Digital and Interdisciplinary Adhesive Conservative Rehabilitation Based on Esthetic and Occlusal Integration:

A Case Report

Germán Albertini, DDS[1]
Diego Bechelli, DDS[2]
Aníbal Capusotto, PhD[1,3]
Ricardo Schäfer, MDT[4]

[1]Oral Rehabilitation and Implantology, Universidad de Buenos Aires, Buenos Aires, Argentina.
[2]Periodontology, Universidad Maimónides, Buenos Aires, Argentina.
[3]Periodontology, Universidad del Salvador, Buenos Aires, Argentina.
[4]Master Dental Technician, Buenos Aires, Argentina.

Correspondence to:
Diego Bechelli
db@clinicabechelli.com.ar

The loss of dental structure due to mechanical and/or chemical factors negatively affects the function, esthetics, and health of the gnathic system, and this loss is further exacerbated by bacterial etiology. Clinicians must recognize and address the early signs of periodontal disease, especially in young patients, to help control the bacterial etiology, minimize or stop the loss of dental tissues, and recover the tooth structures. Improvements in restorative materials technology (composite resins, ceramics, and adhesive molecules) as well as the development of new digital tools allow the clinician to solve these issues in a more conservative and predictable way.

A significant factor in the success of these treatments is a smooth integration between esthetic and occlusal parameters. Several approaches have been proposed to organize a conservative oral rehabilitation, each with its own benefits and limitations. This integration becomes even more important in orthodontic/prosthodontic situations like the case presented in this article. The following pages demonstrate a step-by-step sequence of diagnosis, the planning and execution of a conservative oral rehabilitation in a young patient with dental structure loss, and the integration of esthetic and occlusal parameters by digital means. The presented case also describes an interdisciplinary approach between restorative dentistry, orthodontics, and prosthodontics.

