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# Dynamic navigation technology combined with zygomatic implants as a surgical strategy for insufficient maxillary bone volume

**KEYWORDS**
All-on-X;
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Masticatory function and proper nutrition are critical for daily health.[1] Age-related tooth loss is increasing demand for full-arch implant rehabilitation. Digital workflows provide faster, more accurate results than conventional methods.[2] With dynamic navigation, clinicians can place implants and deliver a 3D-printed fixed dental prosthesis in under 8 h, restoring function the same day.[3] When maxillary bone is lacking, clinicians turn to grafts, pterygoid, or zygomatic implants.[4] This report explained how dynamic navigation could be combined with zygomatic implants to manage severe maxillary bone deficiency.

In this report, the treatment process was carried out using dynamic navigation technology with the X-Guide system (X-Nav Technologies, LLC, Lansdale, PA, USA), as illustrated in Fig. 1. Surgical planning began with the analysis of maxillary bone information obtained from cone-beam computed tomography (CBCT) (Rayscan S-SC, Ray, Seoul, South Korea) (Fig. 1A). Imaging revealed a marked deficiency of bone thickness in the bilateral maxillary molar regions, preventing stable placement of conventional dental implants. Therefore, this report adopted the use of zygomatic implants in the posterior maxilla as a strategy to establish posterior support. Treatment planning was conducted using an implant planning software (DTX Studio Implant software Version 3.6.9.3, Nobel Biocare, Zurich, Switzerland) (Fig. 1B). The regular dental implants were designed based on areas with adequate bone volume.

Specifically, Nobel Biocare Groovy implants (Nobel Biocare) were placed at teeth 13, 11, and 23 sites. For regions with insufficient bone in the posterior maxilla, zygomatic implants (Nobel Biocare) were used as an alternative approach and placed at teeth 15 and 25 sites. Subsequently, the diagnostic wax-up was digitally superimposed onto the surgical planning images to evaluate and refine the planned implant positions and angulations before surgery. On the day of surgery, the clinical workflow included implant placement, impression-taking, and the delivery of the prostheses, following established protocols.[3] A

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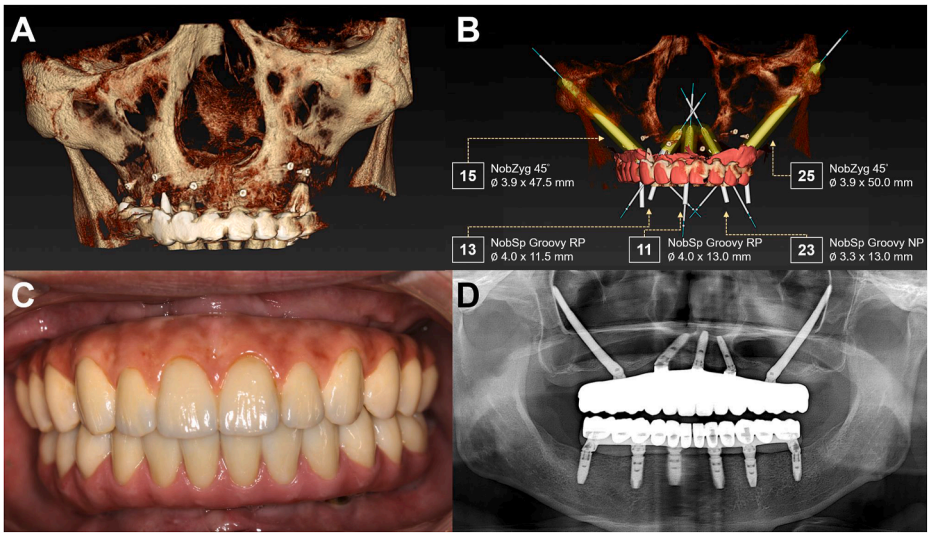


**Figure 1** Technical overview of dynamic navigation technology combined with zygomatic implants. (A) The 3D model of the maxillary bone generated from computed tomography images was used for surgical planning. (B) Dental implant size selection and placement were controlled through DTX Studio Implant software. (C) Intraoral photograph showing the final implant-supported complete-arch fixed dental prosthesis (ISCFDP) in place following installation. (D) The final ISCFDP were placed in the mouth to take X-ray images.

maxillary 3D-printed interim implant-supported complete-arch fixed dental prosthesis (ISCFDP) was delivered immediately after surgery. Approximately six months later, the maxillary and mandibular definitive zirconia ISCFDPs were delivered (Fig. 1C). Postoperative CBCT confirmed successful osseointegration around all implants, including the zygomatic implants (Fig. 1D). The zirconia ISCFDPs demonstrated a precise fit with the implant abutments, showing no marginal gaps. Based on the results, zygomatic implants proved to be an effective strategy for managing insufficient maxillary bone volume. Long-term and extensive follow-up studies are necessary to understand the long-term stability and potential complications associated with zygomatic implants.

Zygomatic implants have primary limitations related to implant angulation, intraoral surgical access, and the clinician's experience. Although digital advances have enhanced the precision of implant angulation, zygomatic implants are generally reserved for clearly defined indications, such as severe maxillary atrophy, previous graft or implant failure, the desire to avoid staged bone-grafting procedures, or reconstruction of maxillary defects after trauma or oncologic resection.[5] To further improve their clinical outcomes, authors continued to investigate the accuracy and biomechanical performance of zygomatic implants, aiming to provide valuable insights into dental implant techniques.

## Declaration of competing interest

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

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