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CLINICAL ARTICLE

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Digital approaches to facially guided orthodontic and periodontal rehabilitation in the anterior esthetic zone: A case report

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Abstract

Objective: The present case report describes digital approaches to plan an orthodontic and periodontal rehabilitation at the anterior esthetic zone.

Clinical Considerations: A young patient attended to the dental practice with esthetic concerns. The facially driven digital planning showed the need of an interdisciplinary treatment to improve smile harmony. Orthodontic treatment was conducted with aligners, followed by periodontal and restorative approaches. Tooth alignment was performed with 31 aligners, whereas eight aligners were used for refinement. Harmony between pink and white esthetics was improved with crown lengthening, followed by bleaching.

Conclusion: By using a conservative approach, a successful esthetic result was achieved respecting functional and biological principles.

Clinical Significance: Digital resources can be used to the interdisciplinary esthetic planning taking into consideration the harmony between smile and face. This approach allows a predictable outcome of the treatment.

KEYWORDS
CAD-CAM, dental esthetic, orthodontics, periodontics

1 | INTRODUCTION

Creating a beautiful smile may be challenging because it involves functional and esthetical aspects.[1–4] In many cases, an interdisciplinary treatment planning is required to create a smile considering the facial harmony and the desired dental proportions.[1,2] Orthodontic approaches may be beneficial prior to an esthetic rehabilitation to create harmony between dental arches, reducing the need for invasive preparations.[5–7] In addition, management of soft tissues is essential to create harmony between soft and hard tissues.[8,9]

The need for additional treatments can only be assessed when the expected result can be simulated and visualized. Contemporary digital resources allow the creation of a virtual patient, for whom a smile pattern with standardized dental proportions can be designed, taking into consideration all the static and dynamic facial aspects.[10–12] To a large extent, this has been made possible by the integration of digital patient files, such as tomographic scans, intra-oral casts, and facial scans.[13] By means of this approach, interdisciplinary treatment planning, with a predictable prognosis can be performed. Moreover, a simulation of the expected result can be presented to the patient.

Thus, many treatment options can be considered, and the patient can actively participate in the final decision.[1]

This case report describes a treatment planning in which orthodontic alignment was performed as part of an esthetic rehabilitation. Soft tissue management was necessary to achieve a natural result with adequate pink-esthetics. The patient was involved in each step of the treatment and was able to visualize the expected result prior to beginning with the treatment procedures.

2 | CASE REPORT

A young woman presented to the private practice with the esthetical need of teeth alignment and improvement of smile harmony (Figure 1). Photographs and intra-oral scans were taken, and the ideal smile was designed with use of the digital smile design (DSD) protocol in cooperation with the DSD Planning Center (DSD Company, Madrid, Spain). In summary, digital data (photographs, intraoral scans) were analyzed using a planning software (NemoStudio, Nemotec, Madrid, Spain). After superimposition of intraoral scans to the photographs, an ideal smile proportion was defined taking in consideration facial references, and a smile frame was drawn. Based on the smile frame, a digital wax-up was designed. Although the DSD is subject to limitations inherent in the photographic process and in the superimposition of 2D–3D files, it is a useful planning tool that assists decision-making, improves diagnostic vision, and facilitates education and communication between professionals and patients. The digital wax-up showed the need for an interdisciplinary plan in order to achieve the ideal esthetic result (Figures 2–4). This consisted of prior orthodontic treatment, followed by periodontal and esthetic procedures (Figure 5).