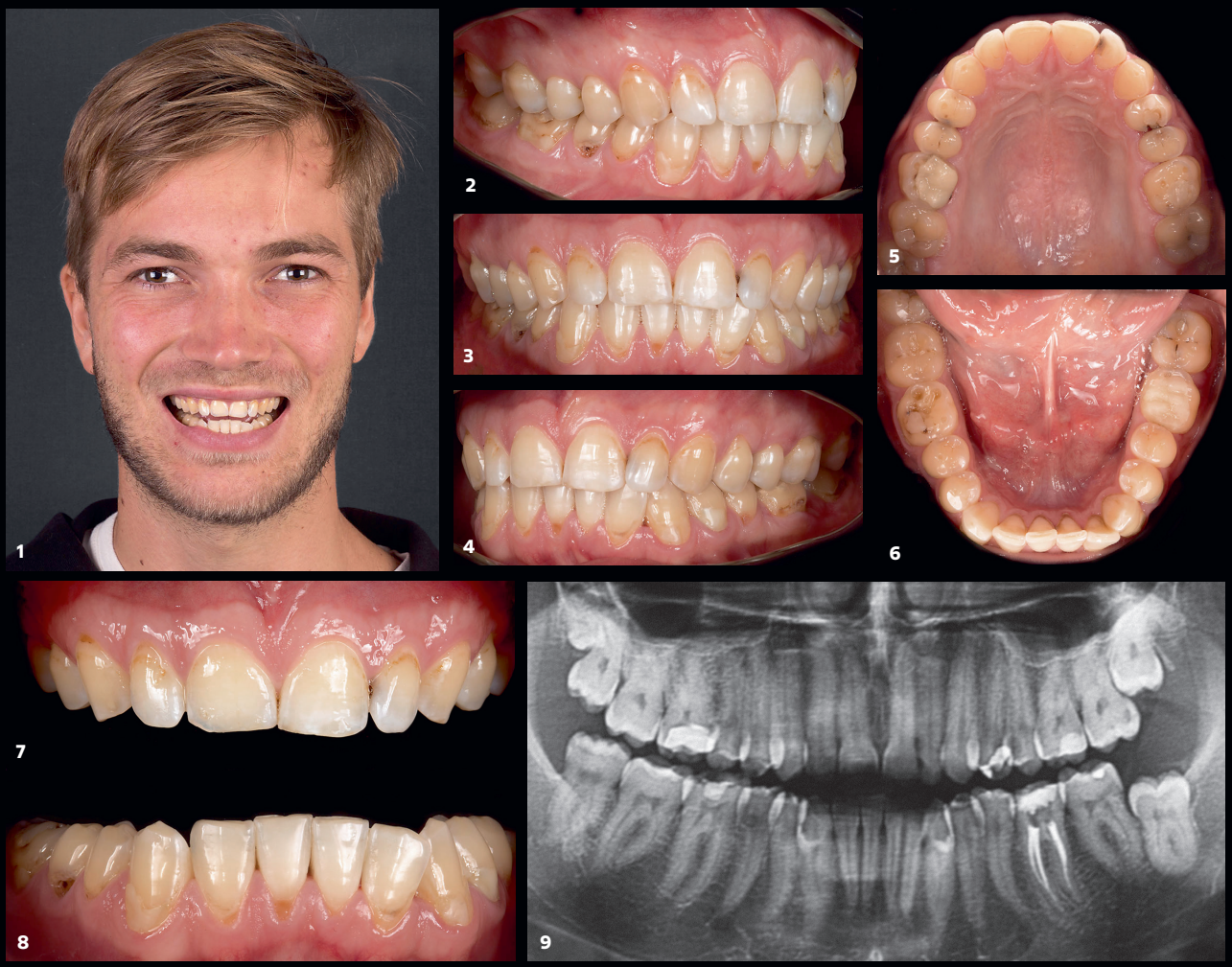
Clinical Presentation

A 25-year-old man presented to the office with esthetic and functional discomfort. The clinical analysis showed tooth crowding, hypersensitivity, failing restorations, caries, and loss of vertical dimension of occlusion (VDO), not to mention poor esthetics. Data collection consisted of photos, intraoral scans (TRIOS, 3Shape), facial scans (VectraH2, Canfield Scientific), and radiography. Figures 1 to 9 illustrate the initial clinical status of this patient and a panoramic radiograph.

Digital Design

All collected data were merged in computer-aided design (CAD) software (Exocad) to perform an anatomical digital design, which recovers tooth structure loss in an additive way. The rationale and step-by-step technique of this digital design have already been published by this team as the esthetically guided and occlusally protected technique (EGOP; see Bibliography). In sum, the oral cavity is divided into four sectors:

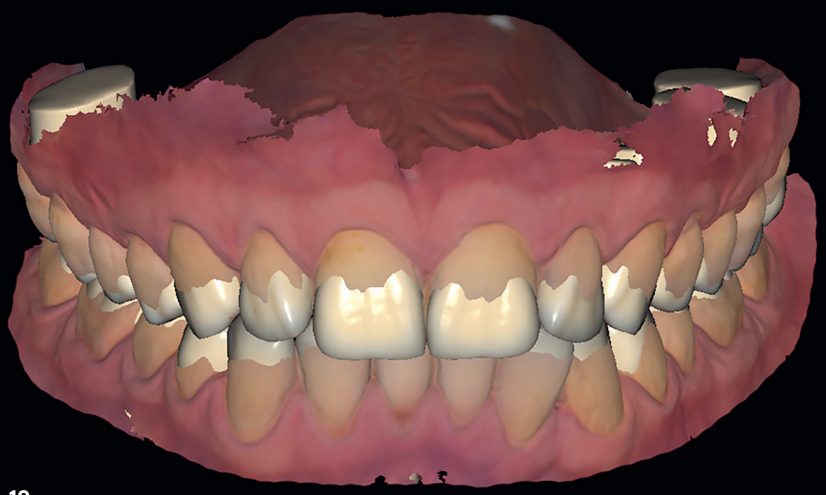
- Sector 1 (S1): Maxillary anterior teeth (canine to canine)
- Sector 2 (S2): Mandibular anterior teeth (canine to canine)

