COMPUTER-GUIDED IMPLANT PLACEMENT IN A PATIENT WITH SEVERE ATROPHY

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Computer software associated with imaging techniques facilitates diagnosis, planning, and management in cases of severe maxillary atrophy, by reducing the incidence of complications and improving the postoperative course and functional outcome. This article reports on a case of a 66-year-old woman with maxillary atrophy. Computer software was used to plan and position 6 maxillary and 4 mandibular implants, taking maximum advantage of the remaining bone. Bicorticalization was sought by angulation and implant fixation in the buttresses, while rehabilitation was carried out by means of a fixed screw-retained upper prosthesis and a lower overdenture. No implants were lost after 36 months of follow-up. This technique optimized precise implant placement as planned without the need for more complex reconstruction techniques.

Key Words: implants, bone atrophy, computer-guided, software

INTRODUCTION

Lack of bone volume and poor bone quality have led to the development of new implant surgical techniques to take maximum advantage of the available bone.[1] Placing angulated implants in the parasinus region, using short implant lengths[2] and wider implant diameters,[3,4] and placing implants into anatomical buttresses[5–7] can help to avoid the need for more complex reconstruction,[5] such as sinus or ridge augmentation.[8] While the choice of technique is dependent upon the characteristics of each case, these management approaches all involve increased complexity and a longer treatment time.

Computer software and 3-dimensional imaging can provide detailed information on the condition of the jaws, and facilitate surgical planning. The application of such programs during oral implant placement is intended to ensure optimum implant placement with a reduction in the risk of damage to neighboring structures and complications. Virtual 3-dimensional views of bone morphology allow the surgeon to visualize the surgery prior to implant placement. Risks such as inadequate osseous support or compromise of important anatomic structures are avoided.[9–11]

This article reports on the use of case planning software in the treatment of a 66-year-old woman with severe maxillary atrophy.

CLINICAL CASE

A 66-year-old woman presented with the complaint that she was unable to wear her upper and lower complete dentures. A review of her medical history revealed that she had arterial hypertension and allergy to penicillin, and that she had worn complete upper and lower dentures for the previous 15 years. Clinical and radiological examinations showed significant Class V[12] bone atrophy (Figure 1). A maxillary computerized tomography scan was requested in DICOM 3.0 format for processing with computer

