



Case Series

Anterior Aesthetic Rehabilitation Using Digital Smile Designing: A Case Series

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ABSTRACT

Background: Anterior dental aesthetics play an important role in facial harmony, psychosocial well-being, and patient satisfaction. Conventional treatment planning for anterior aesthetic rehabilitation may provide limited opportunities for patients to visualize the proposed treatment outcome before definitive rehabilitation. Digital Smile Designing (DSD), integrated with intraoral scanning and computer-aided design and manufacturing (CAD/CAM), enables three-dimensional visualization of the proposed outcome, facilitates patient-clinician communication, and allows predictable transfer of the digital design to the definitive prosthesis.

Case Presentation: This case series presents the aesthetic rehabilitation of three patients with different clinical presentations involving the maxillary anterior region. A 29-years-old female presented with missing maxillary lateral incisors and a midline diastema following discontinued orthodontic treatment. A 27-year-old male with a history of congenital cleft lip and palate presented with missing teeth, retained deciduous teeth, and mal positioned anterior teeth with rotation and inclination. A 20-year-old male presented with missing maxillary right central and lateral incisors following a road traffic accident one year previously, along with irregular positioning of the remaining anterior teeth. A standardized digital workflow was followed in all three cases. High-resolution photographs and videography were obtained, followed by digital intraoral scanning. The smile was digitally designed using Exo cad software, and a digital mock-up was fabricated and transferred intraorally using a putty index. Provisional restorations were fabricated using a bis-acrylic provisional material, allowing clinical evaluation of aesthetics, phonetics, and occlusion before definitive treatment. Following patient approval and clinical validation of the proposed design, the definitive restorations were digitally designed and fabricated using a CAD/CAM workflow. Layered zirconia restorations were subsequently bonded using an appropriate adhesive and resin cementation protocol.

Conclusion: The integration of Digital Smile Designing with intraoral scanning, CAD/CAM technology, digital mock-up, and provisional evaluation provides a systematic and patient-centred workflow for anterior aesthetic rehabilitation. The approach enhances patient participation and communication between the clinician and dental laboratory while permitting clinical evaluation and modification of the proposed aesthetic outcome before definitive prosthetic rehabilitation. This workflow may improve the predictability and efficiency of multidisciplinary anterior aesthetic treatment.

INTRODUCTION

Aesthetic rehabilitation of the anterior dentition requires careful consideration of dental, periodontal, facial, and functional parameters. Tooth morphology, proportion, alignment, colour, gingival display, midline position, and the relationship between the teeth and surrounding facial structures collectively influence the perception of an attractive smile. Conventional aesthetic treatment planning is predominantly based on clinical examination, diagnostic casts, photographs, wax-ups, and direct communication between the clinician and patient. Although these methods remain clinically useful, visualization of the anticipated treatment outcome may be challenging for patients, particularly when extensive changes in tooth position, morphology, or proportion are planned.

The development of digital technologies has transformed the diagnostic and restorative workflow in contemporary prosthodontics. Digital Smile Designing allows systematic evaluation and modification of the proposed smile using photographic, video, and three-dimensional digital records. Integration of facial photographs with digital dental models allows the proposed restorations to be designed with consideration of facial symmetry, dental proportions, midline, incisal position, and overall smile harmony. Intraoral scanners further facilitate acquisition of digital impressions, while computer-aided design and computer-aided manufacturing (CAD/CAM) permit accurate transfer of the approved design to the definitive prosthesis. The use of a digital mock-up and provisional restoration also provides an opportunity for clinical verification of the proposed design before definitive tooth preparation and cementation.

The present case series describes the use of a digitally integrated workflow for anterior aesthetic rehabilitation in three patients presenting with different clinical challenges, including missing lateral incisors with diastema, developmental dental abnormalities associated with cleft lip and palate, and traumatic loss of anterior teeth.