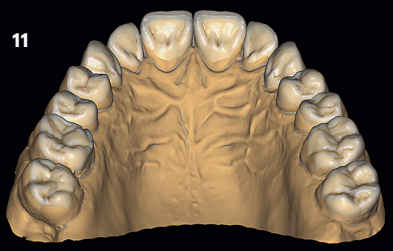


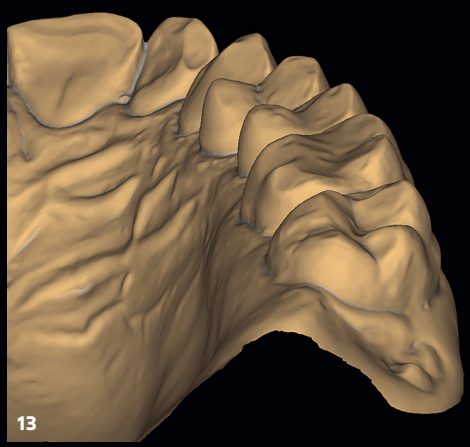
- Sector 3 (S3): Maxillary posterior teeth (premolars and molars)
- Sector 4 (S4): Mandibular posterior teeth (premolars and molars)

The design starts with sector 1, analyzing the lips at rest and on smile, to establish the length and position of the maxillary anterior teeth. Then an anatomical reconstruction of sector 2 is designed based on bilateral canine contact and the creation of a new VDO. The increased interarch space on the posterior teeth permits the design of sector 3, completing the buccal corridor and smile esthetics. Finally, sector 4 is designed, and the centric occlusion stability is achieved with several contacts on posterior sites.

Once this design was virtually approved, models were printed (Whip Mix) and silicone matrices (Elite HD+, Zhermack) were made over them. These matrices were used to transfer the design to the patient's mouth with bisacryl resin (Luxatemp, DMG). This mock-up was recorded by photos and oral scans to establish a fluent communication between team members and the patient. Figures 10 to 18 show the anatomical design, the functional mockup in the patient's mouth, and the impact on the facial aspect.







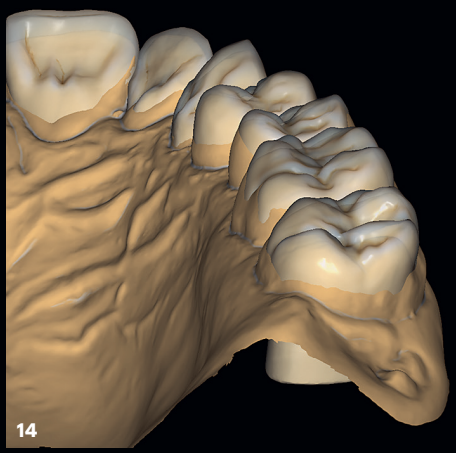


FIG 1 Pretreatment facial aspect of the patient.

FIGS 2–4 Intraoral lateral and frontal views of initial status.

FIGS 5/6 Occlusal views of maxillary and mandibular arches.

FIGS 7/8 Frontal views of maxillary and mandibular arches.

FIG 9 Panoramic radiograph.

FIGS 10–14 Intraoral aspects of the CAD digital design.

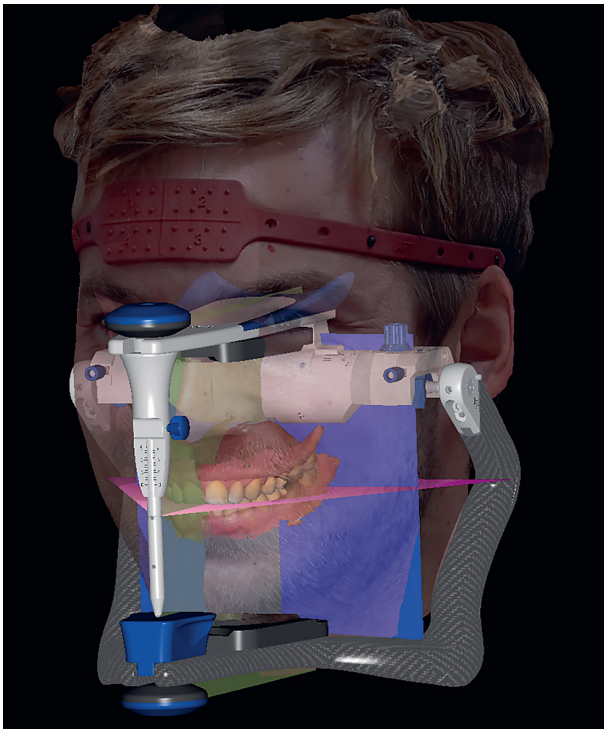


FIG 15
Facial scan and virtual articulator integration on CAD software.

