RESEARCH PAPER

Stackable Surgical Guide for Osteoplasty and Guided Implant Placement in a Completely Edentulous Patient: A Case Report

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ABSTRACT

Background: Prosthetically driven implant placement is essential for predictable full-arch rehabilitation in completely edentulous patients. In some cases, inadequate restorative space due to excessive alveolar bone height requires osteoplasty prior to implant placement. Stackable surgical guides enable sequential guidance of bone reduction and implant placement according to a digital treatment plan.

Case Report: This report describes the use of a digitally designed stackable guide system to perform osteoplasty and guided placement of six implants in a completely edentulous patient. A 38-year-old female presented with complete edentulism and inadequate vertical restorative space for fixed implant rehabilitation. Following cone-beam computed tomography and digital prosthetic planning, a stackable surgical guide system was fabricated. Osteoplasty was performed using a reduction guide with a piezosurgical device to achieve the planned bone level, followed by stacking of an implant placement guide for guided placement of six implants.

Results: Postoperative evaluation confirmed accurate implant positioning and adequate restorative space for prosthetic rehabilitation.

Conclusion: The use of stackable guides enabled controlled bone reduction and precise implant placement, improving the predictability of full-arch implant rehabilitation.

Keywords: guided implant surgery, osteoplasty, stackable surgical guide, piezosurgery, edentulous arch

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Introduction

Implant-supported prostheses are widely considered a predictable and reliable treatment option for the rehabilitation of completely edentulous patients. Since the introduction of osseointegration, dental implants have demonstrated high survival rates and improved patient satisfaction compared with conventional removable prostheses (1). Successful implant rehabilitation requires careful diagnosis, prosthetically driven treatment planning, and adequate bone volume to support optimal implant positioning and long-term prosthetic stability.

In edentulous arches, inadequate restorative space or irregular alveolar ridge morphology may compromise prosthetic design and biomechanics. In such cases, bone reduction procedures such as osteoplasty or alveoloplasty may be required prior to implant placement to achieve appropriate restorative space and favourable implant positioning. Clinical studies have highlighted the

importance of ridge modification procedures and prosthetically driven implant placement for achieving optimal functional and esthetic outcomes in implant-supported rehabilitation (2–4).

Recent advances in digital dentistry have significantly improved the planning and execution of implant therapy. Cone-beam computed tomography (CBCT) combined with digital impressions allows accurate three-dimensional assessment of bone morphology and prosthetic requirements. Digital implant planning software facilitates the integration of prosthetic and surgical considerations, enabling clinicians to design surgical guides that improve the accuracy and predictability of implant placement (5–7).

Guided implant surgery has been shown to enhance precision in implant positioning compared with conventional freehand techniques. The use of surgical guides reduces surgical variability and allows clinicians to perform implant placement according to a pre-planned prosthetic design (8). In recent years, stackable surgical guides have been introduced to facilitate sequential procedures such as bone reduction and implant placement while maintaining a stable reference point throughout the surgical workflow. This approach allows controlled osteoplasty and accurate implant placement in complex cases such as completely edentulous arches (9–12).

Therefore, the present case report describes the use of a digitally designed stackable surgical guide system to perform osteoplasty followed by guided placement of six implants in a completely edentulous patient.

Case Report

A 38-year-old female presented with difficulty in mastication and dissatisfaction with removable dentures. She desired fixed implant-supported rehabilitation. Her medical history was non-contributory. Informed consent was obtained from the patient prior to participation in the study. The patient was provided with detailed information regarding the purpose, procedures, potential risks, and benefits, and participation was entirely voluntary. Confidentiality and the right to withdraw at any time were ensured. The study protocol was reviewed and approved by the Institutional Ethics Committee under Ethics Committee Reference Number: (SRB/SDC/MSIMPLANT-2304/26/036)

Clinical examination revealed complete edentulism with adequate ridge width but limited restorative space for a fixed prosthesis. Cone-beam computed tomography was performed to evaluate bone volume and anatomical structures. Digital impressions were obtained and merged with CBCT data to facilitate prosthetically driven implant planning (4,5).

Virtual planning revealed insufficient vertical restorative space, indicating the need for osteoplasty prior to implant placement. A stackable surgical guide system was designed using ExoPlan-ExoCAD *(Darmstadt, Germany)* implant planning software. The system consisted of a base guide stabilized with fixation pins, a bone reduction guide, and an implant placement guide that could be stacked onto the base guide and printed in surgical guide resin (Figure 1) (9,10).

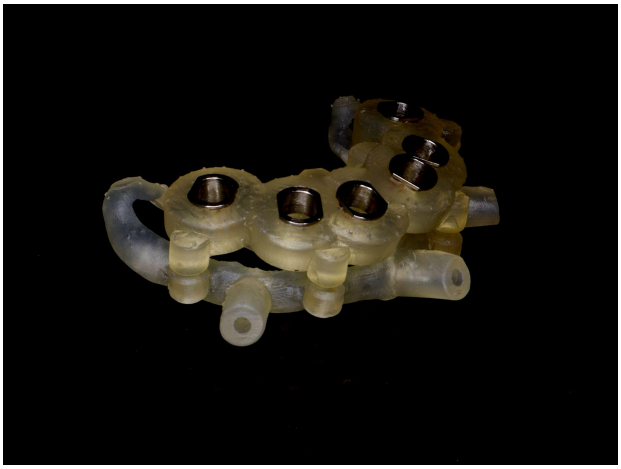

Figure 1: Stackable guide (Base guide with the implant placement guide)

Under local anesthesia, a crestal incision was made and a full-thickness mucoperiosteal flap was elevated. The base guide was positioned and stabilized with fixation pins. The bone reduction guide was then placed onto the base guide to guide osteoplasty.

