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## Prosthetically Driven Implant Placement -A Case Report

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### ABSTRACT

Technology has been used to change the world and to alter the manner of our existence. At present, the technological possibilities that lie ahead are also quite mind bending. The lines between "artificial" and "natural" are blurring by the day, with each new technical advancement and scientific discovery. Thus, in our field of dentistry the latest advancement is a boon to our patients. This is a case report on implant placement using 3D printed completely limiting tooth supported surgical guide with a flapless and immediate loading protocol. Dental implant has been established as one of the most predictable and conservative approaches for the rehabilitation of missing teeth. With the evolution of newer material and advancement in digital technology, especially in computed tomography, implant planning software and guided implant surgery, the outcome and success in implant dentistry have become more predictable. Computer aided design (CAD) technique is being integrated into treatment planning, and computer-assisted manufacturing (CAM) is becoming more popular for rehabilitation procedures. This case report illustrates the diagnosis, planning and application of 3D guided technology in dental implant surgery. This article also emphasises the importance of proper planning in prosthetically driven implant placement.

**Keywords:** Guided Surgery, Flapless Surgery, Loading Protocol, Prosthetically Driven Implants.

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## INTRODUCTION

A proper diagnosis and a proper planning with prompt execution of the planning without any error is the key for long term success in implantology. Rapid prototyping in implant dentistry has more precise control of the implant axis in relation to the prosthetic tooth position and its occlusal relationship. This leads to a higher predictability of the treatment outcome with subsequent patient information on the aesthetic final result., it is well known that navigated surgical guides are more precise than conventional surgical guides produced by the laboratory when it comes to the soft tissue contours as well as the hard tissues are concerned. To transfer the planned implant position information to the clinical situation Jung et al defined the types of techniques as static and dynamic. In the static technique a surgical guide is used. Surgical guide design can be of a non-limiting, partially limiting and completely limiting design <sup>[1]</sup>. These surgical guide designs vary in their design on whether they are for fully edentulous ridges or partially edentulous ridges. The design of the surgical guide also depends on from where the surgical guide takes support. Either it may be tooth supported, mucosa supported or a bone supported surgical guide. In the dynamic technique the surgery is to guide in real time, to localize anatomical structures or pathologies. It consists of a computer workstation and a system that calculates the position and orientation of a surgical instrument. Bone visualization using this technique helps the surgeon to make a final decision regarding bone availability and quality, which may influence the implant treatment outcome. In order to full fill the current requirements of aesthetics and comfort, a minimally invasive and less traumatic technique to place implants has been advocated. The flapless technique is a surgical method in which a flap is not raised in the surgical field and the implants are “blindly” placed. This case report details on the completely limiting tooth supported surgical guide using a flapless surgery along with immediate loading protocol.

### Case report

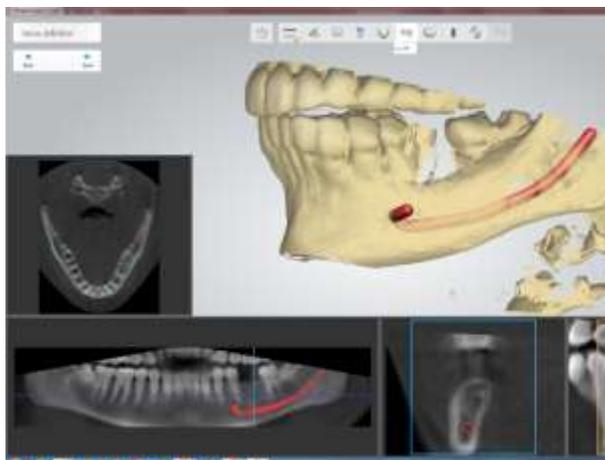
A 36-year-old female patient reported to our Department of Prosthodontics and crown and bridge and Implantology, Sree Balaji dental college and hospital with a chief complaint of missing lower left back tooth. Intraoral examination revealed missing 36, with history of extraction 4 years back (Fig 1). All treatment options for the replacement of the missing tooth were explained, the patient opted for a computer guided surgery using Dio implants (DIO CORPORATION KOREA). The case was then planned and executed according to guided surgery protocol as purposed by Dio Navi system.



