of implant prosthesis is the accuracy during the impression procedure, which is affected by several factors such as the impression material, tray design, splinted or non-splinted impression copings, implants' angulation, and conventional impression or digital intraoral scan.[3]

The most often used impression materials are polyvinyl siloxane and PE (Polyether). Many authors indicate the importance of impression materials and their effect on the accuracy of the intraoral coping acquisition.[3,4] According to the studies conducted by Del'Acqua[5] and Lee and Cho[6], their results show PE materials result in better accuracy than VPS material. This could be explained by the greater rigidity of PE, which prevents movements of the impression copings inside the impression material.

The most common impression techniques are the closed tray (indirect) and the open tray (direct). The indirect technique typically uses tapered impression copings with impression caps, and closed trays that match the height of the transfer. Next, light body impression material is injected around the impression coping and into the tray and then the impression is separated from the mouth and leaves the copings intraorally. The copings are then removed from the implants, connected to implant

analogs, and positioned in its corresponding place in the impression. Finally, the assembled set is sent to the laboratory. The direct technique uses square copings with long retaining screws and custom open trays with holes, which lines up with the transfers when the impression is made. Next, the copings are unscrewed by removing the retaining screws from the implants. This allows the copings to be removed along with the impression. After removing the impression tray, the implant analogs were connected to the impression copings and sent to the laboratory.[3]

According to many studies, most of them advocated the open tray technique. Because many inaccuracies were indicated during impression procedure, such as implant angulation, coping shape, and cap design for closed tray techniques.[3,7,8]

Some studies showed that four or more implants are used, applying the open tray technique can generate more accurate impression. On the other hand, even for three or fewer implants, some authors suggest that the open tray technique should be for the best accuracy.[9]

A study reports that the breakage and distortion of the impression cap engaging the implant shoulder can compromise its reliability. Therefore, the close tray technique is less accurate than the open tray technique.[10]

Whenever multiple implants are restored with a single prosthesis, many techniques have introduced to improve the accuracy of prosthetic fabrication. One of the most important methods is the splinted technique during the impression. Several studies proposed that splinting the impression copings with self-cured resin material to maintain the relationship between the impression copings by rigid fixation.[3,5,6] However, the intraoral splinting of impression copings is time-consuming. And it is difficult to apply the materials to the very posterior region where the access is limited. Furthermore, due to the shrinkage of self-cured resin, distortion of the implant position may still occur.[4] Therefore, some studies advocate sectioning and luting of the splint material as a solution to improve accuracy and prevent shrinkage.

The angulation of implants were usually associated with the accuracy of implant impressions. When implants' angulation increases, the deformation increase during implant impression, which affect the passive fit and success rate of definitive prosthesis. Therefore, the multiple unit implants were required an unique impression technique that allows precise inter-implant relationship.[6,11,12] Therefore, several studies investigate the accuracy variations of parallel and non-parallel implants.[3]According to a study conducted by Elshenawy et al.[13], the indirect technique showed the highest distortion values when angulated implants were used followed by direct unsplinted technique then direct acrylic resin-splinted technique. Therefore, the accuracy of definitive casts was affected by the impression technique only in angulated implant conditions where direct splinted technique provided the most accurate position transfer. In parallel implant situation, these three techniques were similar.

The accuracy of master cast highly depends on the impression. The development of digital dentistry has impacted the impression and fabrication procedures of dental implants. Therefore, the accuracy of digital intraoral scanner has been evaluated from conventional impression. The development of scan bodies has made it easier for clinicians to record implants' locations, and patients feel more comfortable when the intraoral scanner is used than when conventional impressions are made. Moreover, the use of an intraoral scanner can reduce the number of connecting procedures; therefore, its use might minimize the amount of unavoidable component displacement. According to a vitro study conducted by Paulo Ribeiro[1], which studied a model with four parallel implants and found that the deviations of the digital impressions were smaller than those associated with the conventional techniques. This improvement was not observed when using a model with four angled implants, however, where the conventional techniques yielded similar results. Therefore, digital impressions of full arch models were able to achieve the accuracy of conventional impressions in an in vitro model. But the clinical situations were exhibited a number of limitations. The conditions for obtaining conventional and digital impression are easily controlled in in vitro studies, which might not be similar in clinical situations. The presence of saliva, blood, and gingival crevicular fluid will influence the results.[14] For those in vitro studies, the investigation was limited to only one scenario of number of implants, position, and angulation. All of these variables are identified as influencing factors in the accuracy of both conventional and printed casts. However, further in vivo studies are needed to confirm the in vitro results.

Table 1. The better methods of implant impression procedure

The implant impression procedure	Methods	Advantages
The impression material	PE (Polyether)	The greater rigidity
Tray design	The open tray (direct)	The breakage and distortion of the impression cap engaging the implant shoulder can compromise its reliability. Therefore, the close tray technique is less accurate than the open tray technique.
Splinted or non-splinted impression copings	The splinted technique	Splinting the impression copings with self-cured resin material can maintain the relationship between the impression copings by rigid fixation.
Conventional impression or digital intraoral scan	Digital intraoral scan	The use of an intraoral scanner can reduce the number of connecting procedures; therefore, its use might minimize the amount of unavoidable component displacement.

Within the limitation of our case report, it was presented in which the impression was taken via an direct impression (open tray) technique using splinted impression copings with self-cured resin. Then the transferred impression technique was taken using polyvinyl siloxane impression material (open-tray technique). Further, the definitive prosthesis was delivered to this patient and followed every six months. For about two years follow up, this patient was satisfied with the definitive prosthesis which was fabricated from these impression procedures. In conclusion, the accuracy of the definitive prosthesis was achieved with these impression techniques which were mentioned above. (Table 1.)

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