Non-Invasive Stereolithographic Implant Treatment Of A Severely Resorbed Edentulous Maxilla: A Case Report

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Abstract

Objectives: Application of a stereolithographic (SLA) technique for the non-invasive treatment of a severely resorbed maxilla that conventionally requires a major bone grafting & sinus lifting surgery was presented in this case report.

Methods: A 58 year old female patient with a severely resorbed maxilla was referred to the Department Oral Implantology, Faculty of Dentistry, Istanbul University. Nasal and sinus grafting was indicated in previous consultations due to the lack of sufficient bone height. The panoramic radiograph revealed a bone level of 8-9 mm in the anterior maxilla. The residual bone height under the sinus was also below 6 mm. Initially, the patient was treated with a surgical clipper.

Results: The procedures were uneventful and all implants were clinically integrated. The patient was restored with a metal-ceramic fixed restoration.

Conclusions: In selected cases, SLA techniques may help bypassing major surgical procedures required in the classic treatment approach.

Introduction

With the advancements in implantology, the conventional treatment approaches may not fulfill the expectations of patients and seem to be relatively “traumatic”. Especially in cases which multiple numbers of fractures occurred, and many patients are asked to undergo extensive surgeries with considerable risks and post-operative morbidity. A compromise in the complete understanding of the underlying anatomy and vital structures further complicates the extensions of the surgery when combined with severely horizontal and vertical bone resorption. The use of allogeneic bone grafts inherent the risk of donor infection and transmission whereas autologous grafts a second wound would add additional patient morbidity. To overcome these aspects, all alloplastic materials were used, however because a causeless healing as compared to allogeneic and autogenous grafts [1,2]. In the anterior maxilla, sinus lifting surgery has its own limitations and risks and furthermore the overall treatment time is usually over a year due to the skin bone healing [3].

Generally, removable prosthetic restorations are offered for such patients due to the extreme difficulty of matching the positions of multiple implants for a fixed restoration [4]. Stereolithographic surgical techniques enable planning implants in optimum locations, angulations and length before the surgery by using advanced radiological techniques [5, 6]. Computer software is used for combining the computed tomography images and the virtual plans within the stereolithographic surgical procedures [5]. While giving respect to the prosthodontic goals, the clinicians may execute a virtual surgery placing the implants in available bone volume. Thanks to the advanced imaging techniques, clinicians and patients are more likely to facilitate this treatment technique. For instance, the Cone-Beam Computed Tomography (CBCT) is widely used because of its advantages such as low-dose radiation and low-cost when compared with conventional computed tomographic (CT) imaging.

Software applications are being used in order to determine proper implant locations by using radiographic templates. These templates can be prepared either by duplication of an existing prosthesis or by manufacture from a new tooth setup. These radiographic templates are kept inside the mouth while CBCT scans are performed and they represent the final prosthetic outcome on the navigational 2D images easily. Each technique has its own advantages and disadvantages in term of accuracy, ease of manufacturing and required number of visits [7, 8].

In this case report, application of a stereolithographic technique for the non-invasive treatment of a severely resorbed maxilla that requires a major bone grafting and sinus lifting surgery with reference to two-dimensional radiographic was presented.

Case

A 58-year-old female patient with a totally edentulous maxilla was referred to the Department Oral Implantology, Faculty of Dentistry, Istanbul University with complaints of insufficient retention and compromised chewing ability of the prosthesis. On previous consultations, the patient was regarded unsuitable for dental implant surgery due to the risk of disease transfer and infection whereas autografts were not possible due to the lack of sufficient bone height. Open-tray impression was obtained using an individual impression tray (Figure 3). A piece metal-bonded-ceramic block was planned with two distal cantilevers to provide a full arch occlusion. Metal-ceramic fixed prosthodontic procedures were executed and completed uneventfully as the position of the implants were of no constraining (Figure 10).

Surgical site. bite registration was obtained preoperatively whereas the stereolithographic guide was at the centric occlusion and exact positioning of the SLA guide was ensured. After sterilizing with powder inline, the guide was placed inside the mouth with the guidance of the bite registration, before the surgery (Figure 2). Local anesthetization anesthesia was injected in the corresponding area of the fixture screws (Figure 3). The soft tissue punches were used in accordance with manufacturer’s instructions (Figure 4). Then, the fixture screws were placed through the grooves in the guide. Finally, the cortical perforator drills and shaping drills were used respectively, and the osteotomy was completed (Figure 5).

Implants were placed with a triopodal fixation as the surgical guide to ablate the compression forces –produced by excessive stresses–. Initially, we inserted 24, 22 implants were inserted, respectively. Later, one implant removed and one another implant was inserted one by one of the sites (Figure 6). After the procedure was completed in this way, the guide was removed and screws were screwed on (Figure 7). Implants inserted with mean 40 Rcm insertion torque value.

Having acceptable aesthetic characteristics, the existing prosthesis was used as radiographic template. After railing, radiopaque markers (Radio-opaque compacts, Coltene, Switzerland) were placed onto the prosthesis base with three different axes in order to intersect the template with the proper position inside the mouth. Then the patient underwent double scan protocol via a CBCT device. First, the patient was scanned while the device was inside the mouth. Second, just the device was scanned in the same axis. The data transferred to the software is DICOM format. Then, the radiographic template and edentulous jaw were intersected by reference of the radiopaque markers. The axial, sagittal and frontal sections of implant recipient areas were evaluated on the software. Grey density was measured on the DIC at a mean of 388 HU. Short-length implants were mainly distributed in the region between the maxillary sinus giving respect to the proper prosthetic alignment. Then, the planning file was sent to the manufacturer for the production of stereolithographic guide (patient’s clinical data).

Surgical stage. Bite registration was obtained preoperatively whereas the stereolithographic guide was at the centric occlusion and exact positioning of the SLA guide was ensured. After sterilizing with powder inline, the guide was placed inside the mouth with the guidance of the bite registration, before the surgery (Figure 2). Local anesthetization anesthesia was injected in the corresponding area of the fixture screws (Figure 3). The soft tissue punches were used in accordance with manufacturer’s instructions (Figure 4). Then, the fixture screws were placed through the grooves in the guide. Finally, the cortical perforator drills and shaping drills were used respectively, and the osteotomy was completed (Figure 5).

Open-tray impression was obtained using an individual impression tray (Figure 3). A one piece metal-bonded-ceramic block was planned with two distal cantilevers to provide a full arch occlusion. Metal-ceramic fixed prosthodontic procedures were executed and completed uneventfully as the position of the implants were of no constraining (Figure 10).

References


Conclusions

In the classic treatment approach abodelevation of the alveolar bone volume is a prerequisite when a fixed prosthesis is considered for a totally edentulous jaw. With the help of the tomography based stereolithographic techniques, major surgical procedures (i.e. bilateral sinus lifting procedure and an augmented bone transfer for the preoperative period) could be avoided in selected cases.