

Designing a Complete Smile from Incomplete Dentition: A Prosthodontic Case Report

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ABSTRACT

Background: Esthetic rehabilitation in patients with congenitally missing anterior teeth presents a complex clinical challenge, particularly when associated with generalized spacing and altered tooth proportions. Contemporary prosthodontic treatment requires integration of esthetic principles, functional considerations, and predictable restorative planning to achieve a harmonious outcome.

Case Presentation: A 45-year-old female patient reported with a chief complaint of an unaesthetic smile. Clinical examination revealed congenitally missing maxillary and mandibular lateral incisors associated with generalized spacing of the anterior dentition. Radiographic and clinical evaluation also revealed an endodontically treated mandibular right first premolar (44) with extensive loss of coronal tooth structure. Various treatment alternatives, including orthodontic space redistribution and implant-supported rehabilitation, were discussed. The patient elected fixed prosthodontic rehabilitation. Endodontic treatment of the planned abutment teeth was followed by post-and-core restoration of 44, with 45 incorporated as an additional abutment. Diagnostic impressions and face-bow transfer were performed, and the casts were mounted on a Hanau semi-adjustable articulator. A diagnostic wax-up was developed to establish appropriate tooth proportions, spatial distribution, and occlusal relationships. The wax-up was incorporated into a digital workflow for guided tooth preparation and fabrication of CAD/CAM provisional restorations. The provisional phase facilitated evaluation and refinement of esthetics, phonetics, occlusion, and patient acceptance prior to fabrication and cementation of the definitive fixed prostheses.

Conclusion: This case demonstrates the application of a systematic prosthodontic and digital workflow for the esthetic rehabilitation of congenitally missing anterior teeth with generalized spacing. Integration of diagnostic wax-up, guided tooth preparation, and CAD/CAM provisionalization facilitated controlled management of tooth proportions and spatial distribution while enabling patient participation in the esthetic treatment process.

Keywords: Congenitally missing teeth; smile design; esthetic rehabilitation; fixed partial denture; diagnostic wax-up; CAD/CAM; digital workflow; prosthodontic rehabilitation.

Introduction:

Contemporary prosthodontics extends beyond the conventional principles of replacement and rehabilitation, encompassing the restoration of dental and facial harmony. Aesthetic considerations have therefore become an integral component of prosthodontic treatment, with emphasis on achieving natural-looking, harmonious, and patient-centered outcomes.

A harmonious smile is determined by the complex interaction of the teeth, gingiva, lips, and surrounding facial structures. Contemporary esthetic dentistry therefore extends beyond the restoration or replacement of individual teeth and emphasizes the integration of dental, gingival, and facial characteristics to achieve a balanced and individualized outcome. Smile designing provides a systematic approach to the analysis and modification of these components, with consideration of tooth proportions, symmetry, dental and facial midlines, gingival architecture, incisal position, and the relationship between the dentition and the lips.^[8,9]

Congenital absence of permanent teeth, or tooth agenesis, represents one of the most frequently encountered developmental anomalies of the dentition. The maxillary lateral incisors are particularly susceptible to agenesis and, when absent, may significantly influence anterior tooth arrangement and smile esthetics.^[1,10] The resulting edentulous spaces may be associated with altered tooth proportions, spacing, asymmetry, and unfavorable relationships between the remaining anterior teeth. Consequently, rehabilitation of patients with congenitally missing anterior teeth presents both esthetic and functional challenges and requires individualized treatment planning.^[1,12]

The development of digital technologies has further expanded the possibilities for contemporary smile designing. Digital smile design allows systematic evaluation of facial, dentogingival, and dental parameters and facilitates visualization of the proposed treatment before irreversible procedures are undertaken.^[11,12] Digital workflows can also improve communication between the clinician, laboratory, and patient by providing a visual representation of the proposed restorative outcome.^[12] The integration of digital scanning, computer-aided design and manufacturing, and three-dimensional printing further permits transfer of the planned restorative contours into the clinical workflow, potentially improving the predictability of tooth preparation and provisionalization.

This case report presents the comprehensive esthetic rehabilitation of a patient with congenitally missing anterior teeth and associated diastema, with emphasis on systematic smile analysis and prosthodontic treatment planning to establish appropriate tooth proportions, harmonious spatial relationships, and optimal dentofacial esthetics.

