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CASE REPORT

3D Printed Jig for Orienting Custom Abutment in Immediately Loaded Full Arch Cases: A Case Report

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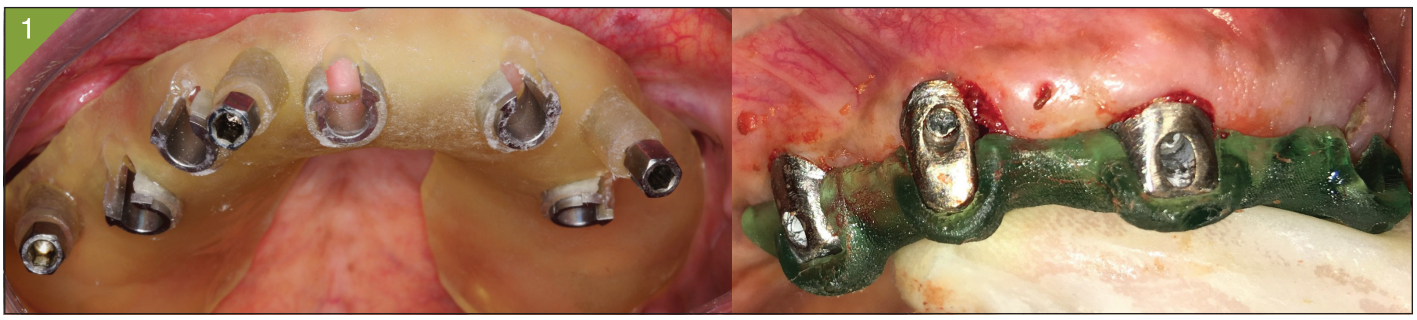

Figure 1a-b. a) Fully edentulous surgical guide with three fixation screws using Simple Guide concept. b) Custom Abutment jig using Zenith 3D Printer®.

Introduction

The procedure of immediately loading implants in full arch cases has been reported as a predictable and successful treatment option. The success of such protocol depends on the accurate implementation to sufficient initial stability while placing the implants in an ideal restorative positions.[1,2,3]

Most clinicians used to immediately load full arch cases using the conversion prosthesis technique. With the technique, the patient removable complete denture is attached to temporary pick-up abutments using auto-polymerizing acrylic resin to convert it into a screw-retained provisional fixed denture. This technique has many drawbacks including, 1) increased chairside time for finishing and fitting the prosthesis, 2) increased weakness of the restoration due to multiple voids and awkward screw access location for anteriorly tilted implants.awkward screw access location for anteriorly tilted implants.[4,5] The introduction of customized abutments can provide an easier and faster approach in cases with severely tilted anterior implants requiring immediate temporization. The problem after fabricating such abutments is to accurately reposition them intra-orally so that the designed temporary fixed denture fits accurately with minimal need of chairside adjustments. The best way to assure proper abutment orientation is to construct an abutment positional jig on the patient cast.[6]

Manually fabricated jigs are sometimes associated with technical inaccuracies that can limit their potential of correctly performing the required task. This case report will introduce a technique to fabricate a digital 3D printed abutment positional jig for completely edentulous situation to solve such a problem.

Case Report

A 62 years old male was presented with a completely edentulous maxillary arch. After thorough examination, the patient removable complete denture was duplicated for CBCT scanning purpose. On the obtained radiograph, virtual implant placement of five maxillary DENTIS s-Clean® implant was planned on tooth number 4, 6, 8, 10, and 13. Due to anatomical limitations, the three anterior implants demonstrated obvious labial inclination that requires correction with angled abutments (Figure 2,3).

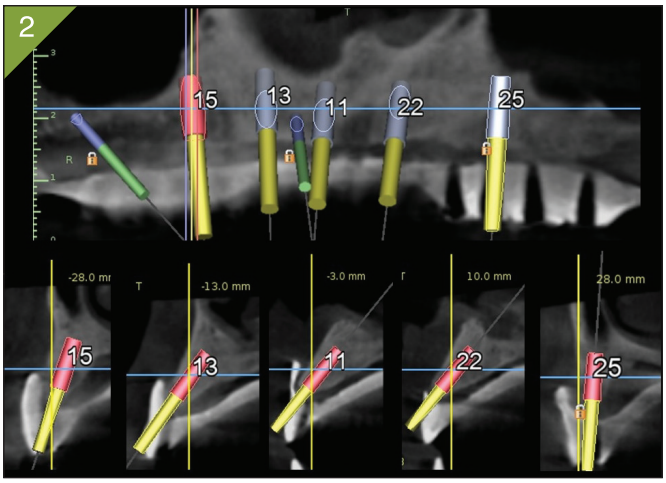

Figure 2. Virtual implant planning.

