Fully Digital Chairside Workflow for Anterior Prosthetic Rehabilitation: A Clinical Case Report from Digital Data Acquisition to Final Smile Enhancement

https://doi.org/10.70921/medev.v32i2.2032

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Received: 6 April 2026; Accepted: 4 May 2026; Published:

Abstract

1.Background/Objectives: The integration of intraoral scanning, CAD/CAM technologies, and additive manufacturing has enabled the development of fully digital workflows in prosthodontics; however, their application in chairside anterior rehabilitations remains less documented. This clinical case aimed to evaluate a complete digital, chairside protocol for anterior maxillary rehabilitation, emphasizing digital planning and staged provisionalization. 2. Case Presentation: A 50-year-old male patient with partial anterior maxillary edentulism was treated using a fully digital workflow, including intraoral and facial scanning, Digital Smile Design, CAD-based wax-up, and fabrication of 3D-printed eggshell and on-abutment provisional restorations, followed by chairside milling of monolithic zirconia fixed prostheses. 3.Results: The staged provisional approach enabled validation of aesthetics and function, guided minimally invasive tooth preparation, and facilitated soft tissue conditioning. The final restorations demonstrated satisfactory marginal adaptation, occlusion, and aesthetic integration, with high patient acceptance. 4.Conclusion: A fully digital, chairside workflow allowed predictable and efficient anterior rehabilitation, improving treatment control, communication, and patient involvement, supporting its clinical applicability in modern prosthodontic practice within the limitations of a single case.

Keywords: Digital dentistry; intraoral scanning; CAD/CAM; chairside workflow; anterior prosthetic rehabilitation; Digital Smile Design; 3D printing; provisional restorations; ovate pontic; monolithic zirconia.

INTRODUCTION

The integration of digital technologies into prosthodontics has fundamentally transformed the diagnosis, planning, and execution of restorative treatments. In particular, the development of intraoral scanners, computer-aided design/computer-aided manufacturing (CAD/CAM) systems, and additive manufacturing has enabled the implementation of fully digital workflows, offering new possibilities for precision, efficiency, and patient-centered care [1].

Intraoral scanning represents a key component of this transformation, providing accurate digital impressions while eliminating many of the limitations associated with conventional impression techniques. Clinical studies and systematic reviews have demonstrated that intraoral scanners can achieve comparable or superior accuracy in fixed prosthodontics, while also improving patient comfort and reducing clinical time [2,3]. These advantages are especially relevant in anterior rehabilitations, where high esthetic demands require precise data acquisition and reproducibility.

Beyond data acquisition, the integration of digital tools into treatment planning has enabled the concept of facially driven prosthetic design, where dental restorations are planned in harmony with facial features and smile dynamics. Digital Smile Design (DSD) has emerged as a valuable tool for improving communication between clinician, technician, and patient, as well as for enhancing predictability by allowing visualization of the final outcome prior to treatment initiation [4].

The evolution toward a fully digital chairside workflow from intraoral scanning to CAD design and CAM fabrication has further streamlined clinical and laboratory procedures. Such workflows can reduce manual errors, improve consistency between treatment phases, and allow rapid iteration of designs, particularly when combined with additive manufacturing technologies such as 3D printing [1,5]. The use of 3D-printed provisional restorations has gained increasing attention due to their cost-efficiency, reproducibility, and ability to accurately transfer digital designs into the clinical environment [6].

Provisional restorations play a critical role in prosthodontic treatment, particularly in the anterior region, where they serve not only as temporary restorations but also as diagnostic tools for evaluating esthetics, function, and soft tissue response. Concepts such as ovate pontic design and staged provisionalization have been shown to support gingival contouring and emergence profile development, contributing to improved esthetic outcomes [7]. When integrated within a digital workflow, provisional restorations can be precisely designed and modified, allowing progressive validation of the treatment plan before fabrication of definitive restorations.

Additionally, the development of chairside CAD/CAM systems has enabled clinicians to perform multiple steps of the restorative process within a single clinical setting. Chairside workflows offer advantages such as reduced treatment time, elimination of conventional laboratory steps, and increased control over the entire process, although they may be limited by equipment capabilities and material constraints [8].

