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Fully digital workflow from bone augmentation to implant-supported prosthetic reconstruction

Adequate bone tissue is needed for implant placement. In cases where bone tissue is insufficient, different bone augmentation methods can be used for bone reconstruction.[1] Digital solutions enable physicians to provide faster and more precise treatments in implant dentistry.[2,3] This report aimed to describe a fully digital workflow for each step consisting of bone augmentation, implant placement, and prosthetic reconstruction.

A 27-year-old female patient was admitted to our clinic for prosthetic treatment of the partially edentulous maxillary anterior region. In her dental history, it was learned that she had a traffic accident 14 years ago and lost her teeth with a significant amount of bone in the maxillary anterior region. Clinical and radiographic examinations revealed that teeth from the right maxillary second premolar to the left maxillary first premolar were missing and there were vertical and horizontal bone defects in the region. The patient stated that she had been using removable partial denture since the date of the accident. Horizontal and vertical bone augmentation with custom-made block allografts using computer-assisted design and computer-assisted manufacturing (CAD/CAM) technology, followed by placement of dental implants using digitally planned insertion guide, and digitally designed prosthetic reconstruction were planned (Fig. 1).

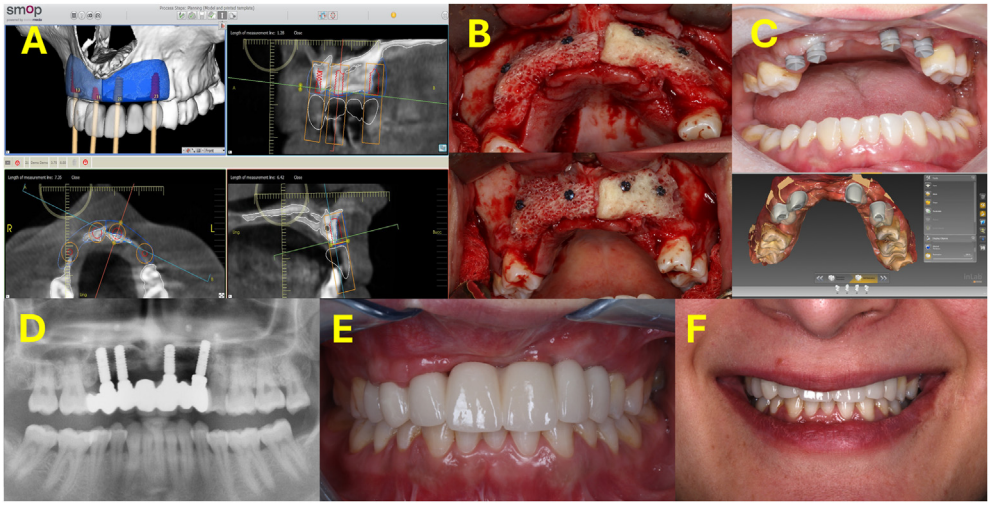

Figure 1 Fully digital workflow. A) Digital planning of bone augmentation, implant placement, and prosthetic reconstruction, B) Surgical view of digitally planned custom-made block allografts placed in the maxilla, C) Digital workflow of prosthetic reconstruction using CAD/CAM technology, D), E) and F) Radiographic and clinical view of two-year follow-up of implant-supported ceramic restorations.

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Using patient's cone-beam computed tomography (CBCT) images, two separate customized CAD/CAM freeze-dried block bone allografts (Maxgraft Bonebuilder®, Botiss Biomaterials GmbH, Berlin, Germany) were designed and produced. Custom-made block allografts were placed and fixed to the maxilla using 1.5 mm titanium mini-screws. Buccal and crestal areas were contoured using xenogenic bone substitute material (Cerabone®, Botiss Biomaterials GmbH). The surgical area was covered with a pericardium collagen membrane (Jason membrane®, Botiss Biomaterials GmbH) which was fixed to the local bone using titanium pins.

Four dental implants (Straumann®, Bone Level Roxolid®, SLActive®, Basel, Switzerland) were placed using digitally planned insertion guide 5 months after augmentation surgery. Prosthetic treatment was performed with ceramic restorations with zirconia infra-structure using fully digital workflow and CAD/CAM technology after 4 months. The second-year follow-up was uneventful, the patient reported no discomfort.

Digitally planned and manufactured custom-made block allografts can provide more precise compatibility and increase bone-graft contact areas which improve bone augmentation success. Digital technology in implant-supported prosthetic reconstruction can enable time-efficient manufacturing, high-level accuracy, and increases patient and clinician satisfaction.

Declaration of competing interest

The authors have no conflict of interest relevant to this article.

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