

DENTAL TECHNIQUE

Esthetic Integration Area concept to improve the emergence profile of fixed restorations: A dental technique

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Predictable esthetic and functional results are the goals of prosthodontic and restorative dental treatment and should be determined before the treatment is started.¹⁻⁶ The development of 3-dimensional (3D) technologies has enhanced comprehensive diagnosis, treatment planning, treatment sequence, and clinical procedures, all integral to successful esthetic oral rehabilitation.⁷ The diagnostic waxing phase has improved compared with conventional procedures, with the development of computer-aided design (CAD) software programs and digital tools that measure design thicknesses, mirror natural tooth shapes, and use dental libraries based on natural algorithms.^{8,9} Diagnostic waxing can be defined as the waxing of the intended restorative contours on dental casts to evaluate and plan restorations or as a wax replica of a proposed treatment.¹⁰ The diagnostic waxing can be classified according to the phase of treatment in which it is to be used¹¹ to verify esthetic and functional parameters such as tooth visibility at rest, the relationship between facial and dental midlines, the smile line, the lip line, and the occlusal plane.^{12,13} These esthetic and functional concepts are used to position the incisal edges of central incisors in the correct mesiodistal and apicocoronal position. Nevertheless, the literature is scarce on the limits

ABSTRACT

A technique for obtaining the esthetic integration and optimal emergence profile of tooth-supported and implant-supported restorations is described. Using a computer-aided design software program, data captured with an intraoral scanner were used to establish the anatomic landmarks for determining the maximum buccal volume to which a restoration can be extended. This technique could be applicable to different types of fixed-dental prostheses treatments. Advantages of this technique include the establishment of periodontal-prosthetic criteria and the improvement of clinical and laboratory communication since the same guidelines for evaluating restorative space in the buccolingual direction of tooth preparations are used to avoid overcontoured restorations. (J Prosthet Dent 2022;■:■-■)

of the maximum buccal volume that can be waxed for a restoration.

The optimal emergence profile of implant-supported restorations has been described.¹⁴⁻¹⁷ Su et al¹⁴ and González-Martin et al¹⁵ define 2 different areas: the critical and subcritical contours. These authors defined the critical contour as the most superficial area of the implant abutment or crown, which is located within 1-mm apical of the gingival margin and which influences the gingival margin level and zenith location. The subcritical contour extends apically from the critical contour to the implant platform. Chu et al¹⁶ published a decision tree to design the critical and subcritical contours related to single-tooth implant location. Subsequently, Gómez-Meda et al¹⁷ proposed the esthetic biological contour (EBC) concept, referring to the subcritical contour and establishing its dimensions in 3 different zones. These authors only referred to the subgingival component of the emergence profile and limited it to

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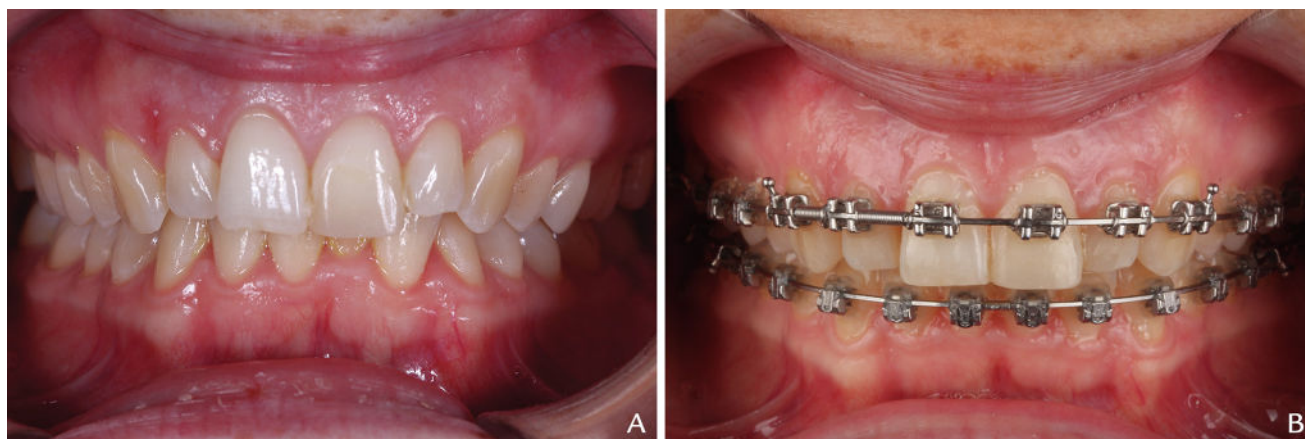


Figure 1. Existing composite resin restoration on left maxillary central incisor. A, Initial situation. B, Orthodontic treatment completed before bracket removal.

implant-supported restorations and how to manage them with an apicocoronal approach. As they did not consider the importance of the supragingival area, criteria for positioning the facial surface of teeth are lacking.