Despite these advancements, the application of fully digital, chairside workflows in multi-unit, tooth-supported anterior rehabilitations remain less documented compared to single-unit or implant-supported restorations. Therefore, further clinical reports are necessary to evaluate their feasibility, advantages, and limitations.

Aim and objectives

The aim of this clinical case report is to describe a complete digital chairside workflow for anterior maxillary prosthetic rehabilitation, highlighting the role of intraoral scanning, facially driven design, staged provisionalization, and CAD/CAM fabrication in achieving a predictable functional and esthetic outcome.

CASE DESCRIPTION

Ethics, Case Introduction, and Clinical Objectives

This clinical case was approved by the Research Ethics Committee of the Victor Babeș University of Medicine and Pharmacy (Approval No. 62/06.11.2025) and was conducted in accordance with the principles outlined in the Declaration of Helsinki. The patient provided written informed consent for participation, including permission for the use of clinical data and photo-video documentation for scientific purposes.

A 50-year-old male patient presented to the Department of Prosthodontics, Faculty of Dental Medicine, seeking prosthetic rehabilitation for missing maxillary right canine and maxillary left lateral incisor (teeth 1.3 and 2.2). The patient was informed about all available treatment options, including implant-supported prosthetic rehabilitation; however, he declined implant therapy and opted for a fixed dental prosthetic solution supported by natural abutment teeth.

Clinical and digital evaluation protocols were implemented, including intraoral examination, photographic documentation, intraoral and facial scanning, and radiographic assessment. Based on these findings, a fully digital chairside workflow was selected.

Initial Clinical Examination and Digital Diagnostic Protocol

A comprehensive intraoral examination was performed, revealing no clinical signs of periodontal disease. The periodontal tissues were clinically healthy, with no evidence of gingival inflammation, bleeding on probing, attachment loss, or pathological tooth mobility. The oral hygiene status was satisfactory, and the remaining dentition exhibited stable periodontal support, making it suitable for prosthetic rehabilitation using natural abutments.

Occlusal analysis identified the presence of premature contacts and minor occlusal interferences, likely associated with the loss of dental units and compensatory tooth wear. These discrepancies were managed through selective enamel recontouring, aiming to establish a stable and functional occlusal scheme prior to initiating the digital diagnostic workflow. This preliminary equilibration step was essential to ensure an accurate and reproducible maxillomandibular relationship during intraoral scanning and digital bite registration.

An evaluation of the vertical dimension of occlusion (VDO) was also conducted through clinical assessment of facial proportions, interocclusal rest space, phonetics, and occlusal relationships. The analysis indicated that the VDO was within physiological limits and did not require modification. The stomatognathic system demonstrated adequate adaptive capacity, compensating for the existing tooth wear and partial edentulism without functional or aesthetic compromise. Therefore, the treatment plan was developed without altering the vertical dimension.

A comprehensive digital diagnostic protocol was subsequently implemented to assess the initial clinical condition and facilitate prosthetic treatment planning. This protocol included standardized intraoral and extraoral photographic documentation, intraoral scanning for digital impression acquisition, bite registration, and panoramic radiographic evaluation. These diagnostic tools allowed for a detailed assessment of both hard and soft tissues, as well as occlusal relationships, forming the foundation for a fully digital workflow.

Extraoral photographs were captured using a DSLR camera (Nikon D7500, Nikon Corp., Tokyo, Japan) equipped with an AF-S Micro Nikkor 85 mm lens and a Fixlite Twin Softbox flash system (Figure 1). Intraoral photographs were obtained using the same photographic setup to ensure consistency and high image quality (Figure 1).

Figure 1. Extraoral and intraoral photographs of the patient

Digital impressions of both arches, along with the interocclusal record, were acquired using an intraoral scanner (Medit i700, Medit Corp., Seoul, South Korea). The use of intraoral scanning enabled precise capture of dental and gingival structures while improving patient comfort and eliminating the need for conventional impression materials.