CASE PRESENTATION

Case 1 :

A 29-year-old female patient reported to the Department of Prosthodontics, Crown and Bridge, Government Dental College and Hospital, Srinagar, with a chief complaint of missing teeth in the upper anterior region. The patient was aesthetically concerned and reported a history of discontinued orthodontic treatment. Clinical examination revealed missing maxillary lateral incisors associated with a midline diastema. A comprehensive clinical and radiographic evaluation was performed. Based on the clinical findings and the patient's aesthetic concerns, anterior aesthetic rehabilitation using a Digital Smile Designing workflow was planned.

LET'S ASPIRE NOT JUST TO SUCCEED; BUT TO INSPIRE AND TO MAKE A CHANGE!

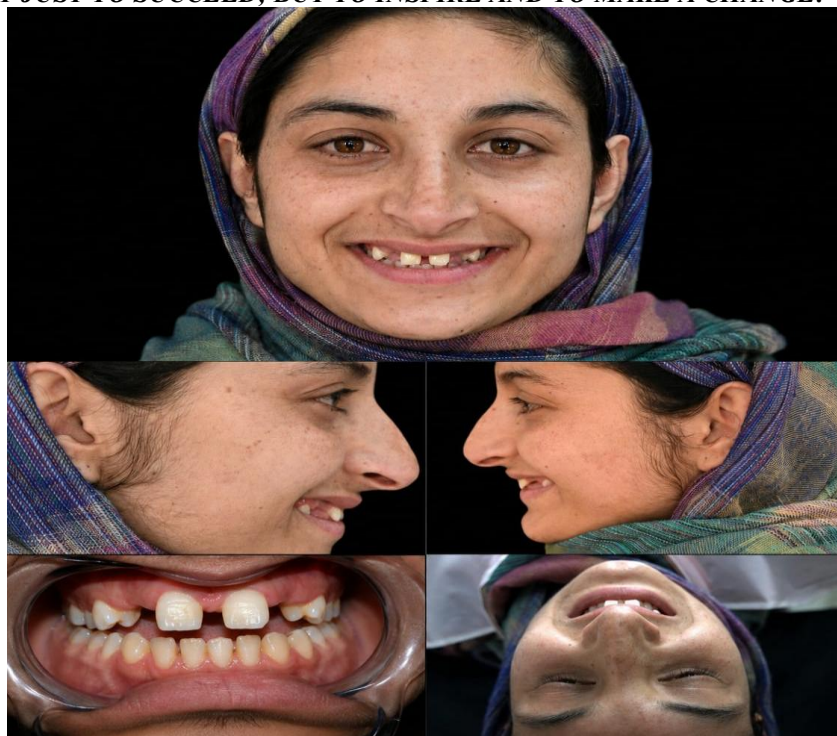


FIG 1 : HIGH RESOLUTION PHOTOGRAPHS USING DSLR CAMERA AND MACRO LENS.

