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Case Report

Flapless Computer-Assisted, Template-Guided Zirconia Implants Placement in Maxillary Bones: A Case Report

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2. Keywords

Zirconia implants; Guided surgery; Flapless surgery

1. Abstract

Computer-assisted implant planning has now become a major diagnostic and therapeutic resource in contemporary dentistry. Stereolithographic surgical guides can be manufactured using the computer treatment plan allowing the clinician to place the implants as precisely as in the virtual surgical plan. Zirconia implants are a promising alternative to titanium with a superior soft-tissue response, biocompatibility, and aesthetics with comparable osseointegration. We report the case of a 61-year-old patient who lost her upper molars and want to replace them with zirconia implants. Diagnosis, decision making and treatment approach were based on clinical findings and detailed virtual three-dimensional implant planning. The patient underwent surgery for placement of the implant fixtures using the stereolithographic surgical guides. No flaps had to be raised, as the surgical guide aligned the drills in the correct position and inclination. At the 2-year recall the, healthy mucosal and stable crestal peri-implant condition could be observed. The patient was very pleased with the esthetic and functional outcome.

3. Introduction

The introduction of computed tomography images, including cone-beam computed tomography (CBCT), improved the outcome of implant-based treatments since it allows preoperative diagnosis with excellent quality and less exposure of the patient to radiation [1]. When CBCT was associated with computer-aided design and manufacturing (CAD/CAM) provided surgical planning in both virtual and 3D environments, providing the practitioner with a realistic view of the patient's bony anatomy, thus permitting a virtual execution of the surgery in an ideal and precise prosthetically driven manner [2]. This approach has been introduced to transfer virtual planning to the clinical procedure, allowing for less invasive surgeries, reduction of postoperative discomfort, adequate implant placement and fabrication of prosthetic structures before surgical procedures [3,4].

In the last few years, zirconia dental implant has emerged as an alternative for titanium implant due to its potential to osseointegrated [5] and having other beneficial properties like its translucency and white color which mimics the natural teeth [6]. Bacterial colonization around zirconia is found to be less as compared to that with titanium [7]. Some studies have reported that zirconia has more biocompatibility as compared to titanium, as the latter produces corrosion products at the implant site [8,9].

4. Materials and Methods

We report the case of a 61-year-old patient who lost her upper molars and want to replace them with zirconia implants. Diagnosis, decision making and treatment approach were based on clinical findings and detailed virtual three-dimensional implant planning. A cone beam computed tomography was performed to proceed with the detailed implant planning (Figure 1). Before implant surgery it was necessary to perform a sinus lift procedure on both maxillary sinuses. During this procedure, a mucosal retention cyst was aspirated into the left maxillary sinus using the technique described by Chiapasco et al. [10] (Figure 2); subsequently an additional CBCT was performed (Figure 3). Six months after the procedure, based on the anatomical conditions and prosthetic planning, 4 implants were virtually planned in the position 16, 17, 26, 27 (Figure 4). The templates were fabricated stereolithographically according to the virtual implant planning. The radiographic evidence showed only a partial reduction of the mucosal cyst which, however, did not result in any clinical symptoms, therefore no further intervention was proposed and implant surgery was performed anyway. The surgical approach consists in flapless guided insertion of the four posterior implants (PURE Ceramic Implant 4.1x10 mm, Institut Straumann AG, Basel, Switzerland), with the surgical template that was tooth supported (Figure 5). All the implants proved good primary stability (Figure 6). Temporary crowns were pre-fabricated at the laboratory and fit on the implants perfectly. After 3 months the final restorations were delivered and esthetics were optimal (Figure 7).