FIGURE 1 Initial situation. (A). Extra-oral view. (B). Intra-oral view. (C) Occlusal view. (D). Panoramic radiograph

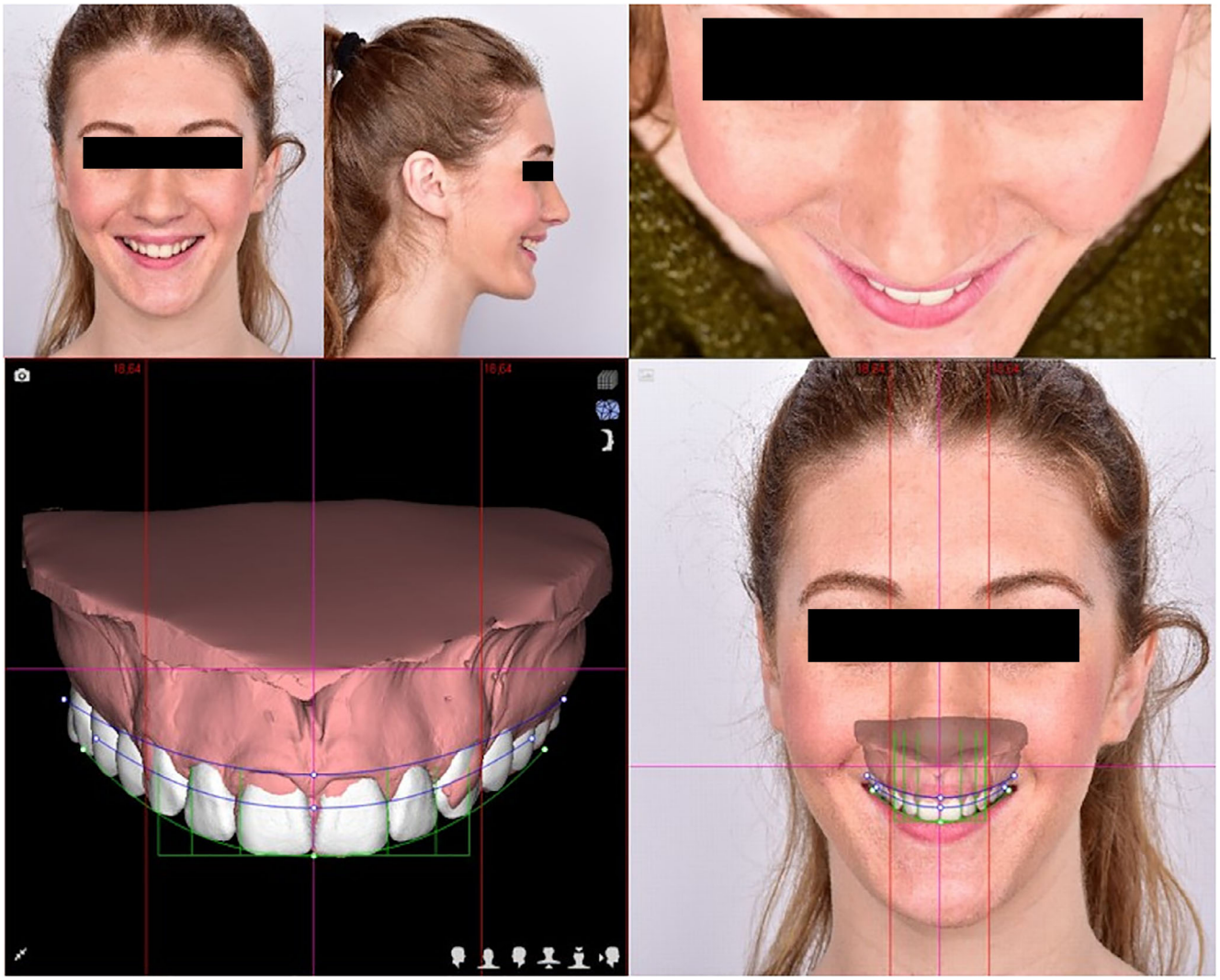

FIGURE 2 Pre-operative digital planning

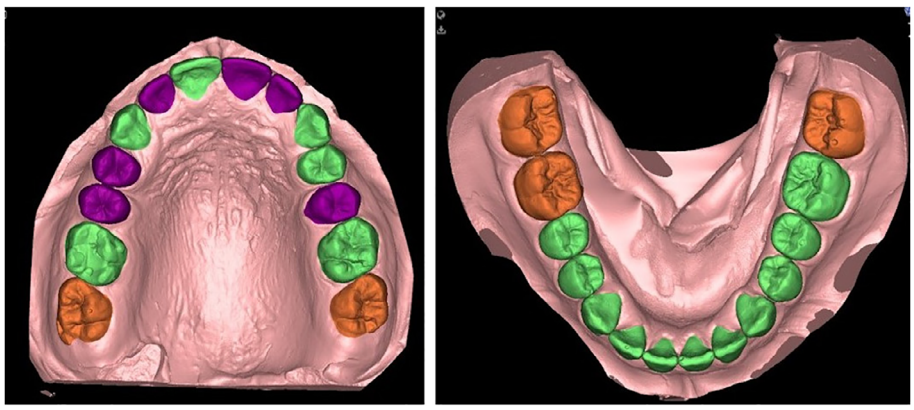

FIGURE 3 A color-based analysis provided by the DSD Planning Center shows the treatment planning. Different colors mean different treatment needs (Green, orthodontic treatment; purple, orthodontic treatment + crown lengthening; orange, no treatment required)

An ideal pre-orthodontic treatment mock-up was made with a silicon guide and Bis-Acryl composite (Telio, Ivoclair). The mock-up was used to present the expected result to the patient (Figure 6). After acceptance of the treatment, a cephalometric analysis was made, and the required orthodontic movement was planned in cooperation with Invisalign (Align Technology in San Jose, CA, USA) and use of Clincheck Software. By means of facially driven digital planning, it was possible to predict the final tooth position

FIGURE 4 Digital wax-up. (A) Ideal smile pre-orthodontic treatment. (B) Ideal smile post-orthodontic treatment. (C) Ideal smile post-orthodontic treatment and crown lengthening. (D) Clinical mock-up fabricated, based on the ideal smile design

FIGURE 5 Clinical mock-up. (A) Initial situation. (B) Clinical proof of mock-up

(Figure 6). In this case, rehabilitation was performed with 31 aligners, while 8 aligners were used for the refinement procedure (Figure 7). Afterward, an ideal post-ortho treatment smile was designed to guide the further treatments (Figure 8).

For the periodontal surgical planning, cone-beam computed tomography (CBCT) data were used. The pros and cons of using a CBCT have been presented to the patient and she accepted the procedure. The distance between gingival margin,