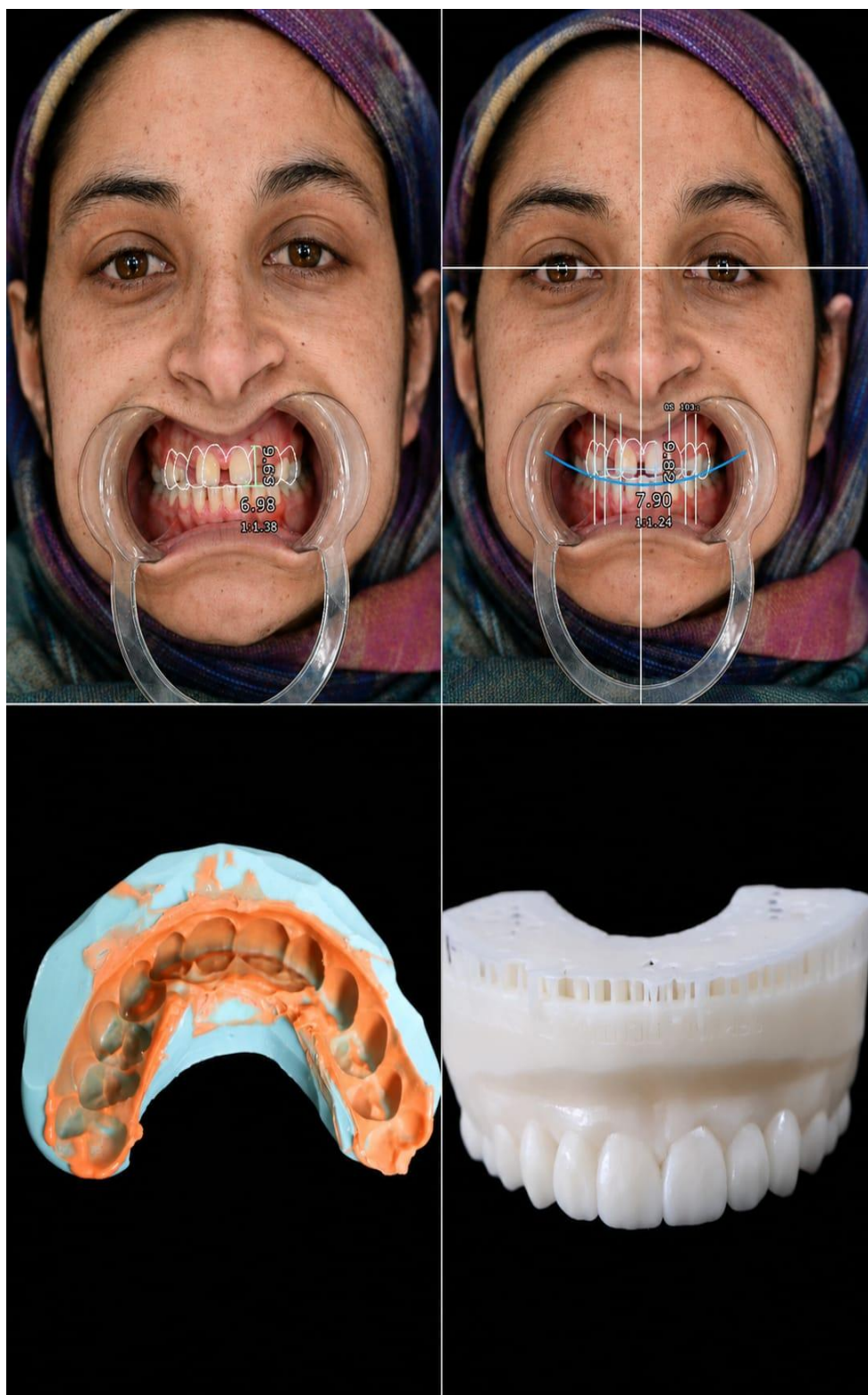


FIG 2 : SMILE ANALYSIS AND SMILE SIMULATION USING EXO CAD 3.0 SOFTWARE.