A facial scan was subsequently performed using the face-scanning function of the same intraoral scanner (Medit i700, Medit Corp., Seoul, South Korea), capturing key facial landmarks including the lips, nose, and surrounding anatomical structures. The intraoral scan data were then imported and aligned with the facial scan mesh within the Medit Link software (Medit Corp., Seoul, South Korea), allowing accurate integration of dental and facial datasets for prosthetically driven treatment planning.

All acquired digital data were exported and imported into a dental CAD software (DentalCAD, exocad GmbH, Darmstadt, Germany) for analysis, planning, and design. A Digital Smile Design (DSD) was developed using the Smile Creator module, which utilized facial reference lines and proportions to guide the aesthetic design of the future restorations in harmony with the patient's facial features.

Following a comprehensive assessment of the clinical findings and a detailed discussion of available treatment options with the patient, a fully digital workflow was selected. The treatment plan included the fabrication of custom "eggshell" 3D-printed interim restorations, indirect on-abutment 3D-printed provisional restorations, and definitive full-contour monolithic zirconia fixed partial dentures (FPDs) (IPS e.max ZirCAD, Ivoclar, Schaan, Liechtenstein).

Digital Wax-Up, 3D Printing, and Fabrication of Provisional Restorations

Based on the diagnostic data and the Digital Smile Design (DSD), a virtual diagnostic wax-up was created using dental CAD software (DentalCAD, exocad GmbH, Darmstadt, Germany), serving as the foundation for the prosthetically driven treatment plan (Figure 2). This digital wax-up allowed visualization of the anticipated functional and aesthetic outcome and facilitated the subsequent fabrication of both provisional and definitive restorations.

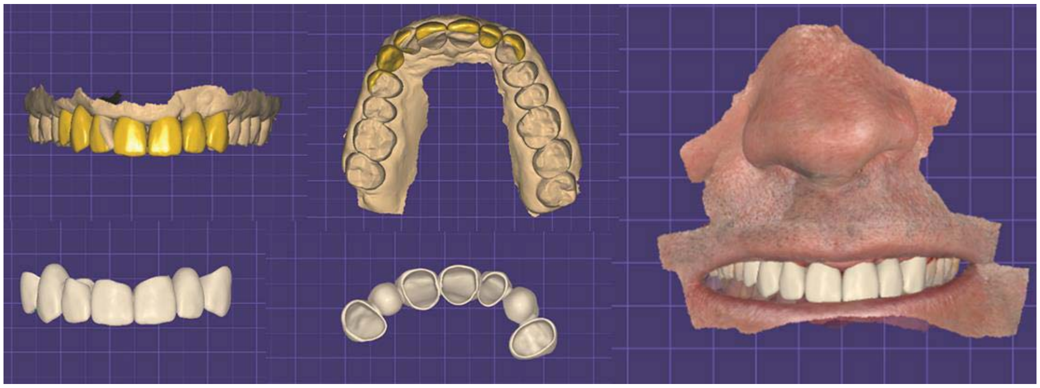
Figure 2. Virtual diagnostic wax-up of the patient alongside the eggshell-type provisional restoration

The virtual design was exported and processed for additive manufacturing. A physical model of the wax-up was fabricated using a stereolithographic 3D printer (Anycubic Photon M5s, Anycubic, Shenzhen, China) and a high-speed gray model resin, previously calibrated according to the manufacturer's specifications to ensure dimensional accuracy and optimal surface quality.

An eggshell-type provisional restoration was then digitally designed based on the validated wax-up. This restoration was intended to function as an indirect interim prosthesis, to be relined intraorally following tooth preparation. The provisional restoration extended across teeth 1.4, 1.2, 1.1, 2.1, and 2.3, with teeth 1.3 and 2.2 replaced as pontics.

The provisional shells were fabricated using a stereolithographic 3D printer (Prusa SL1, Prusa Research, Prague, Czech Republic) and a ceramic-reinforced crown and bridge resin (SprintRay Crown, SprintRay Inc., Los Angeles, CA, USA). Printing parameters were adjusted in accordance with the manufacturer's recommended exposure settings to ensure optimal polymerization and mechanical properties.