An esthetic restoration should emerge through the surrounding periodontal tissues and integrate with the adjacent natural teeth, replicating their shape and color.¹⁸⁻²⁷ The authors have observed that the facial supragingival volume of the restorations has a greater impact on the esthetic integration of prosthetic restorations than the subgingival component. Therefore, it was necessary to define new references that help correctly establish the buccal profile of the teeth to be restored; this is termed by the authors as the Esthetic Integration Area (EIA) concept. The EIA is delimited by anatomic landmarks such as the tip of the papillae, papilla ridges (PRs), and the maximum vestibular volume (MBV) of the gingival margin (GM). The PRs can be defined as the maximum facial volume of papillae that can be used to quantify the interproximal available restorative space of the future restoration. The MBV of the GM is delimited by the distance between the gingival sulcus (GS) and the MBV of the GM, which represents the restoration area (RA). If the RA is exceeded, overcontoured restorations are to be expected.

This technique is illustrated with a clinical treatment. A 30-year-old woman was referred to private practice for prosthodontic treatment. Her chief complaint was her poor esthetics. The treatment plan involved an orthodontic phase because this patient presented an increase in horizontal overlap, maxillary dentoalveolar compression, a Bolton discrepancy, and tooth crowding (Fig. 1). Orthodontic treatment was followed by marginless feldspathic veneers on the right lateral, left central, and left lateral incisors. The left central incisor had an existing composite resin restoration, which was removed in the CAD program and diagnostically waxed digitally by using the EIA concept.

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1. During the first clinical appointment, obtain an intraoral digital scan of the maxillary and mandibular arches with an intraoral scanner (Medit i700; Medit Corp) at an ambient light illuminance of 1003 lux according to the manufacturer's recommended scanning protocol (Fig. 2A).
2. Import the standard tessellation language (STL) file into a CAD 3D software program (3D Viewer; 3Shape A/S).
3. Determine the mesial and distal PRs of the tooth to be restored (Fig. 2B).
4. Make an axial 2-dimensional cut in the CAD 3D software program (3D Viewer; 3Shape A/S) passing through the mesial and distal PRs to visualize the available restorative space interproximally (Fig. 2C). If the line which connects both PRs is exceeded, interproximal overcontoured restorations will be expected.
5. Draw an imaginary line which connects both mesial and distal PRs passing through the teeth and connect them with an imaginary line which follows the contour of the gingival margin (GM) of the tooth to be restored (Fig. 3A, 3B).
6. Make a sagittal 2-dimensional cut in a CAD 3D software program (3D Viewer; 3Shape A/S) to visualize the restoration area (RA) (Fig. 3C).
7. Fabricate the ceramic veneers by following the EIA concepts and then cement the restorations (Fig. 4A-C).
8. Scan the patient with an intraoral scanner (Medit i700; Medit Corp), import the STL files into a 3D viewer (3D Viewer; 3Shape A/S), and make axial and sagittal 2-dimensional cuts to confirm that the restorations do not exceed the volume of the soft tissues (Fig. 4D-F).