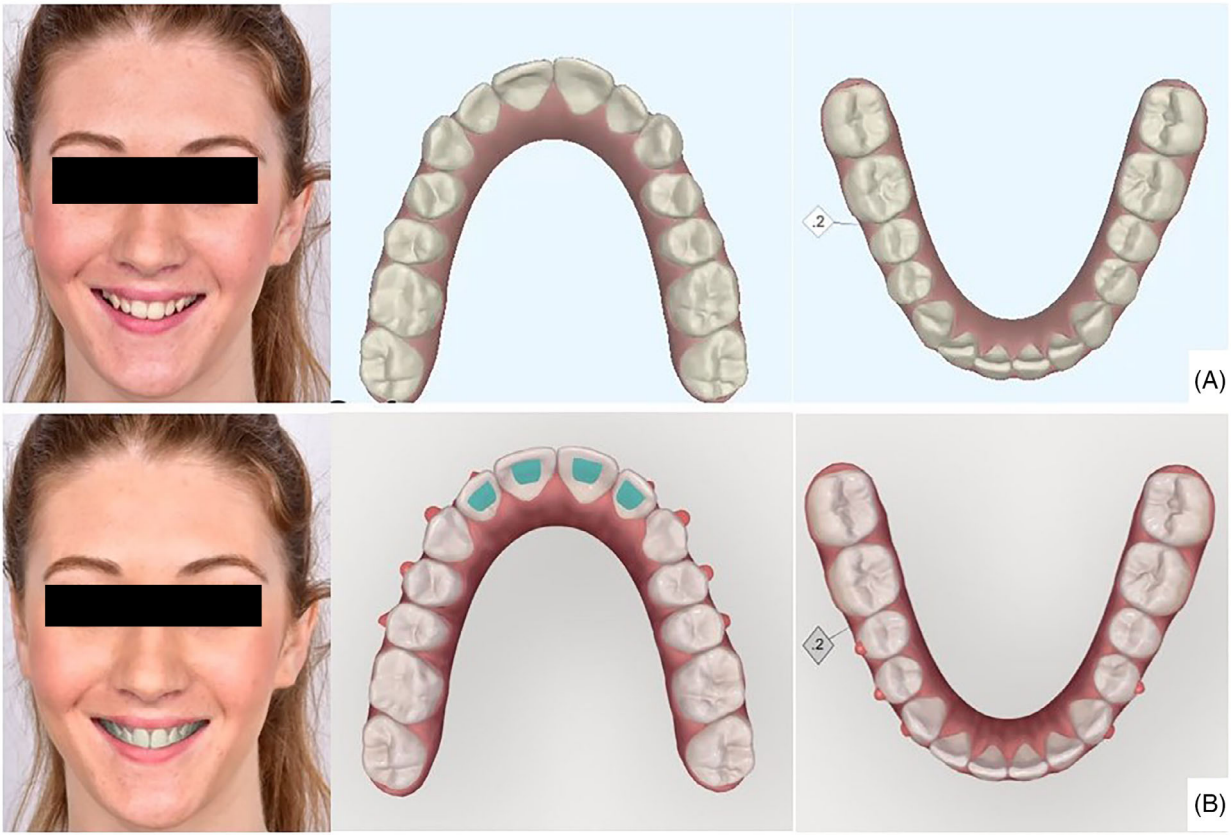

FIGURE 6 Digital planning of tooth alignment performed by Clincheck software. (A) Initial situation. (B) Simulation of the expected result after treatment with aligners

