3D Printing Guide Implant Placement: A Case Report

SUMMARY

Background: Cone Beam Computer Tomography (CBCT) is representing a new concept of radiological diagnostics and its application occupies a special place in implantology. Today, preoperative planning, and quantitative and qualitative jaw bone analysis cannot be done without the use of these techniques. The latest in a series of achievements in this field is a method of making a guide for implant using a 3D printing technique. This way pre implantology planning reduces the chance of surgical complications to a minimum and allows installation of dental implants in the most optimal position for future prosthetic work. Aim: To show benefits of guide implantation in clinical practice. Case report: The patient M.D. 36 years old. After making CBCT there was a qualitative and quantitative analysis of bone tissue, after which we decided to install five implants in positions #36, #37, #45, #46 and #47. The software appliance made virtually implants in the most optimal positions; treatment plan was forwarded by the internet connection into the DICOM format to Simplant Company, along with a folder of scanned plaster models in order to develop a guide. A few days later, after approval sent, we received the guide. Preparation by the pilot bur we did through transmucosal plum of the guide, and then we continued the classic flap surgery technique. Control footage shows the optimal position of the implant from both surgical and prosthetic aspects. Conclusion: Application guide implantology represents a safe and modern method that provides ability of implant placement in optimal positions in terms of future prosthetic rehabilitation.

Keywords: 3D printing, Guide implantology, CBCT

Introduction

Historically, the implant procedure was performed only on the basis of available jaw bone. Several studies have clearly showed that implants placed on this way, often appear to be more buccally or lingualy position, which leads to aesthetic problems that cannot be corrected by prosthetics. Implants that are placed incorrectly in relation to the vertical axis are exposed to damaging lateral forces, resulting in a number of biomechanical problems. For these reasons, there was idea introduced through “prosthesis-driven implant dentistry”, which in addition to the structure of the bones gives also importance and position of the planned implant. This concept, became important with the emergence of a Cone Beam Computer Tomography (CBCT).

CBCT has been promoted as a new concept of radiological diagnostics, but with improved technical characteristics of the device and accompanying software support; today, it became a gold standard in diagnostics. This technique occupies a special place in probably the most attractive dental branch, implantology, where preoperative planning and quantitative and qualitative analysis of bone base cannot be imagined without the use of this technique.

The latest in a series of achievements in this field is a method of making a guide for implant using 3D printing technique. Prepared guide reduces surgical complications
to a minimum and allows installation of dental implants in the most optimal position for future prosthetic work\textsuperscript{5-7}.

**Case Report**

After clinical examination and analysis of panoramic roentgen image (Figure 1), the patient MD, 36 years of age, was submitted to implant-prosthetic rehabilitation of toothless parts of the mandible. The advantage of this option compared to the production of prosthetic bridges is given due to the range of potential between the abutments and the age of the patient. After making CBCT image in device Planmeca Pro 3D Max, a qualitative and quantitative analysis of the bone tissue was performed. The results showed a satisfied bone density type D2, D3 by Misch, as well as vertical and horizontal dimension of the bone that provides possibility of installing the implant with appropriate diameter and length (Figure 2). We decided to install five Bredent implants, diameter of 4 mm and a length of 12 mm, 2 implants on the left side at the positions #36 and #37 and 3 implants on the right side at the positions #45, #46 and #47. Romexis software executed a virtual implant placement in the most optimal positions. Virtual positioning was guided with appearance of future prosthetic work, and software made correct implants’ positions (Figure 3). The treatment plan was forwarded by Internet connection in DICOM format to the company Simplant (Brussels, Belgium), along with a folder of scanned plaster model in order to develop a guide for the preparation with the pilot bur. After designing a guide in the Simplant Company (Figure 4), we received a request for approval of 3D printing guide that we sent by the mail. A few days later, after we sent approval, we got the finished guide (Figure 5).
Before surgery, it was necessary to check stability of the guide in the mouth and make corrections if necessary. Sometimes, it happens that the guide is not completely stable in the mouth. In our case, there were bilateral edentulous areas with natural teeth both anterior and posterior to the areas; therefore, a SLA surgical guide was tooth-supported and stable.

We conducted transmucosal preparation with pilot bur through basins guide (Figure 6), and then we continued surgery with classic flap technique. Control footage shows the optimal position of the implant from both surgical and prosthetic aspects (Figure 7). In the last phase, the implants were loaded with two zirconia prosthetic bridges.

Discussion

There are few clinical studies in the literature regarding use of SLA surgical templates in dental implantology. Tooth-supported SLA guide, which was used in our case, according to many authors, is more stable and leads to better precision than other types of SLA guides (bone supported, mucosa supported)\(^8\). As one of the drawbacks of guide implants, the lack of space is referred in the literature, especially in the lower posterior region\(^13,14\). That problem we also had during preparation in positions of #37 and #47 (Figure 8), and we overcame it using shorter borer in an early stage.

Also some other shortcomings, such as surgical guide shape, length of metal sleeve and surgical drill, template supporting problem, can be found in the literature\(^13,15-18\).

Conclusions

With all of these advantages of using guides, a certain caution is needed in the selection of patients, taking into the consideration technical mistakes and deviations recorded in the precision of preparation that may arise.

Note: The results of this paper were presented as a part of an invited lecture at the 21st BaSS Congress.

References


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