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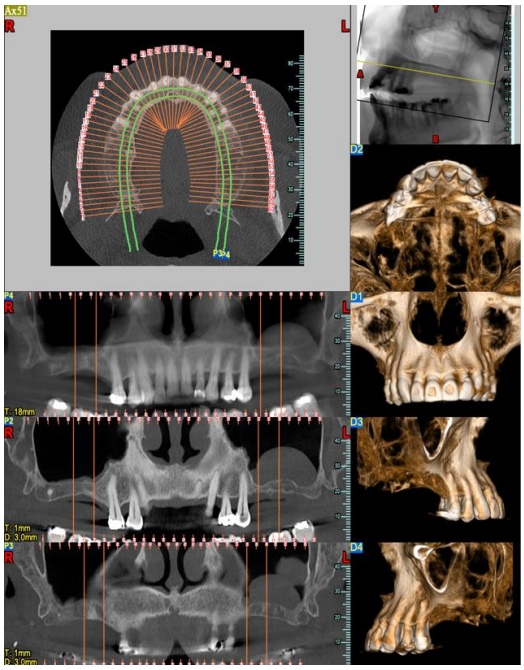

Figure 1: Pre-operative CBCT.

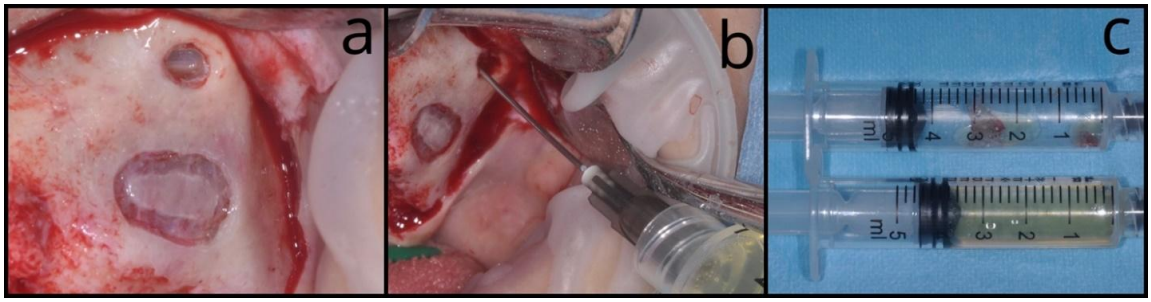

Figure 2: a. Sinus lift procedure, mucosal retention cyst was observed. **b.** Suction of the cyst. **c.** Aspirated content of the cyst.

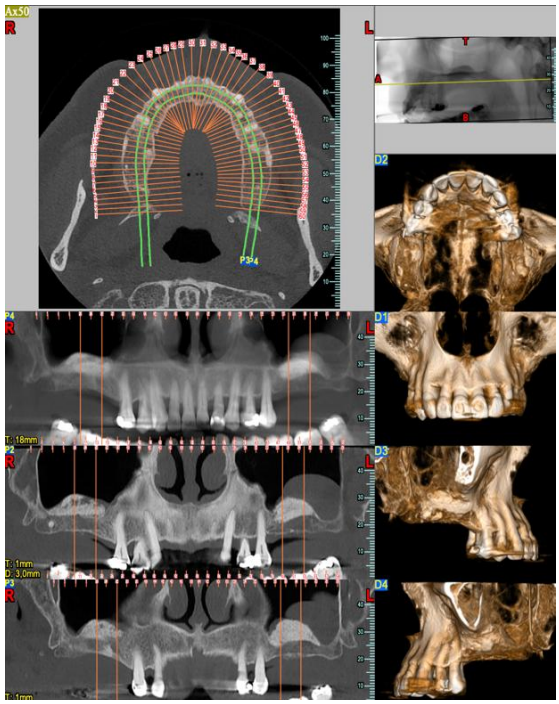

Figure 3: CBCT after sinus lift procedure on both maxillary sinuses.