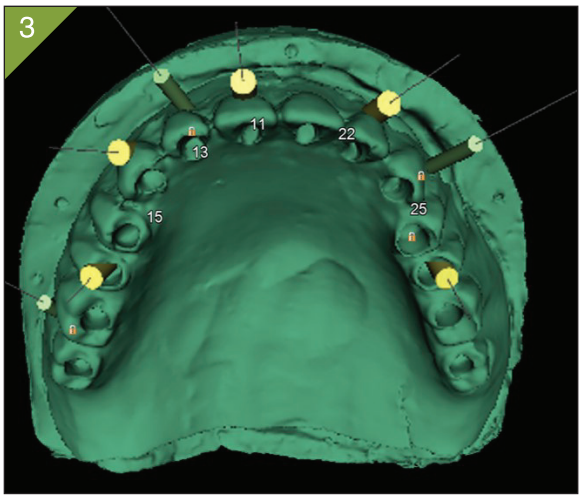

Figure 3. The abutment axis position in relation to patient setup.

A virtual mucosa supported implant guide was designed based on the Simple Guide concept (DENTIS, Daegu, Korea) with three fixation screw channels (Figure 4). The obtained virtual guide was manufactured using Zenith 3D Printer® (DENTIS, Daegu, Korea).
After finishing the guide, open metallic sleeves were attached to the surgical guide holes.

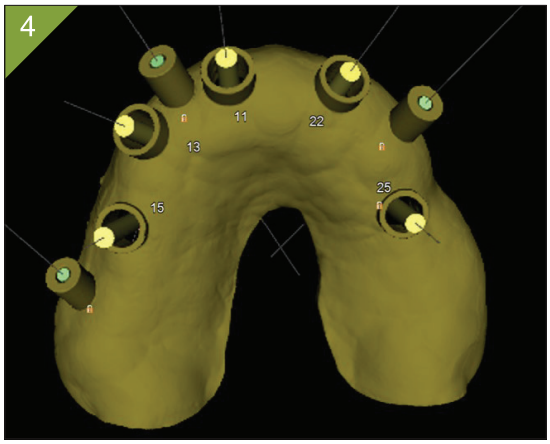

Figure 4. Virtual guide design.

The surgical guide was fixed to the edentulous maxillary using the three fixation screws (Figure 5). DENTIS s-Clean® implants were installed using the DENTIS Simple Guide Kit® (DENTIS, Daegu, Korea). The implants were placed in a flapless minimally invasive technique. After implant insertion, open tray impression was made to transfer accurate implant position the lab (Figure 6). The patient cast was scanned using Dental Wings 3 series laser scanner after attaching scan bodies to the implant analogues (Dental Wings Inc., Canada).

Figure 5. Surgical guide fixed intra-orally with three fixation screws.

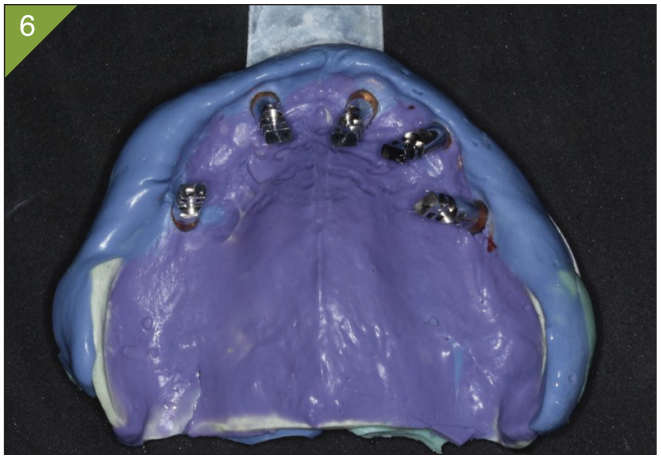

Figure 6. Pick-up impression, immediately on the surgery day.

On the CAD/CAM software, virtual design of the proposed temporary was first designed in proper alignment with the opposing dentition (Figures 7,8).

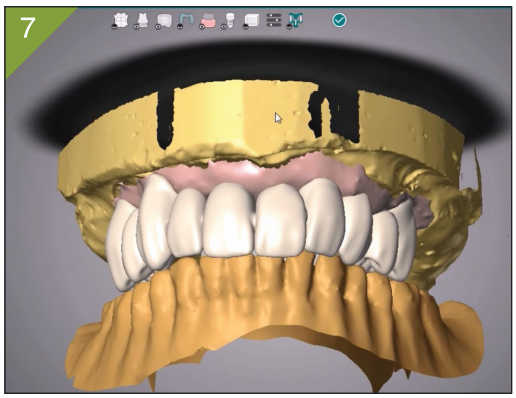

Figure 7. Virtual fixed provisional bridge setup.