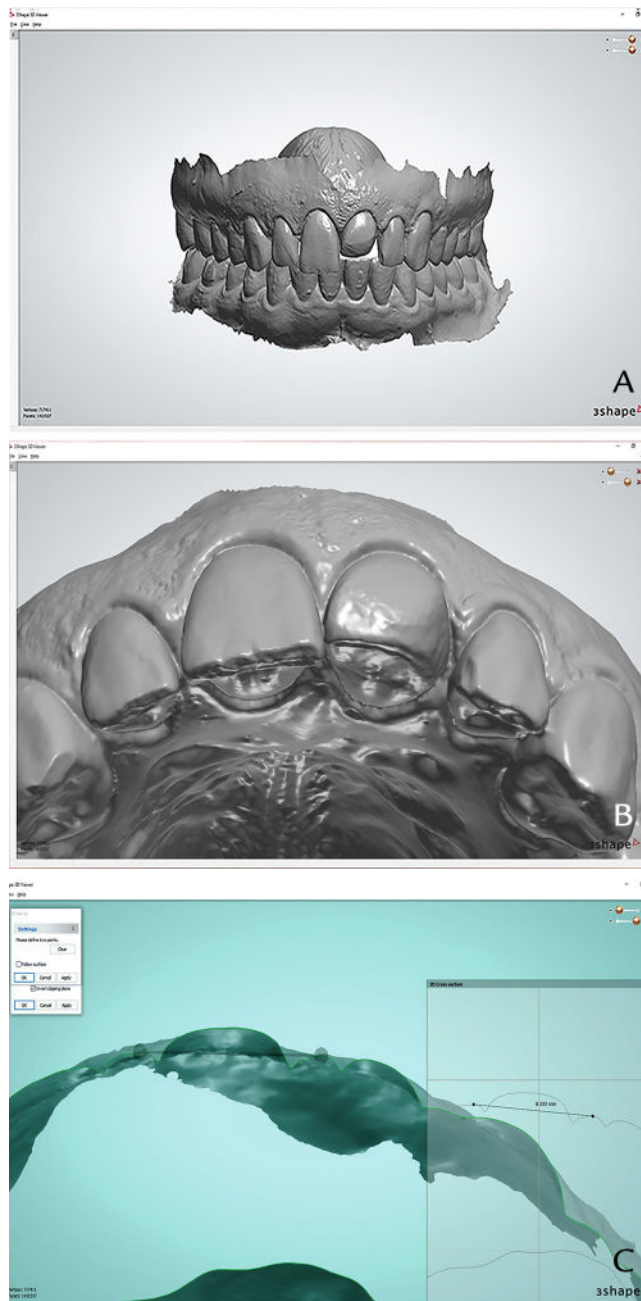


Figure 2. Intraoral digital scans. A, Initial situation after orthodontic treatment and removal of composite resin restoration. B, Mesial and distal PRs determination. C, Axial 2-dimensional slice to visualize interproximal restorative space. PR, papilla ridge.

9. Superimpose the initial STL scan and final scan with the restorations placed and make a sagittal 2-dimensional cut in a CAD 3D software program (3D Viewer; 3Shape A/S) to verify the material thicknesses and that the RA has been respected according to the EIA concept (Fig. 5A-C).