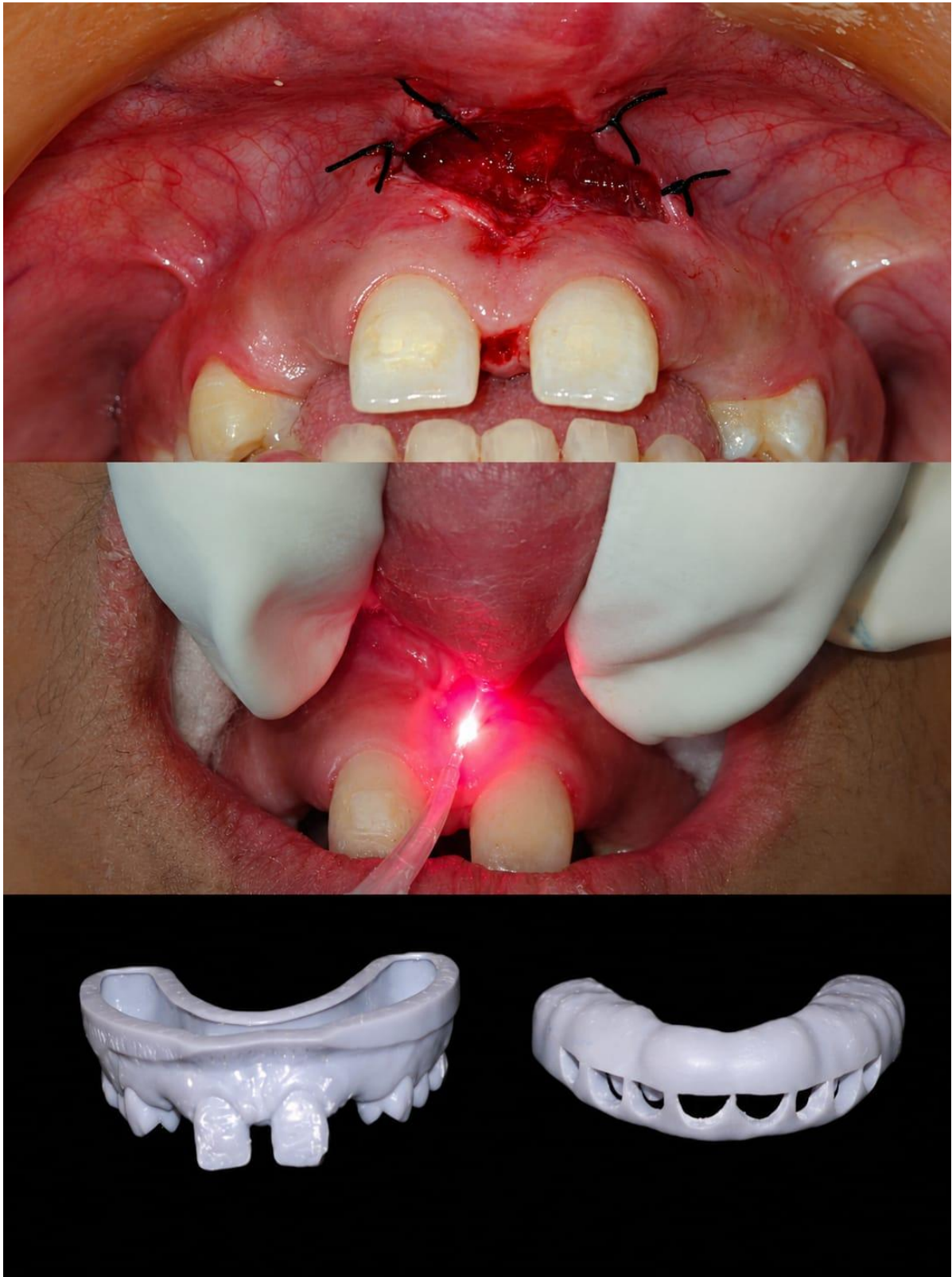


FIG 3 : LASER FRENECTOMY USING DIGITALLY FABRICATED TEMPLATE.



FIG 4 : INTRAORAL PHOTOGRAPHS.



FIG 5 : TEMPORIZATION USING PRO TEMP BIS ACRYLIC .



FIG 6 : DIGITALLY MILLED PROSTHESIS WITH METAL REINFORCEMENT.



FIG 7 : LUTING OF PROSTHESIS USING RESIN CEMENTS.



FIG 8 : POST TREATMENT OUTCOME.





FIG 9 : CASE 2 POST TREATMENT OUTCOME.





FIG 10 : CASE 3 POST TREATMENT OUTCOME.

Case 2 :

A 27-years-old male patient reported to the Department of Prosthodontics, Crown and Bridge, Government Dental College and Hospital, Srinagar, with a chief complaint of irregularly positioned teeth in the anterior region. The patient expressed significant aesthetic concern and reported a history of congenital cleft lip and palate, for which surgical intervention had been performed during childhood. Intraoral examination revealed multiple dental abnormalities, including missing teeth, retained deciduous teeth, rotated teeth, and inclined teeth. Clinical and radiographic investigations were performed to evaluate the existing dental condition and facilitate comprehensive treatment planning. An anterior aesthetic rehabilitation using a Digital Smile Designing workflow was subsequently planned.