**The workflow of the procedure is as follows**

### **Stage 1 – Diagnosis and Treatment plan**

The impressions of Maxillary and mandibular arches were made with polyvinyl siloxane putty along with light body using the single step method and Type III dental stone was poured and diagnostic casts were obtained, the same was mounted in an articulator for diagnosis. On diagnostic evaluation of the model the patient had sufficient inter arch space for replacing the missing 36 both buccolingually and mesiodistally (figure 1). The space was sufficient for an implant retained prosthesis and also the patient had a stable occlusion. An interocclusal wax bite registration was also done, which helped in relating the maxillary and the mandibular casts. The patient was advised to make a full volume CBCT. The CBCT was asked to be made in disocclusion. Hard and soft tissues were examined. The treatment plan after the clinical and radiological examination was confirmed to a guided implant surgery using the dio Navi implant system

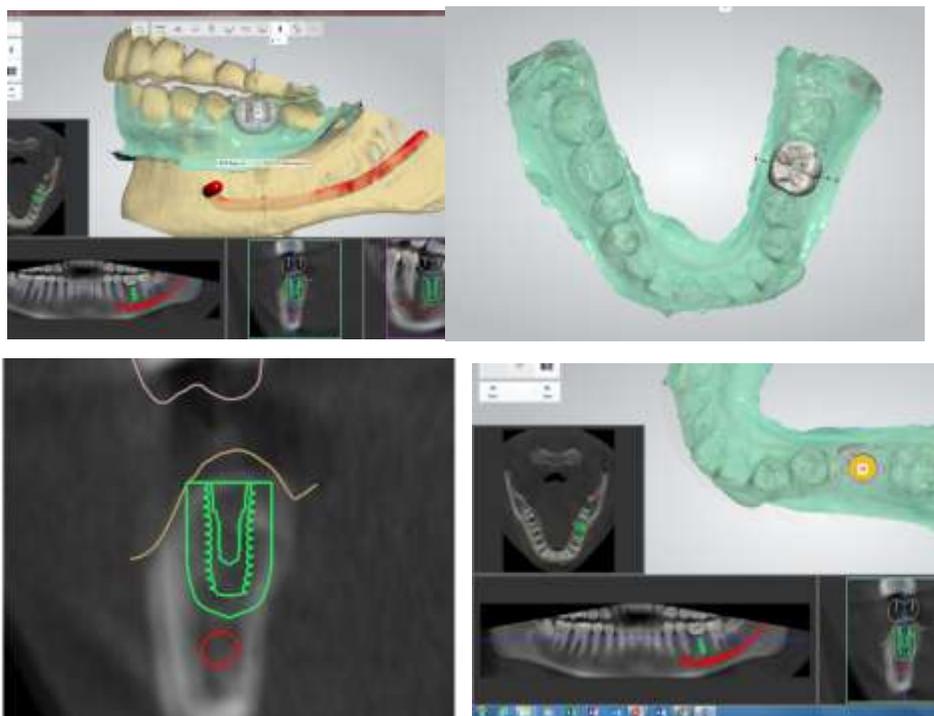


### **Step 2 – Virtual Planning**

A scanning of the maxillary and the mandibular casts were made separately and in occlusion using the trios 3 shape scanner. The scanner details which were in the .stl format (THE TRIOS OUTPUT

IS 30XZ, STL, DCM) and the DICOM file of the CBCT were merged using the software implant studio 2014-1 and implant studio; 2016 3shape medical A/S Version 2.16.22. (figure2) Once both the .stl and the DICOM files are merged virtual planning of the implant planning was done. The sequence in virtual planning for a computer guided surgery are:

1. Negotiate all the vital structures first, inferior alveolar nerve in this case. (Figure 3)
2. Anatomy of the tooth to be replaced was designed
  - a. Determine the prosthesis occlusal view
  - b. Occlusion is checked in 3 dimensions (figure 4)
3. Virtual implant was placed at an off set of 9mm and the size of the implants planned were 4.5mm diameter x 10mm length of DIO implant. (Figure 5)
4. Screw insertion hole was determined and marked so that the surgical guide can incorporate the sleeve (figure 6)
5. The virtually planned implant is verified once again and on perfection the



### Step 3 – 3D Printing of surgical guide

On satisfaction of the position, angulation and the dimension of the implant the file is uploaded to the ProJet MJ 3600 (3Dsystem, Inc., USA) for printing the surgical guide.

### Step 4 – Surgical Phase

Adequate disinfection of the surgical site was done. The surgical guide was tried for proper fit (figure7). Under Local Anaesthesia, the tissue was punched out as the first step. Then bone

flattening was done and the drilling protocol given by the manufacturer was completed (figure 8,9). The implant was placed and the initial stability was assessed. In this case a good primary stability of 35 Nm was achieved, hence immediate loading was done with PMMA. Immediate post operative intraoral radiograph. This crown was replaced by a metal ceramic crown after 3 days (figure 10, 11).