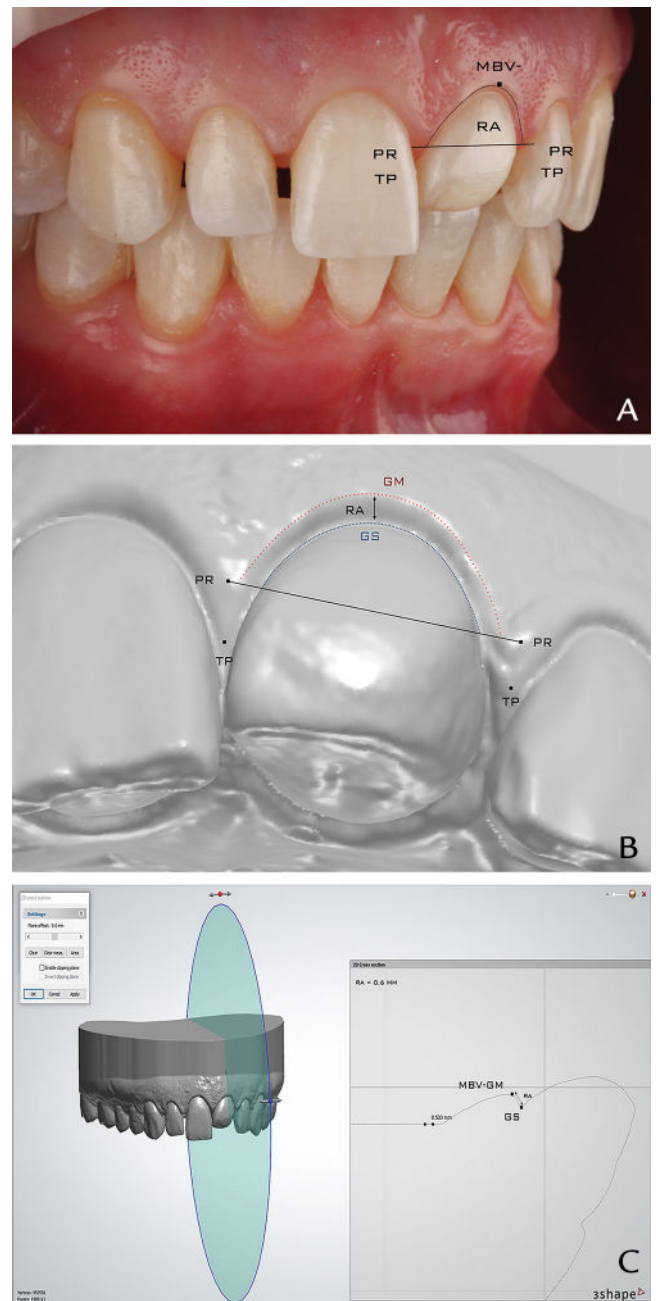


Figure 3. RA determination. A, Lateral view of RA. B, Occlusal view of RA in STL file. C, 2-dimensional sagittal view of RA. RA, restoration area; STL, standard tessellation language.

DISCUSSION

Management of the emergence profile of prosthetic restorations has been described previously.¹⁴⁻¹⁷ However, most reports focused on the management of emergence profiles in implant-supported restorations rather than tooth-supported restorations. Fixed-dental prostheses