FIGS 16–18
Full-mouth functional mock-up fabricated with bisacryl resin to confirm the proposed design.

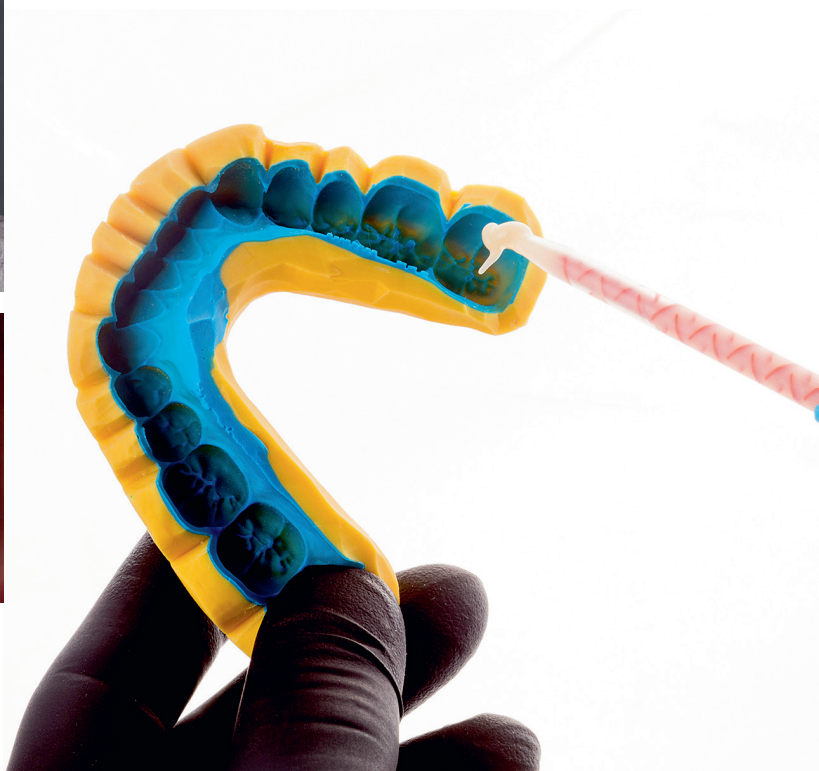


FIG 19 Dental substrate reconstruction performed by sector.

FIGS 20–22 Post-NABR images showing the structural improvement with almost no occlusal changes.

Treatment Plan

Confirmation of the design and planning trial led to the following customized interdisciplinary treatment plan:

1. Periodontal basic therapy, extraction of the third molars, and oral hygiene instructions
2. Nonanatomical Biologic Reconstruction (NABR)
3. Anatomical reconstruction by temporary adhesive systematization (TAS)
4. Clear aligner therapy
5. Sectorized ceramic restorations in the posterior and anterior teeth
6. Maintenance and follow-up with nightguard

Treatment Steps

Phase 1

A detailed periodontal analysis is vital when treating patients with concerns like in this case. The authors began with basic therapy, including scaling and root planing to decrease the infective sites and customized instructions on oral hygiene. Radiographs showed no general bone loss or periodontal defects. To diminish bacterial colonization from risky sites, the third molars were extracted.

Phase 2

NABR is a step of the EGOP approach in which infected dental structure and failing restorations are replaced. Immediate dentin protection and sealing is also performed without occlusal modifications.

This step focused on replacing failing restorations, treating caries, filling cervical lesions, and replacing old crowns for provisional restoration. In this case, dental substrates were treated with burs and an air abrasion unit (AquaCare, Medivance). They were later filled with fibers, bulk-fill resins, posts and cores, and/or flowable composite resins. These procedures should all be done under complete isolation (Nic Tone, MDC Dental).

After these two initial phases, the patient showed periodontal health and recovered dental structure. The occlusal anatomy hadn't been modified at this point. Maximal intercuspation and VDO were maintained. Figures 19 to 22 show NABR procedures on different tooth structures.