Case 3 :

A 20-year-old male patient reported to the Department of Prosthodontics, Crown and Bridge, Government Dental College and Hospital, Srinagar, with a chief complaint of missing teeth in the anterior region. The patient reported a history of a road traffic accident one year previously, following which he had lost his anterior teeth. The patient was primarily concerned about the resulting aesthetic impairment. Clinical examination revealed missing maxillary right central and lateral incisors along with irregularly positioned teeth in the maxillary and mandibular arches. Following comprehensive clinical and radiographic evaluation, anterior aesthetic rehabilitation using a Digital Smile Designing workflow was planned.

CLINICAL PROCEDURE:

Patient Consent and Initial Documentation:

Informed written consent was obtained from all patients before commencement of treatment. The patients were counselled regarding the proposed treatment procedure, anticipated aesthetic outcome, limitations, maintenance requirements, and expected durability of the prostheses. Standardized high-resolution extraoral and intraoral photographs and videography were obtained according to the requirements of the digital smile designing protocol.

Digital Data Acquisition:

Digital intraoral impressions were recorded using an intraoral scanner. The acquired digital data were incorporated into the digital treatment-planning workflow. The photographic, video, and intraoral scanning records were evaluated to establish the proposed aesthetic design.

Digital Smile Designing :

The digital dental records were imported into Exo cad software for three-dimensional treatment planning and smile design. The proposed tooth dimensions, proportions, alignment, and overall aesthetic characteristics were digitally evaluated. A virtual diagnostic design was subsequently generated according to the patient's facial and dental characteristics. The digital design was converted into a physical model using a CAD/CAM printing workflow. A putty index was fabricated over the physical mock-up to facilitate transfer of the proposed design intraorally.

Digital Mock-Up and Provisionalization :

The digitally designed mock-up was presented to the patients to facilitate visualization of the proposed treatment outcome. Following patient approval, the digital design was transferred intraorally using the putty index. Provisional restorations were fabricated using Pro temp bis-acrylic provisional material. The provisional restorations enabled the patients to visualize the proposed aesthetic outcome before definitive tooth preparation. The morphology, proportions, smile appearance, phonetics, and occlusal relationships were evaluated clinically. Necessary modifications were performed based on clinical assessment and patient feedback.

Evaluation of the Proposed Design :

Following evaluation of the provisional restorations, both the clinician and patients assessed the proposed outcome. Only after satisfactory evaluation and patient approval was the definitive prosthetic phase initiated.

Digital Preparation and Definitive Prosthesis :

After finalizing the design, digital intraoral scans of the prepared teeth and provisional restorations were obtained. The digital files were exported in Standard Tessellation Language (STL) format and transferred to the CAD/CAM workflow. The definitive restorations were digitally designed according to the approved smile design and subsequently fabricated using a CAD/CAM milling process. Digitally fabricated layered zirconia restorations using Rubellite zirconia were used as the definitive prostheses. The restorations were subsequently veneered and finished to achieve the desired morphology and aesthetic characteristics.

CEMENTATION PROCEDURE :

The provisional restorations were carefully removed, ensuring complete removal of any residual provisional material from the prepared tooth surfaces. The prepared tooth surfaces were thoroughly cleaned and isolated. The internal surfaces of the zirconia restorations were subjected to appropriate surface treatment according to the bonding protocol. The restorations were sandblasted and subsequently cleaned. The prepared tooth surfaces were etched using 37% phosphoric acid, followed by thorough rinsing and gentle air drying. A bonding agent was applied and light cured according to the manufacturer's instructions. Dual-cure resin cement was placed within the internal surfaces of the definitive restorations. The restorations were carefully seated with controlled pressure. Excess cement was removed from the margins and interproximal areas. The restorations were subsequently light cured to facilitate polymerization of the resin cement. The definitive restorations were evaluated for marginal adaptation, proximal contacts, occlusion, phonetics, morphology, and overall aesthetic integration.

POSTOPERATIVE INSTRUCTIONS AND FOLLOW-UP :

Following definitive cementation, the patients were provided with detailed instructions regarding oral hygiene and maintenance of the definitive restorations. Patients were advised to maintain appropriate oral hygiene practices and attend periodic follow-up appointments for assessment of the prostheses, occlusion, periodontal tissues, and overall aesthetic outcome.