Bone reduction was performed using a piezosurgical device according to the predetermined level indicated by the reduction guide. Piezosurgery allowed controlled and precise bone removal while minimizing trauma to surrounding tissues. Adequate osteoplasty was achieved to establish the required restorative space (11).

After bone reduction, the reduction guide was removed while maintaining the base guide in position. The implant placement guide was then stacked onto the base guide and secured. Six implants CopaSky *(Bredent, GmbH, Senden, Germany)* were placed according to the guided surgical protocol at the predetermined positions and angulations, achieving satisfactory primary stability (Figure 2).

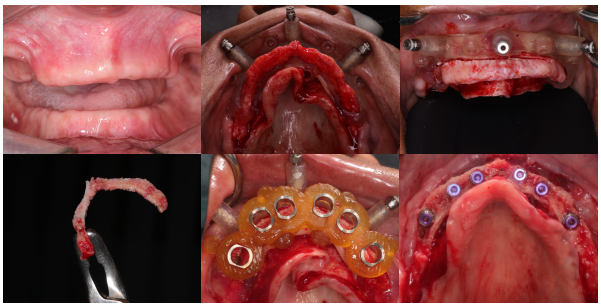

Figure 2. Surgical workflow for maxillary implant placement. (A) Preoperative view of the maxilla. (B) Flap elevation and stabilization of the base surgical guide using fixation pins. (C) Osteotomy performed with piezosurgical instruments. (D) Excised bone segment following osteotomy. (E) Placement of the implant positioning guide. (F) Final placement of the dental implants.

The surgical site was irrigated and closed with interrupted sutures. Postoperative evaluation confirmed accurate implant positioning consistent with the digital plan and adequate restorative space for prosthetic rehabilitation.

Discussion

Prosthetically driven implant placement is a fundamental principle in modern implant dentistry. Adequate restorative space is essential to ensure appropriate prosthetic design, occlusal stability, and maintenance of peri-implant health. In cases where excessive alveolar bone height or irregular ridge contours are present, bone reduction procedures such as osteoplasty may be necessary before implant placement. Previous studies have emphasized the importance of ridge modification procedures to improve prosthetic outcomes in implant rehabilitation (3,4).

Digital implant planning has transformed the workflow of implant dentistry by allowing clinicians to visualize anatomical structures, prosthetic requirements, and implant positions in a virtual environment prior to surgery. The integration of CBCT data with digital impressions enables prosthetically guided planning and enhances treatment predictability. Studies evaluating digital implant workflows have demonstrated improved diagnostic accuracy and better communication between surgical and prosthetic phases of treatment (5–7).

Computer-guided implant surgery has gained popularity due to its ability to improve the accuracy of implant placement and reduce surgical complications. Several investigations have reported that guided implant surgery results in more precise implant positioning compared with conventional freehand techniques, particularly in complex cases involving full-arch rehabilitation (8,10). In addition, digital workflows can help reduce surgical time and improve overall treatment efficiency.

Stackable surgical guide systems represent an advancement in guided implant surgery that allows sequential surgical procedures to be performed using a single reference guide. This technique enables clinicians to first perform controlled osteoplasty using a reduction guide and subsequently place implants using a stacked implant guide while maintaining the same surgical reference. Such an approach improves surgical accuracy and ensures that bone reduction corresponds with the prosthetic treatment plan (11,12).

In the present case, a digitally designed stackable guide system was used to perform osteoplasty followed by guided placement of six implants in a completely edentulous maxilla. The use of a piezosurgical device allowed precise and controlled bone removal with minimal trauma to surrounding tissues. Previous research has highlighted the advantages of piezosurgery in oral surgical procedures, including improved precision and reduced risk of soft-tissue injury (13).

Postoperative evaluation confirmed accurate implant positioning consistent with the digital treatment plan and adequate restorative space for prosthetic rehabilitation. The findings of this case support previous reports that digital planning combined with guided surgery can significantly improve the predictability of implant placement and prosthetic outcomes (14–18).

Conclusion

Stackable surgical guides combined with piezosurgical osteoplasty provide a predictable method for controlled bone reduction and guided implant placement in completely edentulous patients. This technique facilitates accurate bone reduction and prosthetically driven implant positioning, improving the predictability and success of full-arch implant rehabilitation.

Informed consent statement

Informed consent was obtained from all subjects involved in the study.

Institutional review board statement

The study was conducted in accordance with the Declaration of Helsinki, and approved by the Institutional Research Ethics Committee (SRB/SDC/MSIMPLANT-2304/26/036).

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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