A key design feature of the shell provisional restorations was the incorporation of an ovate pontic morphology for teeth 1.3 and 2.2. This design was intentionally selected to promote soft tissue contouring and support the development of a natural emergence profile in the edentulous areas. The ovate pontic exerted controlled pressure on the healing mucosa approximately two months post-extraction, facilitating the shaping of the gingival architecture without the need for surgical intervention. This approach was particularly relevant given that the patient declined all surgical procedures, including gingivectomy, alveolar ridge modification, or other soft tissue recontouring techniques.

Although gingival recontouring was initially considered as part of the treatment plan to optimize the gingival aesthetic line (GAL), it was ultimately excluded due to the patient's explicit refusal. Clinical evaluation of the smile line revealed minimal gingival exposure, which, in combination with the patient's preferences, allowed continuation of the treatment without surgical modification of the gingival margins, accepting a compromise in achieving an idealized gingival aesthetic line.

To transfer the digital wax-up into the clinical setting, a silicone index was fabricated using a condensation silicone material (Zetaplus System, Zhermack SpA, Badia Polesine, Italy). The index was then loaded with a bis-acrylic crown and bridge material (LuxaCrown, DMG, Hamburg, Germany) and used to fabricate a direct intraoral mock-up.

This mock-up served both as a functional and aesthetic preview of the proposed treatment outcome (Figure 3) and as a clinical guide for minimally invasive, prosthetically driven tooth preparation. It enabled precise control over reduction depth while ensuring preservation of tooth structure and alignment with the final restorative design.

Figure 3. Facial and intraoral view of the direct intraoral mock-up

<u>Tooth Preparation, Gingival Retraction, and Digital Impressions</u>

All clinical procedures were performed under local anesthesia. The abutment teeth were prepared for full-coverage zirconia restorations using a minimally invasive, prosthetically driven approach guided by the previously validated digital wax-up and intraoral mock-up. Tooth preparation was carried out with the aim of preserving maximum dental structure while ensuring adequate space for the restorative material and optimal marginal adaptation.

Gingival displacement was achieved using a single-cord retraction technique. Considering the patient’s thin gingival biotype, a size 00 retraction cord (Ultrapak, Ultradent Products Inc., South Jordan, UT, USA) was selected. The cord was carefully and atraumatically placed circumferentially into the sulcus, slightly apical to the preparation margins, to allow proper exposure of the finish lines while minimizing the risk of soft tissue trauma. This approach ensured optimal visualization and accessibility for accurate impression capture.

Following gingival retraction, digital impressions of the prepared teeth were obtained using the same intraoral scanner (Medit i700, Medit Corp., Seoul, South Korea), previously calibrated according to the manufacturer’s instructions. High-resolution full-arch scans of both the maxillary and mandibular arches were acquired, along with an interocclusal record, to accurately capture occlusal relationships and spatial positioning. The use of intraoral scanning allowed for immediate verification of scan quality and margin clarity, contributing to the precision of the subsequent digital workflow.

Subsequently, the previously fabricated 3D-printed eggshell provisional restorations were relined chairside using a bis-acrylic crown and bridge material (LuxaCrown, DMG, Hamburg, Germany). This relining procedure ensured optimal marginal adaptation and internal fit of the provisional restorations to the prepared abutment teeth.

The provisional restorations were then cemented using a eugenol-free temporary cement (TempBond NE, Kerr Corporation, Orange, CA, USA), allowing for adequate retention while avoiding interference with the polymerization of future resin-based luting agents.

In addition to providing immediate functional and aesthetic rehabilitation, the provisional restorations played a critical role in conditioning the soft tissues. Specifically, the ovate pontic design exerted controlled pressure on the edentulous ridges, promoting gingival contouring and the development of a favorable emergence profile in the pontic areas. This phase was essential for achieving an optimal soft tissue architecture prior to the fabrication of the definitive prosthetic restorations.

Second Provisionalization and Final Digital Impression

After one week of healing with the initial eggshell provisional restorations in place, a second set of provisional restorations was fabricated and prepared for clinical insertion. This intermediate phase aimed to further refine gingival contouring and to clinically validate the definitive prosthetic design in terms of aesthetics, function, and patient acceptance.