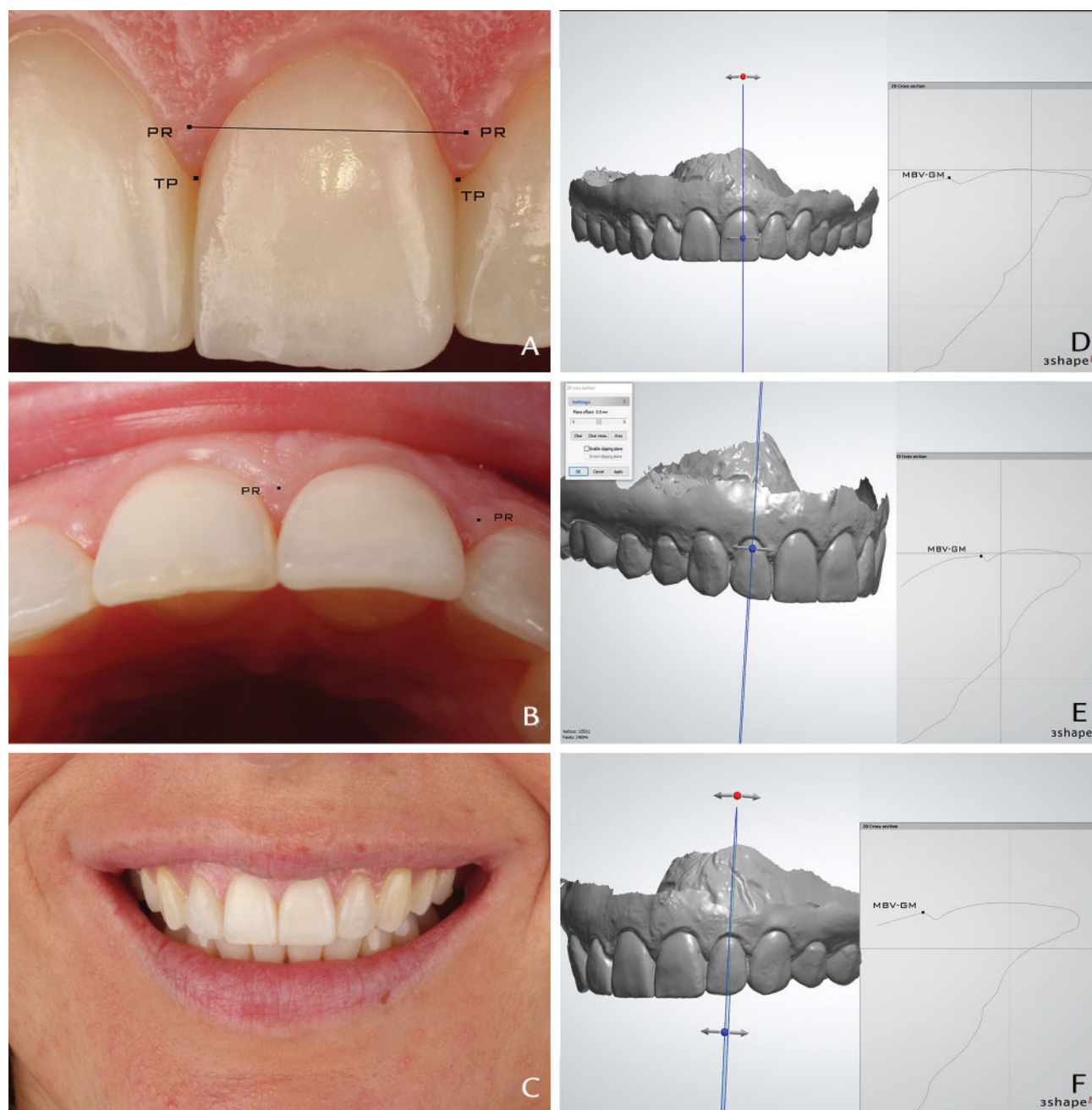


Figure 4. Feldspathic veneers placed following EIA concept. A, Lateral view. B, Occlusal view. C, Integration of restorations during smile. D-F, 2-dimensional sagittal view of cemented restorations. EIA, Esthetic Integration Area.

should be esthetically integrated, but not all of them can manage the subgingival component as in implant-supported restorations. This fact may suggest that the esthetic integration of prosthetic restorations is not strongly influenced by the subgingival component. The EIA concept provides anatomic parameters common to all types of restorations and establishes the maximum facial volume as far as a restoration can be extended in

the buccolingual direction. The thorough analysis of EIA zones could determine whether soft tissue augmentation through connective tissue grafts is necessary, emphasizing the importance of the supragingival component. Tissue thickness in the horizontal and vertical directions is key to bone crest stability,²⁸ to hiding the color of the underlying abutment, to establishing the biological width,^{29,30} and to determining the prosthetic



Figure 5. Superimposition of initial scan and final scan once restorations have been cemented. A, Right lateral incisor. B, Left central incisor. C, Left lateral incisor.

restorative space. Soft tissue deficit will lead to implant-supported restorations with poor esthetics, and, in tooth-supported restorations, it will mean increased tooth preparation if overcontoured restorations are to be avoided. The final esthetic contour of implant-supported restorations should be provided by the critical contour¹⁴⁻¹⁷ that serves as a support for the soft tissues. The

esthetic integration of restorations is obtained by not exceeding the interproximal available space and RA in a buccolingual direction, as described in this article, with tooth- or implant-supported restorations. The EIA concepts can be previsualized digitally by using a CAD software program and different digital tools, improving treatment planning. Once the emergence profiles have been confirmed during the interim restoration stage, intraoral digital scans should be made to replicate them in the definitive restorations.

The EIA concept requires the establishment of the gingival soft tissues in their original position. When gingival displacement cords are placed for making definitive impressions, the GM is modified, being located in a more apical position and impacting the EIA concept parameters (Fig. 5A-C). Therefore, it is necessary to obtain 2 definitive impressions, with and without displacement cords, for the dental laboratory technician. The dental laboratory technician should align both scans, design the restoration over the digital scan with displacement cords, as the preparation margins are recorded, and then finalize the facial volume of the restorations by following the EIA concepts with the first digital scan.

The EIA anatomic landmark points cannot be determined in patients with a loss of alveolar volume and gingival architecture. Therefore, the vertical and horizontal reconstruction of hard and soft tissues is essential. It will then be necessary to manage soft tissues with interim restorations to restore the gingival architecture by following the EIA concept (Fig. 6A-E).

Understanding the different zones of the EIA concept allows for the design and fabrication of restorations that fulfill optimal biological, functional, and esthetic requirements. The guidelines proposed by the authors can be applied to different types of dental treatments and should be taken into consideration, especially, when no-preparation veneers are provided.

SUMMARY

The described periodontal-prosthetic dental technique provides new references for positioning the facial surface of teeth in a buccolingual direction. The technique focuses on the importance of the supragingival component, providing step-by-step guidelines for the analysis of patients needing prosthodontic treatment and for obtaining natural-looking restorations. Advantages of this technique include improved quantification of the available restorative space to avoid overcontoured restorations and to improve communication between dentists and dental laboratory technicians. The EIA concept can only be applied when mesial and distal interproximal papillae are present.