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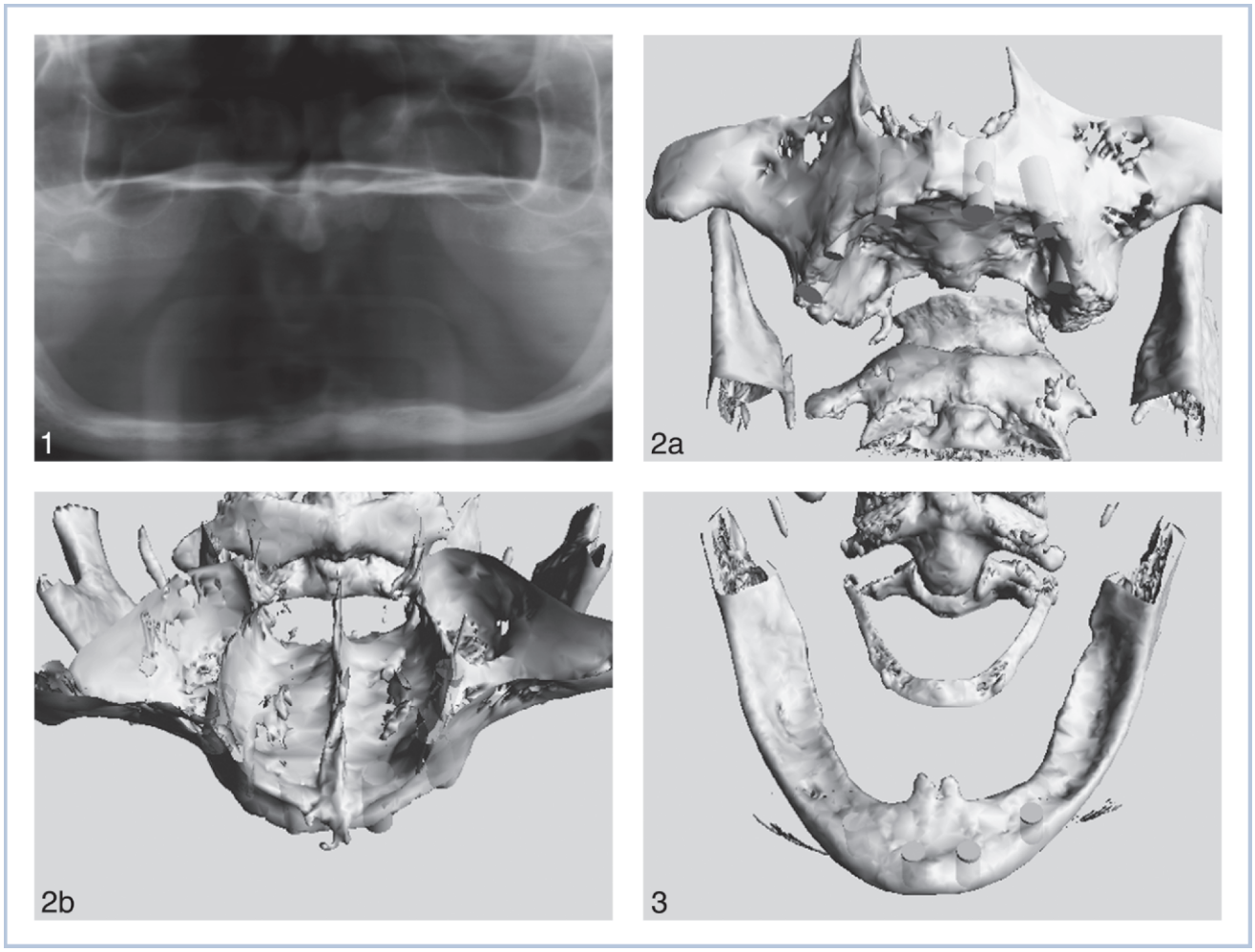
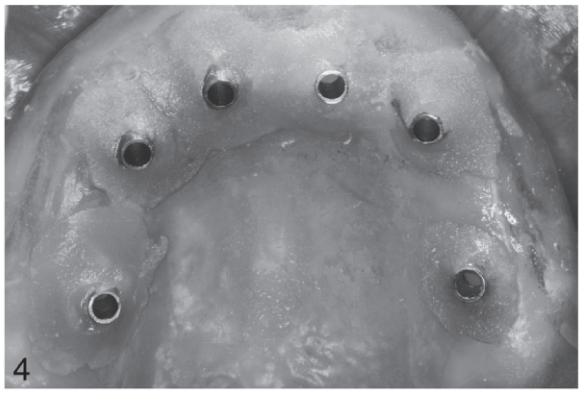


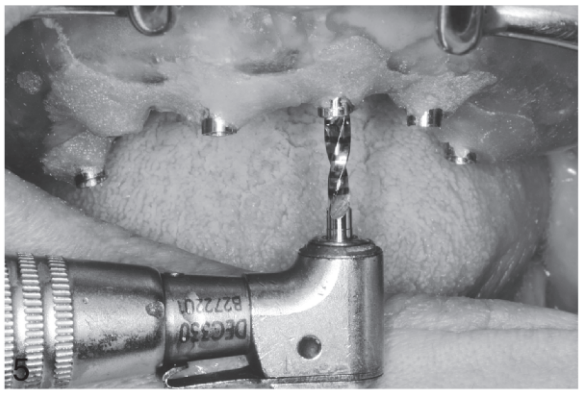
FIGURES 1–3. FIGURE 1. Orthopantomography before implant surgery. FIGURE 2. Digitally constructed image of the atrophic maxilla. FIGURE 3. Digitally constructed image of the atrophic mandible.

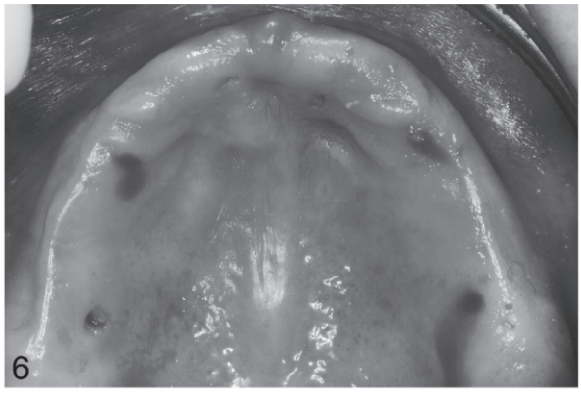
software to obtain 3-dimensional reconstructions of the maxillas (Figures 2 and 3). The software program (Implametric, 3DENT, Valencia, Spain) was used to simulate implant placement in the most appropriate available zones. The simulation was, in turn, used to manufacture a surgical splint with metal rings at the points where the implants were to be placed with the required angulation.