The second set of provisionals was designed based on the previously acquired intraoral scan obtained after tooth preparation, which accurately reflected the prepared abutments and the post-preparation clinical situation. Unlike the initial shells, these restorations were conceived as full-contour, on-abutment provisional restorations, closely replicating the morphology and aesthetic parameters of the intended definitive prostheses.

The provisional restorations were fabricated using a stereolithographic 3D printer (Prusa SL1, Prusa Research, Prague, Czech Republic) and a ceramic-reinforced crown and bridge resin (SprintRay Crown, SprintRay Inc., Los Angeles, CA, USA). This material selection allowed for improved mechanical resistance and surface quality, making it suitable for functional provisionalization in the anterior region.

Upon removal of the initial eggshell provisionals, a favorable soft tissue response was observed, with evident gingival contouring and maturation in the edentulous areas, particularly at the sites corresponding to teeth 1.3 and 2.2 (Figure 4). The ovate pontic design of the initial provisionals had successfully contributed to the shaping of the peri-prosthetic soft tissues, resulting in a more natural emergence profile.

Figure 4. Favorable emergence profile observed in the pontic areas (teeth 1.3 and 2.2) after 7 days of provisionalization. The ovate pontic design exerted controlled pressure on the edentulous ridges, contributing to soft tissue contouring and the development of a natural gingival architecture

The second set of provisional restorations was carefully adjusted for marginal fit, proximal contacts, and occlusion, and subsequently cemented using a eugenol-free temporary cement (TempBond NE, Kerr Corporation, Orange, CA, USA). These restorations served as a functional and aesthetic prototype of the final prosthetic outcome.

The patient expressed full satisfaction with the aesthetic appearance and overall design of this provisional stage, effectively approving the definitive restorative concept.

Following an additional one-week period to allow for further soft tissue stabilization and maturation, a final intraoral digital impression was obtained.

This definitive digital impression captured the fully conditioned gingival architecture and the stabilized prosthetic field, providing the basis for the fabrication of the final restorations. The previously validated digital design was then adapted to this final clinical situation, ensuring optimal integration of functional, biological, and aesthetic parameters in the definitive prosthetic outcome.

<u>Laboratory Workflow and Fabrication of Final Restorations</u>

All digital records including the final intraoral impressions, preoperative photographic documentation, Digital Smile Design (DSD), facial scan, and validated digital wax-up were imported into dental CAD software (DentalCAD, exocad GmbH, Darmstadt, Germany). These datasets were used to refine and adapt the previously established prosthetic design to the final clinical situation, ensuring consistency between the provisional phase and the definitive restorations.

Based on the validated esthetic and functional parameters, the definitive restorations were digitally designed as full-contour monolithic zirconia prostheses (Figure 5). To maintain a fully chairside workflow and accommodate the technical limitations of the milling unit, the restorations were strategically divided into three separate components. This approach was dictated by the maximum milling capacity of the chairside system, which allowed fabrication of up to three-unit fixed partial dentures. Accordingly, the definitive restorations were segmented as follows: one full-contour monolithic zirconia fixed partial denture (FPD) replacing tooth 1.3, supported by teeth 1.4 and 1.2; one single full-contour monolithic zirconia crown on tooth 1.1; one full-contour monolithic zirconia FPD replacing tooth 2.2, supported by teeth 2.1 and 2.3. This segmentation enabled complete chairside fabrication without compromising the prosthetic design or clinical outcome.