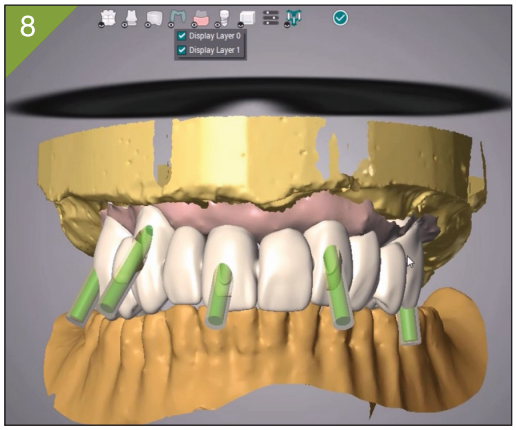

Figure 8. View of the implant long axis in relation to the bridge setup.

Custom abutments were then designed to cope with the outline of the virtual temporary. The abutments axial walls were modified to assure a common path of insertion for the prosthesis. Furthermore, the abutment finish line was designed at 0.5mm-1mm subgingival position (Figure 9).

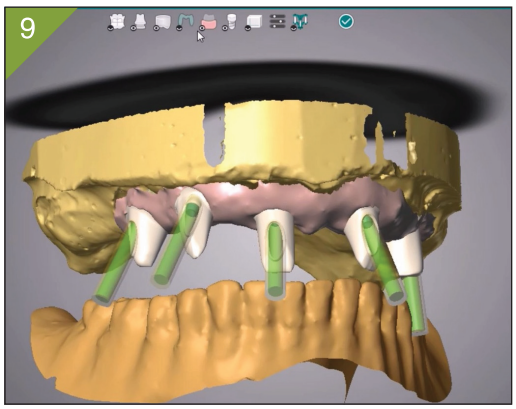

Figure 9. Customizing abutment dimension and inclination.

After finishing the abutment design, the final model was processed to the partial denture module to construct a virtual "u-shaped" abutment jig over the designed abutments. The jig extended to cover the proximal, lingual and occlusal aspect of the abutment with an opening at the screw access channels. Additionally, the jig was designed to cover the lateral palatal walls and part of the rugae area (Figure 10). The custom abutments were milled from titanium alloy blocks using a 4-axis milling machine (Yenadent, Turkey). The abutment jig and temporary bridge were printed using Zenith 3D Printer® (DENTIS, Daegu, Korea) (Figure 11).

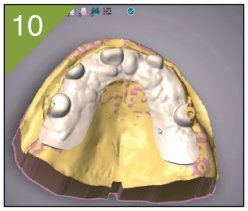

Figure 10. Abutment jig virtual design.

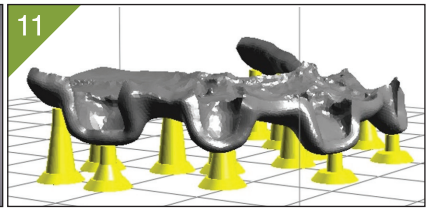

Figure 11. Jig positioned on the Zenith software with virtual support for printing.

Two days after implant placement, the abutments were seated onto the implants using the 3D printed positioning jig. The provisional bridge was then cemented using Zinc Oxide temporary cement (Figure 12-14).

Figure 12. The abutment jig aids to accurately position the abutments.

Figure 13. Clinical view of seated final abutments.

Figure 14. Lateral view of the provisional bridge in place.

Discussion

There is a growing trend in dental implant field towards digitizing all implant procedures. This report describes one of many steps to comfortably completing the digitally guided implant surgery. The technique may be minor, yet important, to position the abutment accurately in the predetermined position.

The conventional dimple method and manually fabricated positioning jig will not be possible in a complete digital workflow. Moreover, trials to locate the abutments without a jig, especially with conical implant connections, will be a lengthy procedure. The digitally designed and printed jig will offer an easy, and it is a fast tool for such purpose.

Proper design and soft tissue extension of the jig design is mandatory to assure proper seating when orienting the abutments.

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Products Used

DENTIS, Daegu, Korea
Zenith 3D Printer

3D PRINTER LEADER ZENITH

DENTIS, Daegu, Korea
Simple Guide Kit®

SIMPLE GUIDE DENTAL GUIDE SYSTEM