Surgery was carried out under intravenous conscious sedation and local anesthesia (4% articaine and adrenalin 1:100 000; Ultracain, Normon, Madrid, Spain). The surgical splint was positioned on the maxilla, and a pilot drill was used to mark the implant locations through the oral mucosa and in the bone (Figures 4 through 6). A supracrestal incision was made, joining the marked points from one tuberosity to the other with 1-cm distal releasing incisions, followed by the raising of a full-thickness flap (Figure 7). Six implants (Defcon TSA, Impladent, Senmenat, Barcelona, Spain) with grit-blasted surfaces were placed (Table). In both anterior implants, the nasal fossa was lifted and augmented with bovine xenograft (Bio-Oss, Geistlich, Wolhusen, Switzerland). All implants were placed using conventional techniques under abundant irrigation with sterile saline solution (Figure 8 and Table). The distal implants were placed towards the palatal wall and anchored in the sinus septum; the middle implants were placed in the canine eminence; and the anterior implants were subjected to bicortical anchoring with the floor of the nasal fossa.

In the mandible, a crestal incision was made with central vestibular releasing incisions, and implants measuring 8.5 mm in length and 4.2 mm in diameter were placed with bicortical anchoring between the mental foramina (Figures 9 through 11). Suturing was



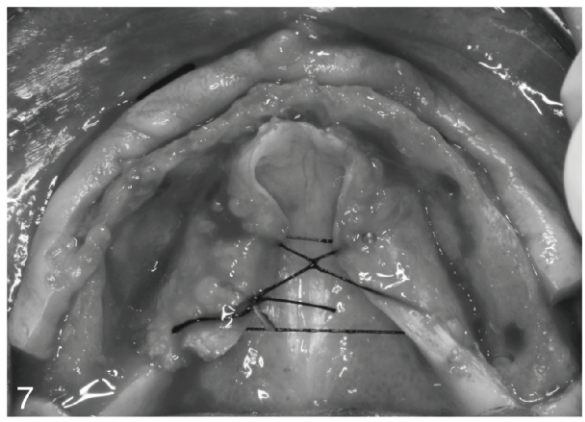




FIGURES 4–6. FIGURE 4. Surgical splint positioned on the maxilla. FIGURE 5. Pilot drill marking the implant locations. FIGURE 6. Occlusal view of implant locations.

carried out with 3/0 silk (LorcaMarin, Murcia, Spain) leaving the implants submerged. The patient's existing complete dentures were relieved and lined with tissue conditioner for use as provisional restorations.

Antibiotic (Rhodogil, Aventis Pharma, Madrid, Spain) coverage (1.5 mill. UI of spiramicin and 250 mg of metronidazole every 12 hours for 7 days) was