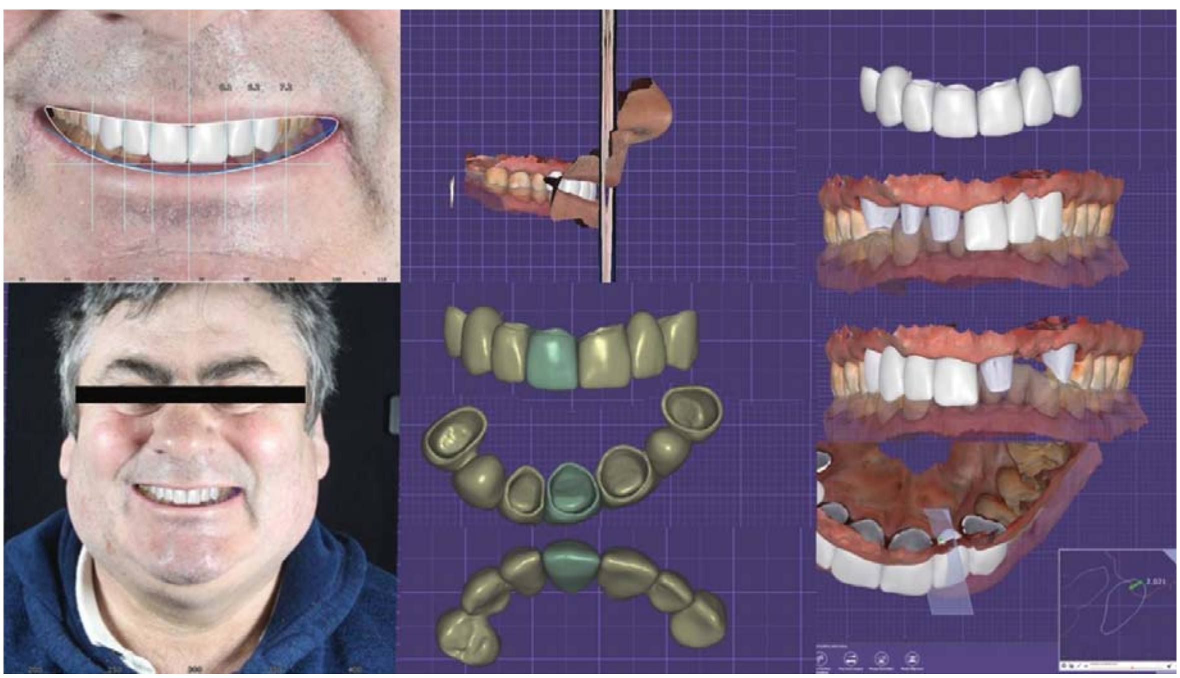

Figure 5. Digital design of the definitive restorations

The restorations were milled from zirconia blocks (IPS e.max ZirCAD HT/B45, Ivoclar, Schaan, Liechtenstein), a material characterized by high flexural strength and favorable optical properties suitable for anterior restorations. The milling procedure was performed using a chairside milling unit (Planmeca PlanMill 40, Planmeca Oy, Helsinki, Finland).

Following milling, the restorations were finished and polished in accordance with the manufacturer's recommendations and subsequently sintered in a high-temperature furnace (Programat CS6, Ivoclar, Schaan, Liechtenstein) to achieve their final mechanical properties and translucency.

Characterization was performed through selective staining of the buccal surfaces to enhance aesthetic integration. The restorations were polished rather than glazed, particularly on the occlusal surfaces, in order to preserve the precise occlusal morphology and contact relationships established during the digital design phase.

The completed restorations were then subjected to a clinical try-in, during which marginal adaptation, proximal contacts, occlusion, and overall aesthetics were carefully evaluated. Both the clinician and the patient approved the final outcome.

Definitive cementation was performed using a resin-modified glass ionomer cement (GC FujiCEM 2, GC Corporation, Tokyo, Japan), ensuring adequate retention and marginal seal. The final cemented restorations are presented in Figure 6 alongside the overall aesthetic outcome.