FIG 23 Printed models and translucent matrices for TAS procedure.

Phase 3

Anatomical reconstruction by TAS is a clinical instance in which an adhesive transference of the digital design (previously approved and clinically tested) is performed through a translucent matrix and high-ceramic flowable composite resins.

Recovering full anatomy and maintaining tooth independence before orthodontic aligner therapy was vital, so different models were printed to create several silicone matrices and transfer the designed planning.

The phase started with relative isolation of the maxillary anterior sector. Each tooth was cleaned with air abrasion, the enamel was etched with phosphoric acid 37% (Ultra-Etch, Ultradent), and the entire structure (enamel, dentin, and composite resin) was treated with a universal adhesive system (All-Bond Universal, Bisco). Teflon tape was placed to protect neighboring teeth, and silicone keys were filled with flowable composite (Beautifil 00 A1, Shofu) and placed into the patient's mouth. Once the keys were perfectly fitted, light-curing procedures were performed on all aspects of each tooth (VALO, Ultradent).

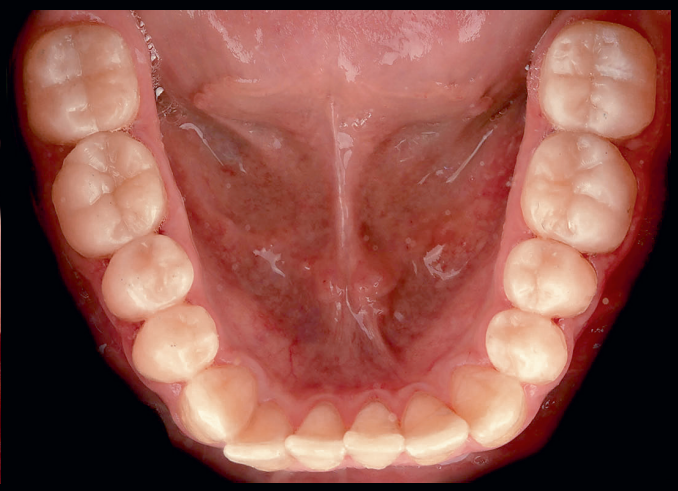
This step was repeated on all teeth, sector by sector, following the EGOP technique. Later, texturing and polishing techniques were performed to obtain the final esthetic aspect and the final occlusal adjustment.