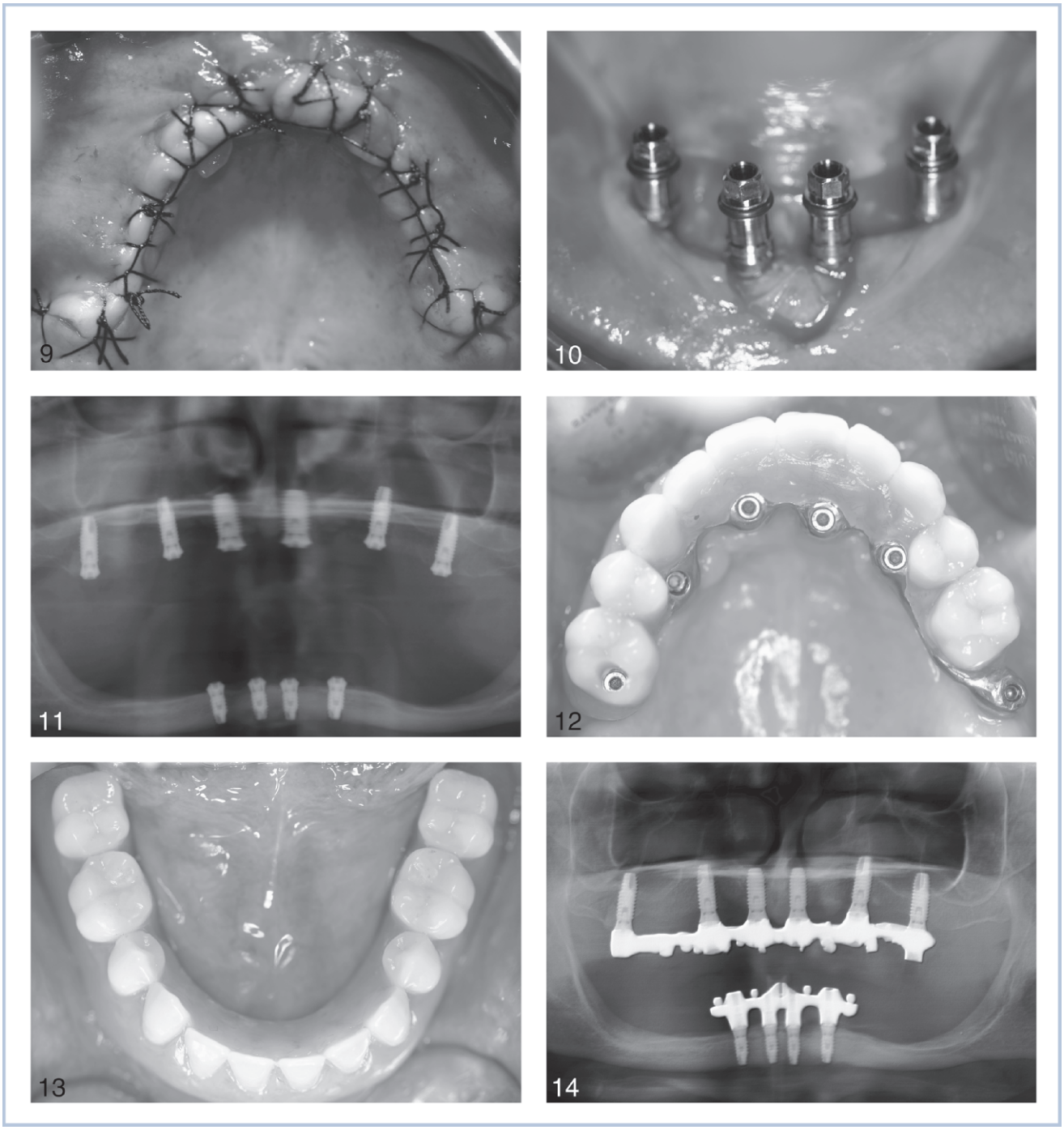
FIGURES 7 AND 8. FIGURE 7. Intraoperative image with a supracrestal incision. FIGURE 8. Intraoperative view with the implants in place.

administered together with ibuprofen (600 mg every 8 hours, during 4 days). Sutures were removed after 1 week, and second-stage surgery was performed after 4 months. All implants osseointegrated and were asymptomatic. One month later, impressions were made for fabricating the maxillary screw-retained prosthesis and mandibular overdenture (Figures 12 and 13).

TABLE

Distribution of maxillary implants placed

	Placement Location		Dimensions (mm)	
Implant No.	Quadrant	Tooth	Diameter	Length
1	Right	1st Molar	4.1	13
2	Right	Cuspid	4.1	13
3	Right	Central incisor	4.1	11.5
4	Left	Lateral incisor	4.1	11.5
5	Left	1st Bicuspid	4.1	13
6	Left	1st Molar	4.1	13



FIGURES 9–14. FIGURE 9. Reapproximated and sutured tissues achieved primary closure. FIGURE 10. Mandibular implants at the time of placement. FIGURE 11. Panoramic radiograph after implant placement. FIGURES 12 AND 13. Final prostheses in place. FIGURE 14. Orthopantomography after placement of the definitive prostheses.

Thirty-six months after delivery of the prostheses, the patient indicated satisfaction on a visual analog scale (VAS). VAS score was 9 (range 0–10). Panoramic radiographic examination at that time did not show any evidence of peri-implant radiolucency (Figure 14).

DISCUSSION

The use of computer software with 3-dimensional imaging can greatly facilitate the surgical planning, positioning, and placement of dental implants,[10,13] followed by immediate provisionalization.[14] A number

of authors[15–18] have used computer-guided implant placement for a broad range of purposes, including measurement of the height of marginal bone, and quantification and comparison of the types of bone and the different oral regions. Parel and Triplett[9] used interactive images for planning, manufacturing, and placing the prosthesis.

Krekmanov et al[19] placed 75 implants in 22 atrophic maxillas in angulated positions: 19 in the palatal concavity, 11 in the anterior sinus wall, 10 in the posterior wall, and 14 in the pterygoid process. The survival rate was 94.7% after 18 months of follow-up. In this clinical case, the computer software allowed maximal bone utilization by placing implants in angulated positions and in anatomical buttresses, with great precision and safety.

In this case, computer-guided implant placement was the only way to treat this patient without more complex reconstruction techniques, such as sinus lifting or ridge augmentation procedures.

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