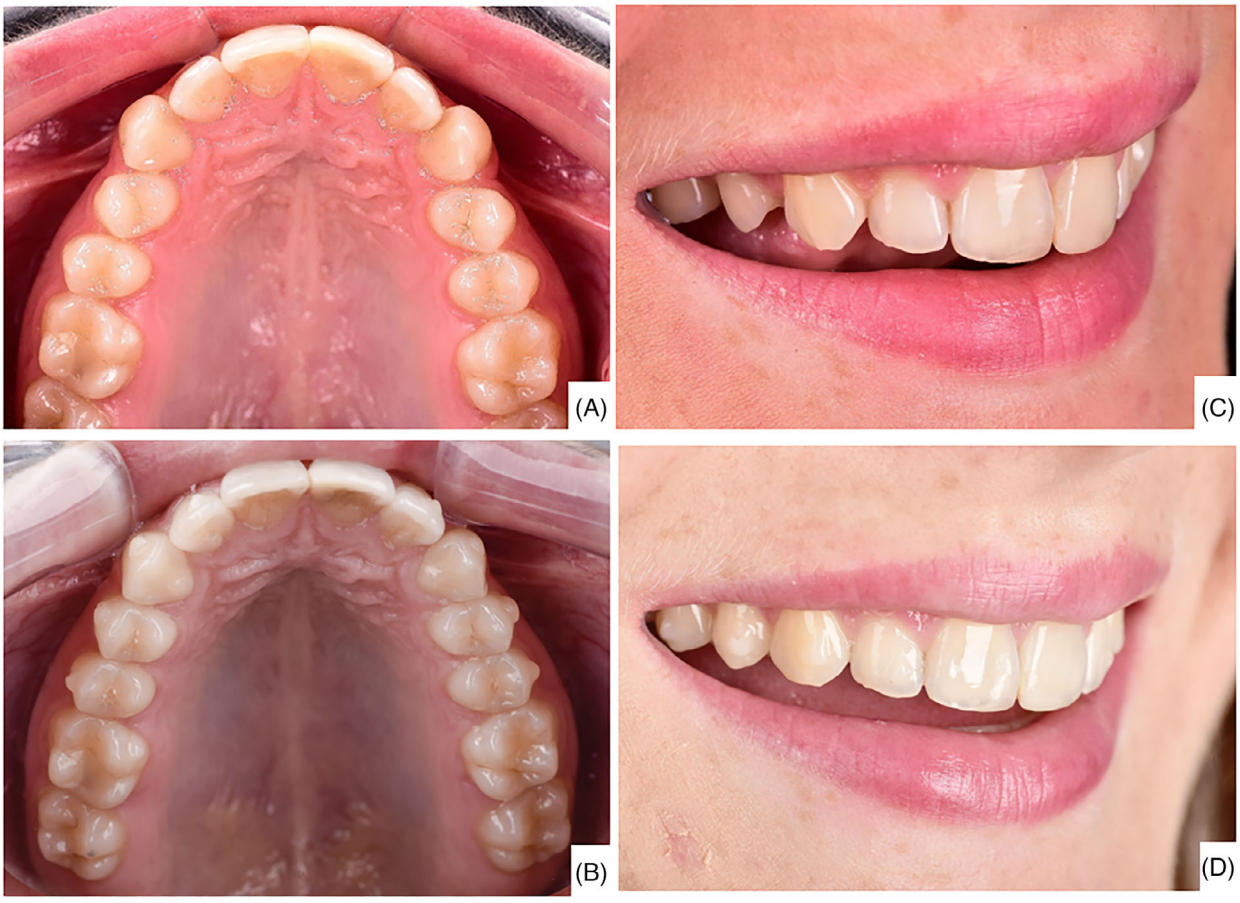

FIGURE 7 Orthodontic treatment. (A) Intra-oral situation prior to orthodontic treatment. (B) Intra-oral situation after orthodontic treatment. (C) Smile prior to orthodontic treatment. (D) Smile after orthodontic treatment