Figure 7



Figure 8



Figure 9



Figure 10



Figure 11

## DISCUSSION

This case report used a completely limiting tooth supported type of surgical guide for placement of implant in the tooth number 36 and was loaded immediately. Surgical guides have a very definitive

history and it dates back to 1987 when Thomas Balshi & Garver described about a stent where 2mm holes were made in an acrylic resin template to act as a guide for the 2mm pilot drill <sup>[1]</sup>. Because of its thickness and spacing to allow irrigation, the stent cannot always guide the drill to the full depth of the hole. CM Ten Brugenttate in 1994 explained the important aspect of surgical diagnosis before implant placement is measurement of the width of the alveolar ridge <sup>[2]</sup>. It has been well documented in literature that the implants placed using surgical guides and planning are more accurately positioned than those without the guide. Since the 1980s, many studies describing different techniques for surgical guide fabrication have been published. Surgical guide design concepts are classified based on the amount of surgical restriction offered by the surgical guide templates. While using a surgical guide and a flapless surgery always necessitates proper pre-planning. The planning of the prosthesis which should be in harmony with the existing occlusion and also should be able to transfer the forces parallel to the long axis of the implant so no detrimental forces act on the implant. CBCT had made the planning procedures for implants easier. To transfer the planned implant position to the surgical site, needs more care and should also be accurate. And this is taken care of the stereolithography where the 3dimensional accuracy is achieved in the surgical guide. Many authors have reported studies on various materials for surgical guide manufacturing <sup>[3]</sup> There are many literatures which compares different prototyping techniques also <sup>[4]</sup>, this case report used a stereolithographic surgical guide. A possible correlation between primary stability and peri-implant bone density measured within the 3D planning software was explained by Christoph vasak in the year 2015<sup>[4]</sup>. So pre-operative planning is very important and plays a vital role in determining the prognosis. Based on the study done by Sarment et al in 2008 concluded that presurgical planning transferred to the surgical reality with tooth-bone-borne stereolithographic template, can be completed with complete confidence <sup>(5)</sup>. Howritz in 2009 also confirmed that Computer-assisted implant planning and insertion provides good accuracy. There are deviations and were mainly related to system and reproducibility errors. Multiple use of drills and titanium sleeves significantly reduces system accuracy <sup>(6)</sup>. Ozan in 2011 did a study by introducing SLA surgical guide system into the rehabilitation of a 62 - year-old male patient with mandibular edentulism <sup>(7)</sup> Nickenig, H J in 2012 concluded that since uncertainties still exist despite the use of a drilling template, it is recommended that the minimum safety distance from adjacent structures be maintained. The successful use of surgical guide templates requires comprehensive knowledge of and experience in using three-dimensional information for the virtual planning of implant position <sup>(8)</sup>. Cristache in 2017 did a study to evaluate the accuracy of a stereolithographic template, with sleeve structure <sup>(9)</sup>. Lee et al in 2013 came to a conclusion that the

control of errors at the coronal center and stabilization of the anterior part of the template are needed for safe implant surgery and future prosthodontic treatment incorporated into the design, for computer -guided dental

implant insertion in partially edentulous patient <sup>(10)</sup>. Scherer in 2014 described features of three software packages and the respective computerized guided surgical

templates (GST) fabricated from them <sup>(11)</sup> Dolcini et al in 2016 presented a procedure for fully digital planning of implants and short -span fixed implant - supported restorations has been shown to be reliable and quoted for further studies to validate these results<sup>(12)</sup> Fernández-Gil et al in 2017 said some degree of deviation can occur between the planned placement of the implant and its definitive placement, and this deviation may be influenced by the surgeon's experience. Expert surgeons show less angle deviation than novice surgeons <sup>(13)</sup>

Patients expect the best aesthetic results and so the emergence profile is very much concerned even in the posteriors flapless surgery preserves the existing soft tissue contour to some extent. The world is digitalized and as are the expectations of the patients immediate loading in possible cases makes the patient's desire satisfied and this case was also loaded immediately. Immediate loading is supported by many authors in literature too. On the 6<sup>th</sup> week the PMMA crown was changed to a metal ceramic cemented type of crown and was luted permanently.

This case was followed up to 6 months and it had a very good prognosis and an IOPA taken revealed good oseointegrated implant fixture.

## CONCLUSION

3D printing and guided implant surgeries are very successful and precise. Technology can be used for its best to make our day today work easier and safer. Implants that are placed by satisfying the prosthetic needs always end in successful implants with long term success.

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