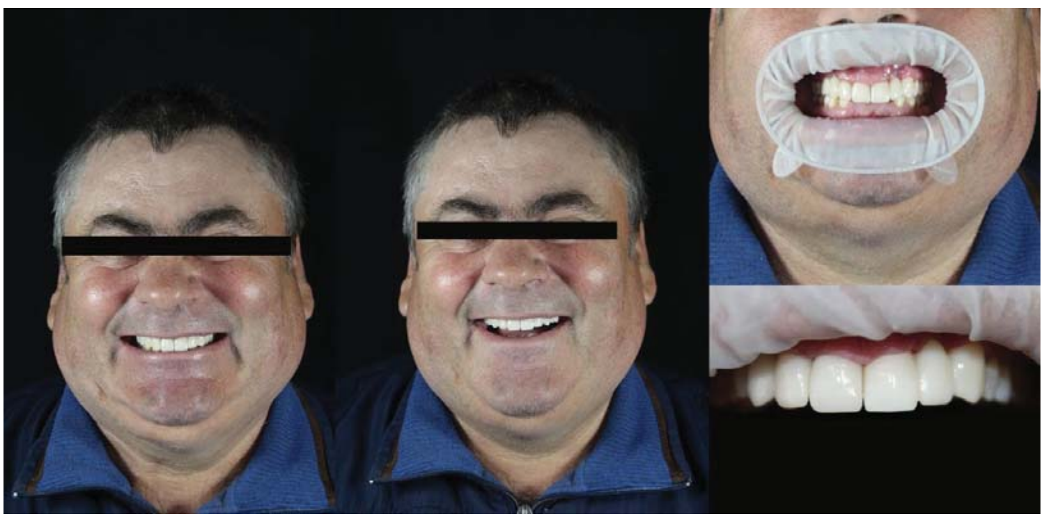

Figure 6. Final restorations after cementation

DISCUSSIONS

This clinical case illustrates how a fully digital chairside workflow, centered on intraoral scanning and chairside CAD/CAM technologies, can be used to rehabilitate the anterior maxilla in a patient who declined implant and surgical soft-tissue procedures. One of the principal strengths of the protocol was the integration of diagnosis, simulation, provisionalization, and definitive restoration into a coherent digital sequence. Current evidence supports the growing role of fully digital chairside workflows in fixed prosthodontics, particularly because they may improve time efficiency, streamline communication between clinical and technical phases, and enhance patient-centered outcomes. However, the literature also emphasizes that evidence remains limited for complex tooth-supported restorations, and further clinical validation is required [1].

A major strength of the present treatment was the use of intraoral scanning as the foundation for all subsequent steps. Intraoral scanners have significantly improved impression accuracy, workflow efficiency, and patient comfort compared with conventional impression techniques. A systematic review demonstrated that digital impressions are generally preferred by patients and may reduce clinical working time while maintaining comparable accuracy [2]. These advantages are particularly relevant in anterior rehabilitations, where precision and repeatability are critical.

The fully digital chairside workflow enhanced predictability by integrating all diagnostic and therapeutic data photographs, intraoral scans, facial scans, Digital Smile Design, and CAD planning into a unified workflow. Systematic reviews have reported that fully digital chairside workflows can be efficient and clinically acceptable; however, they also highlight variability in outcomes and the need for more standardized long-term studies [1].

Another important strength was the use of facially driven planning through Digital Smile Design (DSD). This approach allows clinicians to integrate facial proportions, smile dynamics, and dental morphology into treatment planning. Recent studies suggest that DSD improves communication with patients and enhances treatment acceptance by enabling visualization of the final outcome before intervention [4,9,10].

The use of a diagnostic wax-up and mock-up-guided preparation contributed significantly to the minimally invasive nature of the treatment. The literature supports that prosthetically driven preparation based on a mock-up reduces unnecessary tooth reduction and allows more controlled and conservative preparation, especially in esthetically demanding cases [10,11].

A distinctive aspect of this case was the use of an initial 3D-printed eggshell provisional restoration with ovate pontics. This approach provided several advantages: it transferred the digital wax-up accurately to the oral environment, reduced chairside time, and facilitated non-surgical soft-tissue conditioning. Studies have shown that ovate pontic designs can improve gingival contour and emergence profile, particularly in post-extraction sites, enhancing esthetic outcomes in the anterior region [12].

The staged use of multiple provisional restorations further increased treatment predictability. The first provisional facilitated gingival conditioning, while the second allowed functional and esthetic validation of the final design. This stepwise approach aligns with prosthodontic principles that emphasize provisional restorations as diagnostic tools rather than merely temporary solutions [11].

The use of 3D printing for provisional restorations offered advantages in cost-efficiency, reproducibility, and speed. However, systematic reviews indicate that while 3D-printed provisional materials show clinically acceptable marginal accuracy, they may exhibit inferior mechanical properties compared to milled alternatives, depending on the material and processing protocol [6].

The chairside workflow represented another major strength. It allowed for complete control of all clinical and technical steps, reduced treatment time, and minimized dependency on external laboratory processes. Chairside CAD/CAM systems have been shown to provide efficient and esthetically satisfactory restorations with reduced turnaround time [8].