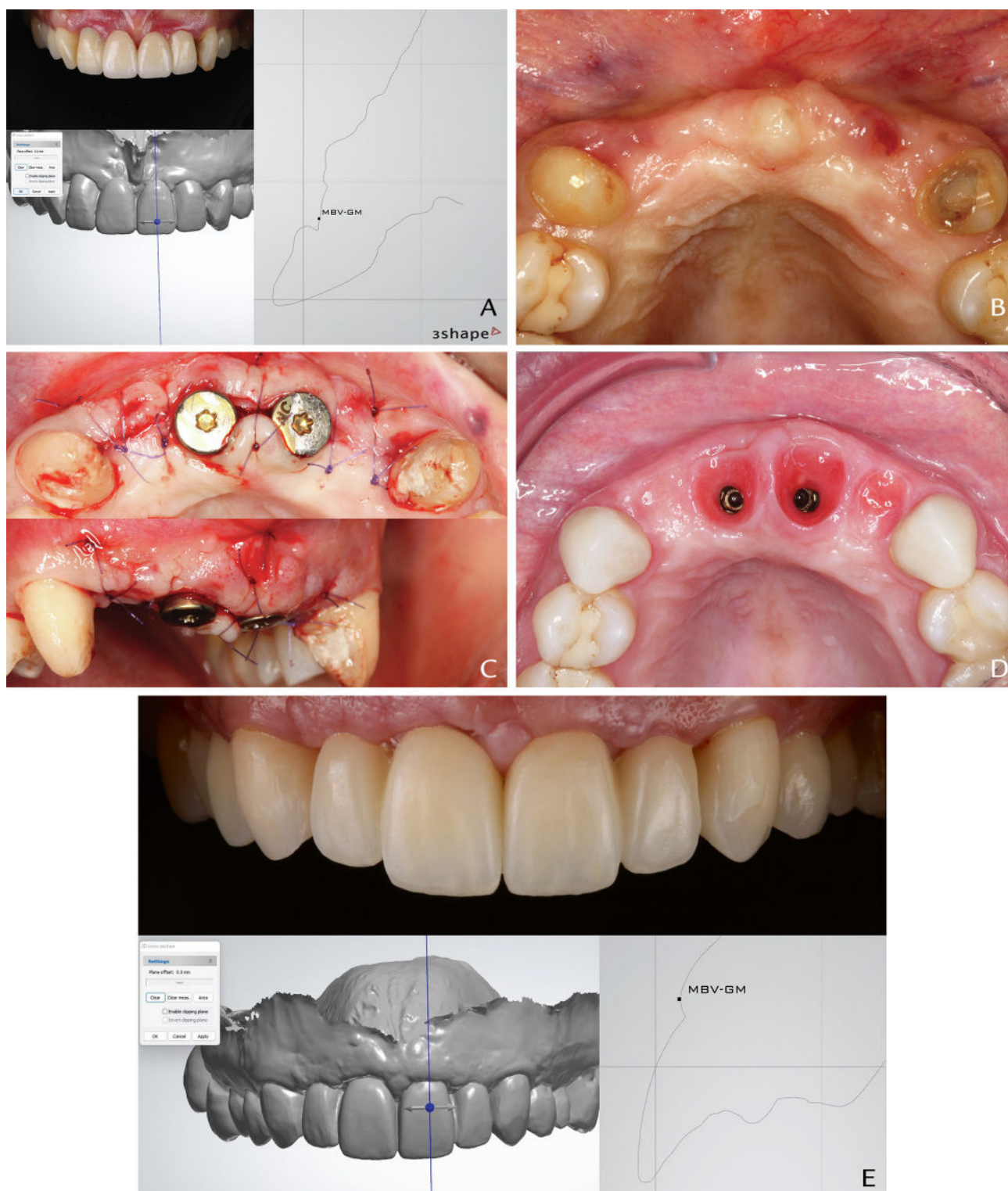


Figure 6. Patient with horizontal and vertical alveolar volume loss. A, Initial situation. MBV- GM located behind interim restorations. B, Horizontal volume loss from right to left canine. C, Hard and soft tissue reconstruction associated with implant-supported restorations. D, Soft tissue and gingival architecture management through implant-supported restorations. E, Definitive implant-supported restoration placement. Facial surface of right central incisor located behind MBV-GM according to EIA concepts. EIA, Esthetic Integration Area; MBV-GM, maximum vestibular volume of gingival margin.

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