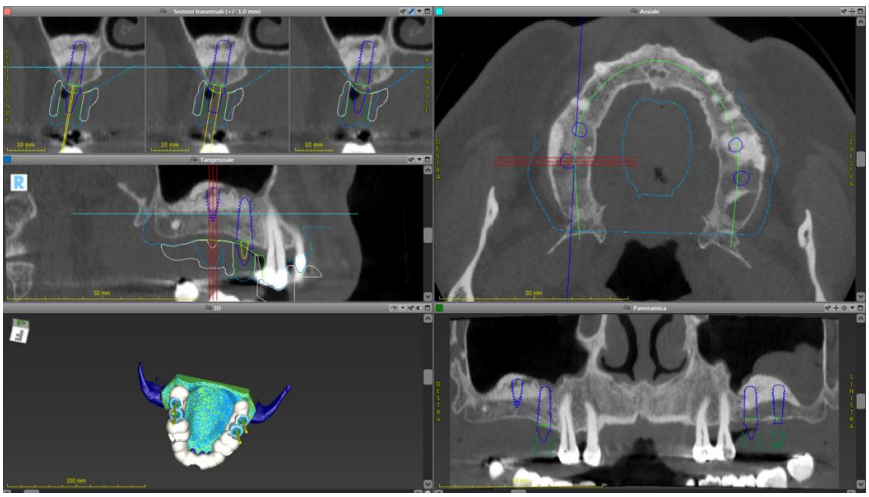

Figure 4: Virtual surgical planning on software.

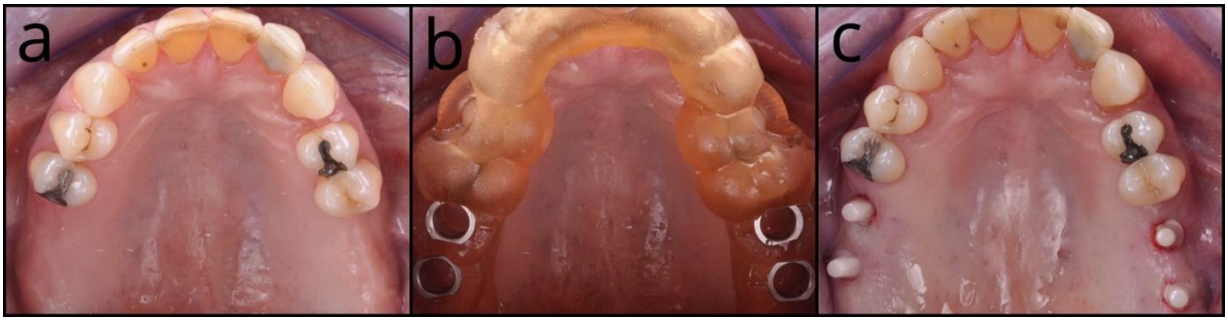

Figure 5: a. Occlusal view before implant placement. **b.** Occlusal view of the stereolithographic guide in situ, supported on teeth. **c.** Occlusal view of the 4 implants immediately after placement.

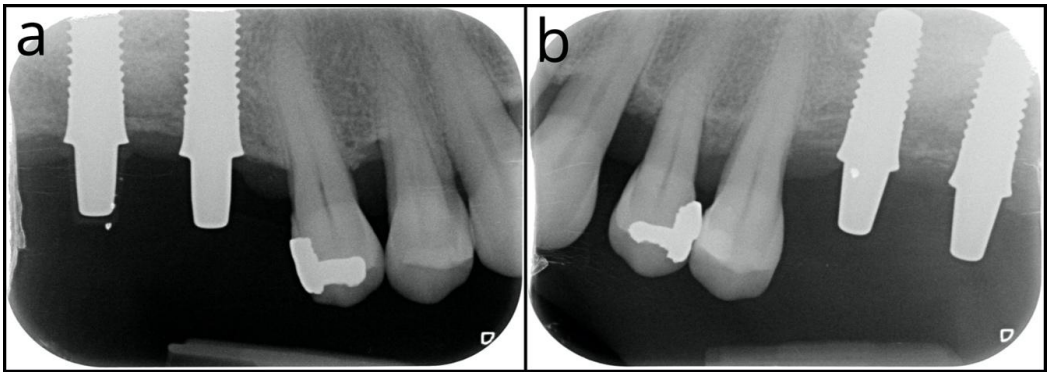

Figure 6: Radiographs performed immediately after implant placement. a. 1.6 and 1.7 positions. b. 2.6 and 2.7 positions.

Figure 7: a. Final restorations. **b.** Lateral view of 2.6 and 2.7 final restorations. **c.** Lateral view of 1.6 and 1.7 final restorations.