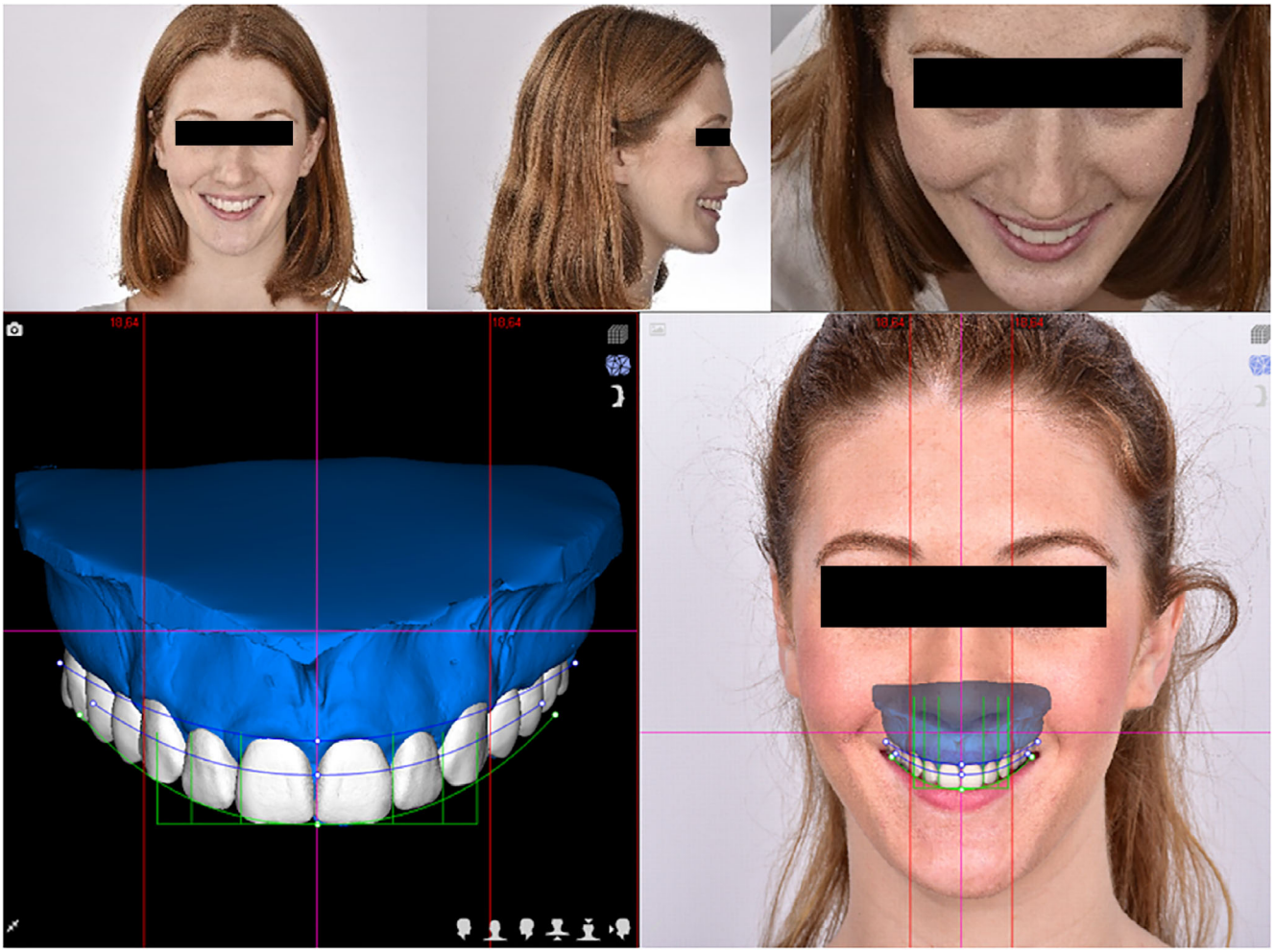

FIGURE 8 Digital planning after orthodontic treatment

bone, and cement-enamel junction were measured. Based on these parameters and having the smile design as reference, the desired measurements were calculated. These were transferred to a so-called crown lengthening guide, which was used to guide the gingival resection level. In this case, bone resection was not required (Figure 9). Treatment was completed by bleaching with the use of 25% hydrogen peroxide. (Phillips Zoom, Phillips, USA). Figure 10 shows the quality control session after 4 months. A successful esthetic result was achieved by respecting the functional and biological requirements of the treatment.

3 | DISCUSSION

Esthetical and functional outcomes can be improved when interdisciplinary treatment planning is performed. This article presents an overview of how interdisciplinary approaches can be used to conduct facially-driven interdisciplinary treatment planning.

Aligners are a comfortable and esthetic approach to correcting the misalignment of teeth.[6,7] These devices may be used prior to restorative procedures to improve the esthetic outcome. In addition, orthodontic treatment brings the teeth into an optimal position, so that less removal of dental structure is required during the preparation of the teeth.[5,7,12]

While the conventional crown lengthening procedure is performed with limited artifices to determine the final gingival and bone margin, digital workflow provides an assessment of the relations between hard and soft tissues, by means of fusion of CBCT and intraoral scans. Additionally, a double crown lengthening guide can be designed in order to provide references of how much tissue must be removed to achieve the desired bone and gingival level. In this case report, the