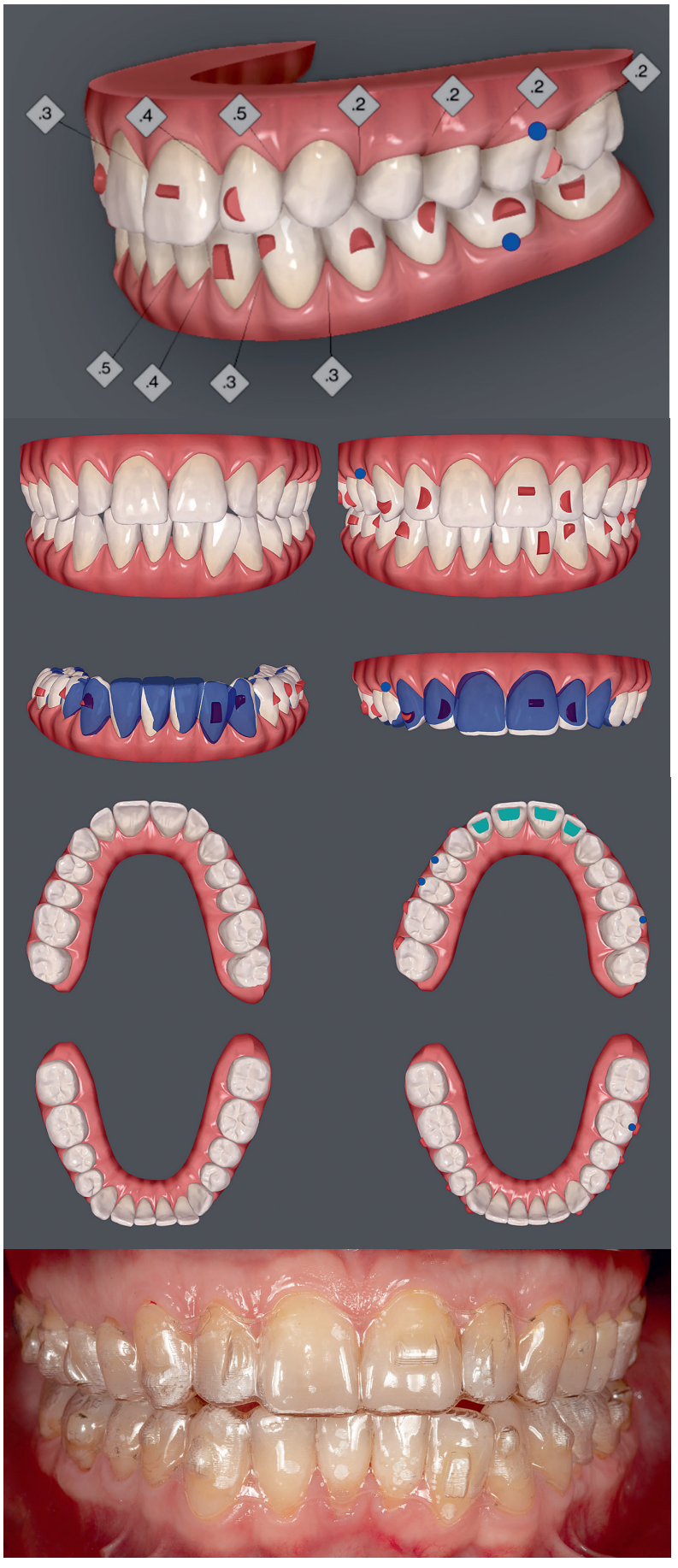
After this phase, the patient received a full-mouth resin rehabilitation, recovering all lost dental anatomy while maintaining the previous misalignments. Occlusal characteristics were improved, because a new VDO and centric relation (CR) were established, and the esthetics were recovered. Upcoming orthodontic treatment would correct the untreated occlusal and esthetic aspects. Figures 23 to 31 show some of the TAS clinical steps and the facial impact of this temporary rehabilitation.

FIGS 24–27 TAS individual reconstruction in sector 1.

FIG 28
Matrix filling with flowable composite resin in sector 2.

FIGS 29–31
Intraoral images with the new occlusal and esthetic rebuild after TAS procedures.





Phase 4

With the structural tissues (NABR) and anatomy (TAS) recovered, the patient was ready for orthodontic treatment using clear aligners (Invisalign). This would improve the patient's occlusion and reduce the invasiveness at the time of tooth preparation.

The phase began with a maxillomandibular intraoral scan and an occlusal registration (iTero). The Invisalign treatment plan included 17 aligners with attachments on both arches for 6 months followed by another 11 aligners on both arches for 4 months of refining. The movements included maxillomandibular transverse expansion, intrusion of the mandibular anterior teeth, and strategic stripping on the proximal areas of several teeth. After 1 year of treatment, a vacuum maxillary nightguard was indicated to maintain the occlusion. Figures 32 and 33 show the clear aligner planning and a clinical view during treatment.

FIG 32
Aligner planning.

FIG 33
Clinical view of the aligners in place.

Phase 5

By the beginning of this phase, the patient had achieved the following clinical parameters:

- Fully rehabilitated with composite resins
- No tooth preparations or wear due to the 100% additive dentistry
- Centric occlusal relationship
- Increased VDO
- Functional anterior guidance
- Improved esthetics

This phase consisted of two different steps performed by sector:

- Step 1: Tooth preparations, intraoral scanning, provisionalization, and dental lab production
- Step 2: Tooth cleaning, adhesive procedures, and occlusal adjustment

The phase began with a maxillomandibular scan, a 3D model impression, and the elaboration of polyvinyl siloxane (PVS) silicone keys (Zetalabor, Zhermack) and printed devices to guide tooth preparations and provisionalization.