5. Results

All the four implants osseointegrated successfully without complications. Healthy mucosal conditions were present, the panoramic radiograph at the day of the delivery showed optimal prosthetic and osseous conditions. At the two-year follow-up appointment, healthy mucosal and stable crestal peri-implant conditions could be observed (Figure 8). The patient was very pleased with the esthetic and functional outcome. Thus, the performed treatment was successful and showed stable results without complications.

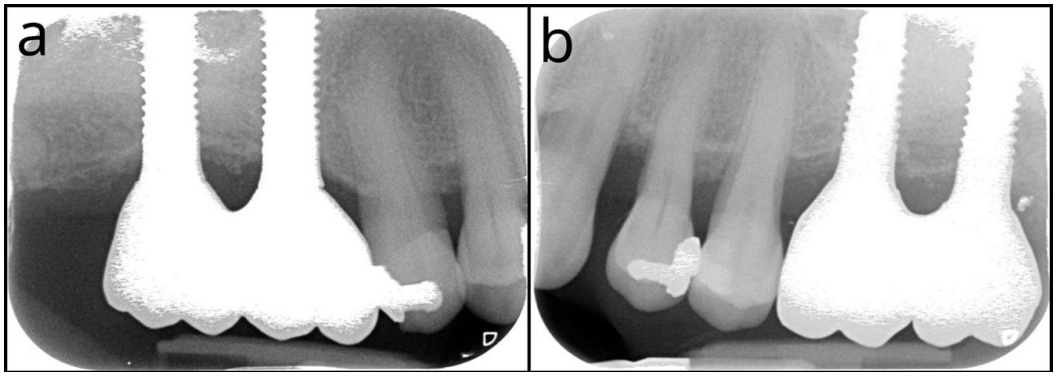

Figure 8: Radiographs performed after two years shows full integration of the implants. a. 1.6 and 1.7 positions. b. 2.6 and 2.7 positions.

6. Discussion

The use of Computed Assisted Implantology (CAI) software in the preoperative virtual three-dimensional implant planning allowed for guided implant placement, and proved to be especially beneficial in the presented case. The use of computer simulation software enables higher accuracy and more predictability. Flapless implant surgery has been proposed as a potential treatment possibility for the enhancement of implant aesthetics and easy to execute [11]. Nevertheless, by conducting this procedure blindly, you should be conscious of the danger of deflecting implants due to the difficulty of evaluating alveolar bone contours and angulations. Pre-surgical diagnostics with adequate software programs provides all necessary information regarding the implant site and anatomical reference points. If appropriate guide support is provided, accurate and efficient surgical procedures can be completed [12]. One advantage of CAI is certainly its ease of use; only a few "clicks" on the keyboard separate the CT examination from an interactive 3D image visualizing the axial, transverse and panoramic planes of the reconstruction. The learning curve is fast enough non to constitute an insurmountable barrier, even for the practitioner who is not very keen on computers. It is a decisive advantage to be able to "visit" in advance the intervention sites. Zirconia implants proved successful osseointegration, optimal biocompatibility and soft-tissue response. Through in vitro and in vivo studies, zirconium has earned its place as a valid substitute for titanium. From a biologically interesting perspective, zirconium has significant advantages. It has shown a lower affinity with bacterial plaque, smaller quantities of inflammatory infiltrations and optimal soft tissue integration. These characteristics could decrease the risk of peri-implant disease [13]. The biomechanical features of zirconium oxide implants have been evaluated successfully in several studies [14,15]. Nevertheless, the early failure rates of the zirconium oxide implant systems that have been designed and tested to date have generally exceeded those of titanium implants. Strong data on long-term outcomes are poor. Technical failure caused by material fracture is a delicate problem and a crucial issue for usability and adherence in daily practice.

7. Conclusions

The present case report emphasized the efficient workflow and the predictable outcome using computer assisted implantology. In addition, zirconia implants in this case have proven to be an excellent alternative to titanium implants after more than two years of follow-up. All the implants have been perfectly osseointegrated and the results obtained both aesthetically and functionally were optimal.

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