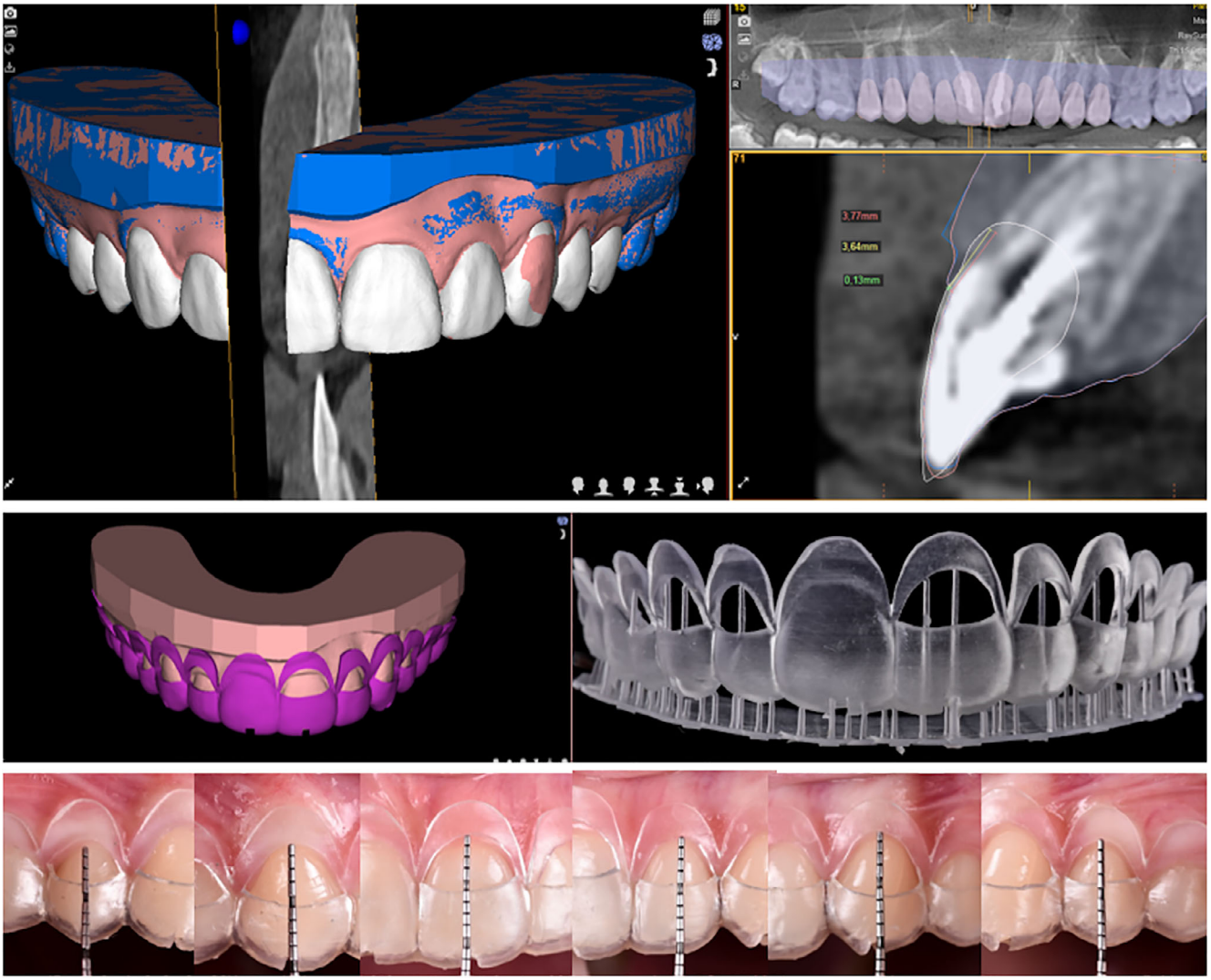

FIGURE 9 Digital planning of crown lengthening. A standard tessellation language file was superimposed to the DICOM file to the measure of periodontal parameters. A periodontal surgical guide was digitally designed and printed to be used clinically

double guide was used as a template during the surgical procedure to ensure the removal of an optimal quantity of soft tissue.[8,9]

The integration of facially driven treatment planning into the digital orthodontic simulation allowed the group of professionals in the team to visualize the required procedures according to the expected outcome.[1,2,11] This approach led to greater predictability of the outcome, and allowed participation of the patient in the treatment planning.[13]

A successful outcome was only possible because the patient was involved in each step of the treatment. By means of the digital planning, the desired smile could be designed prior to and after the orthodontic treatment. Furthermore, this design was printed for use as a mock-up. Photos taken with the mock-up in mouth provided the patient with a perspective of the final result.

4 | CONCLUSION

Facially driven interdisciplinary treatment planning and software simulations allowed clinicians to visualize how each dental procedure would influence the further treatments. Therefore, this integrated approach improved the predictability of different procedures in restorative dentistry, orthodontics, and periodontal surgery.