Preparations can have different designs based on the amount of remnant dental structure, the volume of superficial composite resin, esthetic aspects, occlusal forces, and biomechanics. In this case, the following designs were indicated:

- Maxillary anterior teeth (sector 1): Palatal veneers and buccal veneers with incisal reduction
- Mandibular anterior teeth (sector 2): Buccal veneers with incisal reduction
- Posterior teeth (sectors 3 and 4): Vonlay design (occlusal and buccal reduction)

Tooth preparation scans were sent to the dental lab to design (Exocad) and mill (Amann Girrbach) the selected blocks. The chosen material for this case was lithium disilicate (LT A1, e.max, Ivoclar Vivadent). Restorations were then textured with burs and stained/glazed with liquid ceramic (MiYO, Jensen Dental).

Ceramic fixation sessions started with local anesthesia. The provisional restorations were then removed and any tooth remnants cleaned. The patient was then ready for complete isolation in the sector to be treated.

The adhesive protocol included air abrasion, enamel phosphoric acid etching, and application of universal adhesive. Ceramics were etched with hydrofluoric acid, cleaned with alcohol, dried, and treated with silane.

Once every sector was cemented, the last step was occlusal adjustment. A high-quality occlusal paper (Bausch Progress) was used to find the strongest contacts to be eliminated, and the largest number of contacts was obtained. Bilateral canine contacts and simultaneous posterior contacts and canine guidance with no posterior interference were the main references to obtain the overall result of this adjustment.

A Michigan Splint was installed as a nightguard to prevent mechanical stress on the restorations. Figures 34 to38 illustrate the preparation procedures and delivery of palatal veneers in sector 1; Figs 39 to 44 show posterior ceramic preparations and restoration; and Figs 45 to 50 highlight the anterior ceramic veneers.

FIG 34 Digitally printed guide for palatal veneer preparation in sector 1.

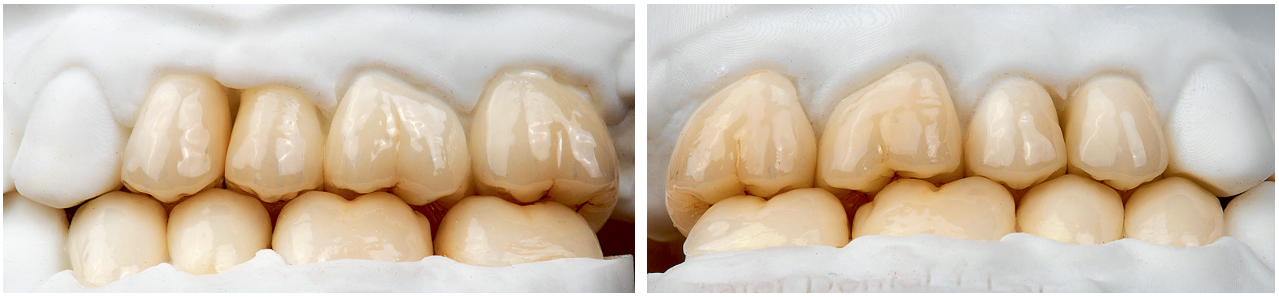
FIG 35 Palatal veneers on printed model.

FIGS 36–38
Adhesive procedure for palatal veneer fixation.

FIG 39
Intraoperative posterior tooth preparations. The selected design included occlusal and buccal faces of every premolar and molar (vonlay design).

FIG 40 STL files from the intraoral scanner. Preparations in sectors 3 and 4 were completed, and the digital files were sent to the dental lab for design and production.

FIG 41
Precrystallized lithium disilicate pieces after macro- and microtexture steps.



FIGS 42–44
Stained and glazed ceramic restorations in sectors 3 and 4. Note the precise occlusal contacts and bilateral canine contact to maintain VDO.

FIGS 45/46
Sector 1 veneer preparation including incisal edges.

FIG 47
Tooth preparations in sectors 1 and 2 ready for scanning.

FIG 48
STL files from the intraoral scanner to be sent to the dental lab for veneer design and production.

FIGS 49/50
Stained and glazed monolithic lithium disilicate veneers for sectors 1 and 2.

Phase 6

Once treatment was complete, immediate and long-term follow-ups were scheduled. Sessions focused on periodontal maintenance and occlusal and splint controls. The patient's oral hygiene was also checked. At 30 days after installation, a new occlusal adjustment was performed to touch up the contacts and anterior guidance function. Figures 51 to 59 show the final results of treatment and the impact of the oral rehabilitation on the intraoral and facial aspects.