Nevertheless, the fully digital chairside workflow introduced limitations. The most significant constraint was the milling unit's limitation to a maximum of three-unit restorations, necessitating segmentation of the prosthetic design. While this did not compromise the outcome in the present case, it may represent a limitation in more extensive rehabilitations. Additionally, current evidence suggests that digital workflows are less validated for larger-span prostheses and more complex cases [13].

The selection of monolithic zirconia as the definitive restorative material provided high mechanical strength and acceptable esthetics. Clinical studies have demonstrated favorable performance of digitally fabricated zirconia restorations, although long-term data especially for multi-unit restorations remain limited [14].

A notable limitation of this case was the inability to surgically optimize the gingival aesthetic line (GAL) due to the patient's refusal of surgical intervention. However, given the minimal gingival display during smiling, the esthetic outcome remained acceptable. This highlights the importance of individualized, patient-centered treatment planning.

A critical limitation of this workflow relates to the constraints of chairside CAD/CAM systems. The necessity to segment the prosthetic design due to milling limitations may introduce additional interfaces, which could potentially affect long-term mechanical stability and prosthetic integrity. Furthermore, although 3D-printed provisional materials offer advantages in speed and reproducibility, their mechanical properties and wear resistance remain inferior to milled alternatives, which may limit their use in extended provisional phases. Another important consideration is the learning curve associated with fully digital chairside workflows, as well as the financial investment required for equipment and software integration. These factors may influence the broader clinical applicability of such protocols.

Finally, it must be acknowledged that this report represents a single clinical case, and therefore its findings cannot be generalized. Future research should focus on long-term clinical outcomes, comparison between digital and conventional workflows, and further evaluation of 3D-printed materials and chairside limitations.

CONCLUSIONS

This clinical case demonstrates that a fully digital, chairside workflow can provide a predictable and efficient approach for anterior prosthetic rehabilitation. The integration of intraoral scanning, facially driven digital planning, Digital Smile Design, and CAD/CAM technologies enabled precise control over diagnosis, treatment planning, and execution.

The use of staged provisional restorations including eggshell and on-abutment 3D-printed provisionals played a key role in validating aesthetics and function, improving patient communication, and allowing progressive soft tissue conditioning. Mock-up-guided preparation further supported a minimally invasive, prosthetically driven approach.

Within the limits of a single clinical case, this protocol highlights the clinical advantages of digital technologies, including improved workflow efficiency, enhanced predictability, and greater patient involvement, supporting their growing role in modern prosthodontic practice.

Author Contributions

Conceptualization, A.-B.F, A.J.; methodology, A.J., I.T., A.-E.A.-L., R.R. and A.-B.F.; software, A.-B.F., I.T., R.R. and A.-E.A.-L.; validation, A.J., I.T. and A.-B.F.; formal analysis, A.J. and A.-B.F.; investigation, A.-E.A.-L.; resources, A.J., A.-E.A.-L., I.T., R.R. and A.-B.F.; data curation, A.J., A.-B.F., I.T., R.R. and A.-E.A.-L.; writing, A.J., R.R. and A.-B.F.; writing-review and editing, A.J., R.R. and A.-B.F.; visualization, A.-E.A.-L., I.T., R.R. and A.-B.F.; super-vision, A.J., R.R. and A.-B.F.; project administration, A.J. All authors have read and agreed to the pub-lished version of the manuscript.

Institutional Review Board Statement

This study was conducted in accordance with the Declaration of Helsinki and approved by the Research Ethics Committee of the Victor Babes University of Medicine and Pharmacy Timisoara (approval No.62/06.11.2025)

Informed Consent Statement

Informed consent was obtained from the subject involved in this study. Written informed consent has been obtained from the patient to publish this paper.

Data Availability Statement

The data presented in this study is available on request from the corresponding author.

Acknowledgments

The Article Processing Charge (APC) was funded by "Victor Babes" University of Medicine and Pharmacy in Timisoara, Romania.

Conflicts of Interest

The authors declare no conflict of interest.

The APC was funded by "Victor Babes" University of Medicine and Pharmacy in Timisoara, Romania.

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