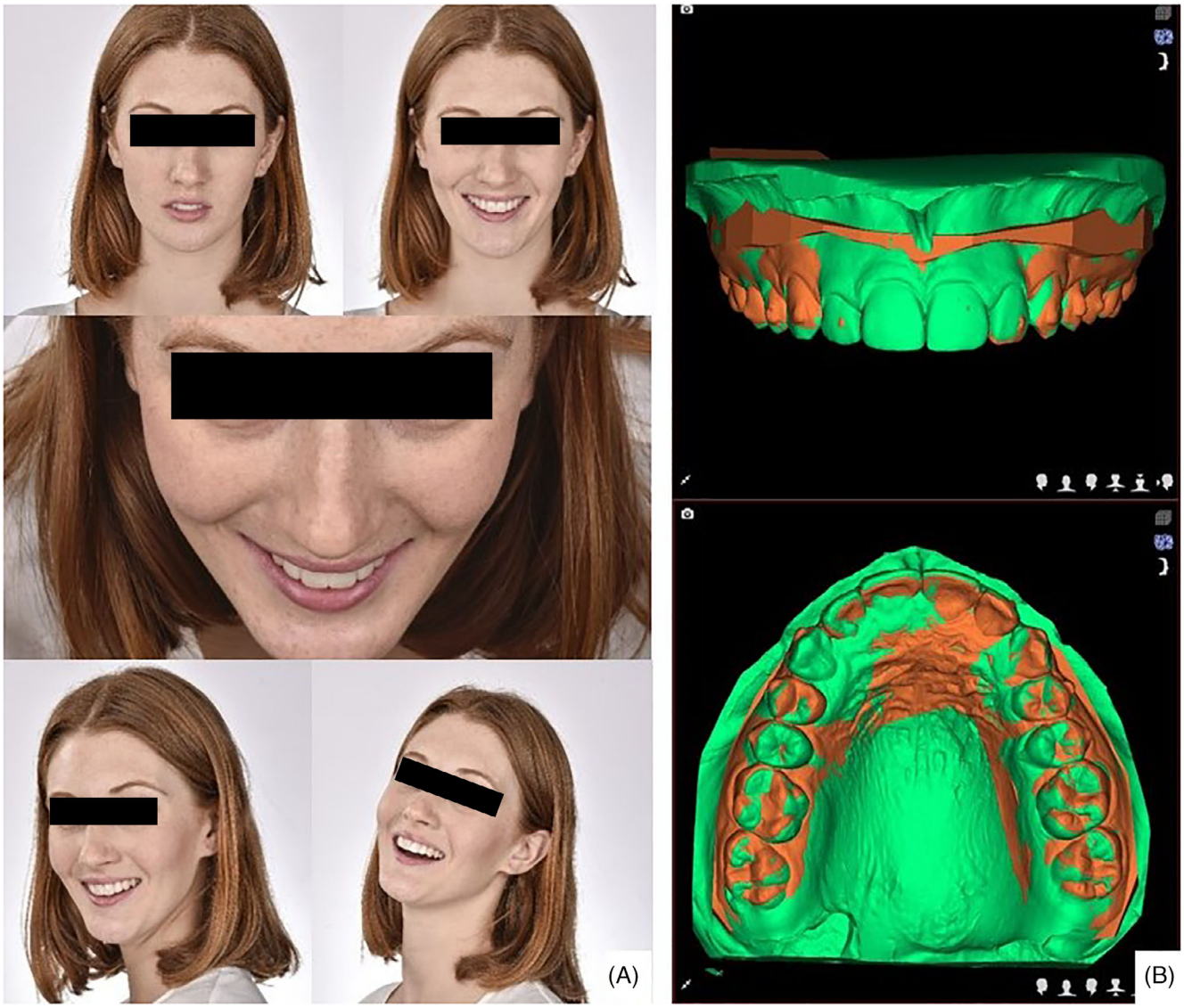

FIGURE 10 Follow-up after 4 months. (A) Final result. (B) Quality control by superimposing the casts representing the initial orthodontic simulation provided by the software Clincheck (green) with the post-orthodontic outcome (orange)

DISCLOSURE

Christian Coachman is the founder of the Digital Smile Design Group.

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

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