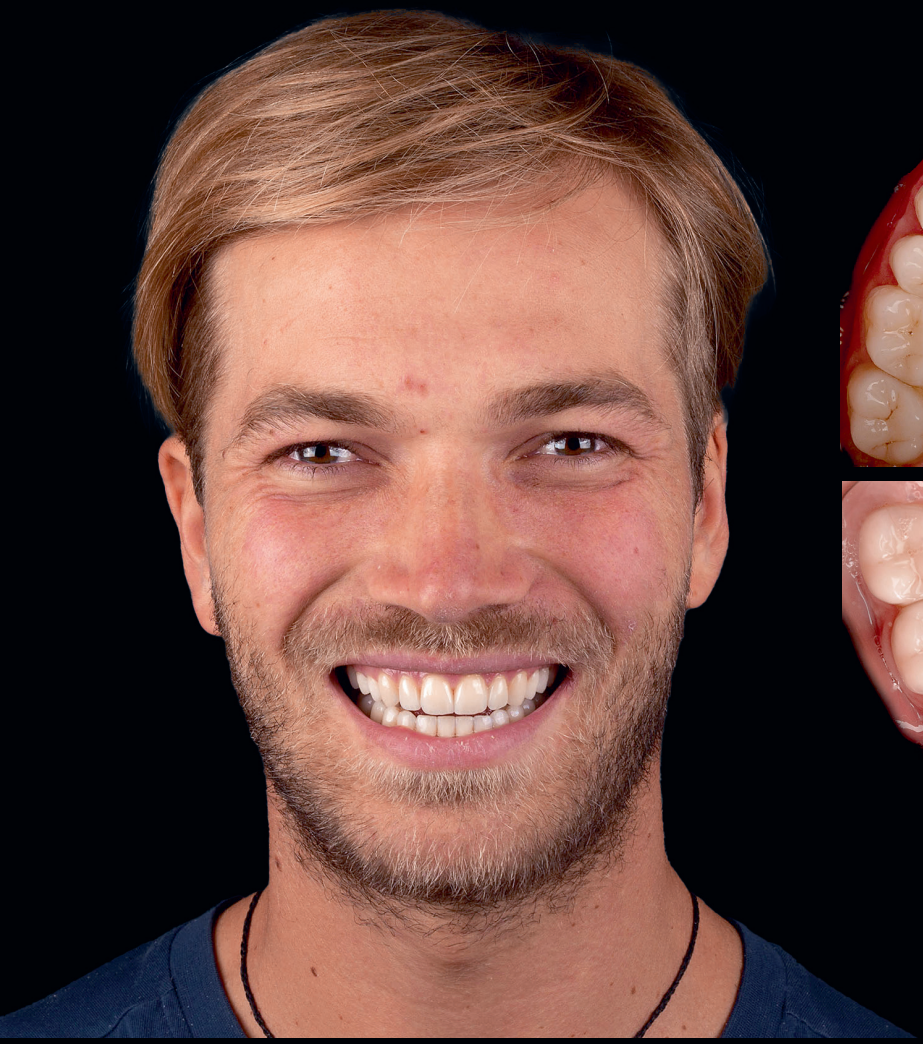


FIG 51
Facial aspects of the final oral rehabilitation.

FIGS 52/53
Occlusal views of maxillary and mandibular arches showing the recovered natural occlusal anatomy.

FIGS 54–56
Lateral and frontal intraoral views in occlusion.

FIGS 57/58
Buccal and palatal veneers in sector 1.

Conclusion

The presented case report described an interdisciplinary approach based on a full digital workflow. The treatment was executed following three pillars: facially driven planning, tissue conservation, and esthetic/occlusal integration. Both maxillary and mandibular arches were divided into four zones with specific objectives and goals to achieve the integration of facial esthetics and occlusion on a digital basis. The proposed technique (EGOP) is a reliable interdisciplinary approach to treat young patients with worn dentition.

FIG 59
The final result shows the natural esthetic achieved and a nice tissue-ceramic integration.

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