DISCUSSION :

The increasing integration of digital technologies into prosthodontic practice has facilitated a transition from predominantly conventional treatment planning toward digitally assisted, patient-centred workflows. Anterior aesthetic rehabilitation presents a particular challenge because the treatment outcome must satisfy both functional requirements and subjective aesthetic expectations. A restoration that is technically acceptable may nevertheless be perceived as unsatisfactory if tooth proportions, alignment, incisal position, or facial integration do not correspond to the patient's expectations. Digital Smile Designing provides a structured method of communicating the proposed treatment outcome. In the present cases, digital photographs, videography, intraoral scanning, CAD-based smile design, and a physical mock-up were integrated into a single workflow.

One of the important advantages of the workflow was the ability to provide the patients with a preview of the proposed treatment outcome before definitive rehabilitation. The digital mock-up and provisional restorations allowed the proposed tooth morphology and arrangement to be assessed clinically rather than relying exclusively on two-dimensional

visualization. The three cases also demonstrated different clinical indications for digitally guided anterior rehabilitation. The first case involved missing maxillary lateral incisors and a midline diastema following discontinued orthodontic treatment. The second case presented a more complex developmental and anatomical situation associated with congenital cleft lip and palate, including missing teeth, retained deciduous teeth, rotation, and inclination. The third case involved traumatic loss of the maxillary anterior teeth and irregular positioning of the remaining dentition.

Despite differences in the underlying clinical conditions, the same basic digital workflow could be adapted to each patient. This demonstrates the flexibility of digital treatment planning in managing diverse anterior aesthetic problems. Another important aspect of the workflow was the use of provisional restorations as an intraoral validation stage. Rather than proceeding directly from digital design to definitive prostheses, the provisional phase allowed assessment of aesthetics, phonetics, and occlusion. Patient feedback could subsequently be incorporated before final fabrication. The integration of intraoral scanning and CAD/CAM fabrication also reduced dependence on conventional impression procedures and facilitated digital communication between the clinical and laboratory stages. The STL-based workflow allowed the approved digital design to be transferred efficiently to the manufacturing phase.

However, digital smile designing should be considered a diagnostic and communication tool rather than a substitute for comprehensive clinical judgement. Digital planning must be supported by appropriate clinical, periodontal, radiographic, functional, and occlusal evaluation. Furthermore, the final aesthetic outcome depends on multiple variables, including tooth preparation, material selection, laboratory execution, surface characterization, cementation, and maintenance. The present case series is limited by the small number of cases and the absence of a comparative conventional workflow. In addition, longer follow-up and standardized patient-reported outcome measures would be valuable for evaluating the long-term clinical performance and patient satisfaction associated with digitally guided aesthetic rehabilitation.

CONCLUSION

Digital Smile Designing, when integrated with intraoral scanning, CAD/CAM technology, digital mock-up, and provisional evaluation, provides a structured workflow for anterior aesthetic rehabilitation. The technique facilitates visualization of the proposed treatment outcome, improves communication between the patient, clinician, and laboratory, and allows clinical validation of aesthetics, phonetics, and occlusion before definitive prosthetic fabrication. The three cases demonstrate that a digitally integrated workflow can be adapted to different anterior aesthetic conditions, including missing teeth, developmental dental anomalies, and traumatic tooth loss. Nevertheless, comprehensive clinical diagnosis and conventional prosthodontic principles remain essential for achieving predictable and functional long-term outcomes.

DECLARATIONS

Patient Consent

Written informed consent was obtained from the patients for the clinical procedures and for the use of relevant clinical photographs and records for academic and publication purposes.

Ethical Considerations

The treatment was performed following appropriate institutional clinical protocols. Where required by the journal, institutional ethical approval/waiver documentation should be provided according to the applicable institutional and journal requirements.

Conflict of Interest

The authors declare no conflict of interest related to the present case series.

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Author Contributions

All authors contributed to the clinical management, treatment planning, documentation, preparation, and review of the manuscript.