Case Presentation

A 45 year old female patient reported to the Department of Prosthodontics with the chief complaint of unaesthetic smile. The patient sought definitive prosthetic rehabilitation with the primary objective of achieving an improved and harmonious esthetic outcome. A comprehensive medical and dental history was obtained. Extraoral examination revealed no significant abnormality, with no facial asymmetry present. Intraoral examination revealed congenitally missing maxillary and mandibular lateral incisors, accompanied by generalised spacing present between the maxillary and mandibular anterior teeth. Further clinical and radiographic evaluation revealed an endodontically treated mandibular first premolar in the fourth quadrant, with extensive loss of clinical crown structure.



Figure 1: Front Profile of the Patient



Figure 2: Side Profile of the Patient



Figure 3 : Pre-Operative OPG

Based on the findings, various treatment options were formulated and discussed with the patient. The available prosthetic alternatives, along with their respective advantages, limitations, treatment duration, aesthetic considerations, maintenance requirements and estimated costs, were explained. Considering the congenital absence of the maxillary and mandibular lateral incisors, generalized anterior spacing, and the existing tooth condition, following treatment modalities were considered.

1. Orthodontic space redistribution followed by prosthetic replacement:

Orthodontic treatment could be undertaken to redistribute the existing spaces and establish appropriate mesiodistal dimensions for replacement of the congenitally missing lateral incisors. This approach would facilitate the establishment of more favorable tooth proportions and interproximal relationships prior to definitive prosthetic rehabilitation. However, it would require a prolonged treatment period and additional orthodontic intervention.

2. Implant-supported prosthetic rehabilitation:

An implant-supported rehabilitation was also considered as an alternative treatment modality. Owing to the existing space distribution, this approach would have necessitated extraction of the maxillary and mandibular central incisors, followed by placement of two implants in the resulting edentulous spaces and subsequent rehabilitation with a four-unit implant-supported fixed partial denture. Although this option could provide a fixed prosthetic solution, it involved additional surgical intervention and extraction of otherwise maintainable teeth, along with a more extensive and prolonged treatment sequence.

3. Fixed prosthodontic rehabilitation:

A fixed prosthodontic approach involving crowns and fixed partial dentures was considered to simultaneously address the congenitally missing teeth, generalized spacing, and existing dental conditions. This approach permitted controlled modification of tooth dimensions and distribution of the existing spaces to achieve improved tooth proportions and overall smile harmony. It also provided a definitive, fixed restoration with predictable control over the esthetic arrangement of the anterior dentition.

Following comprehensive discussion of the available alternatives, including their advantages, limitations, treatment duration, biological considerations, and expected esthetic outcomes, the patient elected to proceed with fixed prosthodontic rehabilitation.

Treatment Plan

The treatment plan was then formulated in accordance with the patient's aesthetic expectations, clinical requirements and informed preference. The definitive treatment plan comprised endodontic treatment of the maxillary and mandibular anterior teeth, followed by rehabilitation with fixed partial dentures to address the congenital tooth absence and associated anterior spacing. The endodontically treated mandibular right first premolar (44), which exhibited extensive loss of coronal tooth structure, was planned for restoration with a post-and-core foundation. The mandibular right second premolar (45) was incorporated as an additional abutment to provide enhanced support and stability for the definitive fixed prosthesis.

The proposed treatment plan was thoroughly discussed with the patient, including the anticipated esthetic and functional outcomes, advantages, limitations, maintenance requirements, alternative treatment modalities, estimated treatment duration, and associated financial considerations. The patient's queries and expectations were addressed, and written informed consent was obtained prior to commencement of the treatment.

The treatment was carried out through a sequential prosthodontic workflow integrating conventional and digital techniques.

Endodontic Treatment

Endodontic treatment was done of the maxillary and mandibular anterior teeth i.e. 11,13, 21, 23, 31, 33, 41 and 43. The endodontically treated teeth were subsequently evaluated both clinically and radiographically.

Diagnostic Records and Preliminary Analysis

Diagnostic Impressions were obtained and the resultant casts were evaluated. A face-bow transfer using Whip Mix Face-Bow (Whip Mix Corporation, Louisville, KY, USA) was done to record the spatial relationship of the maxillary arch to the hinge axis and facilitate accurate transfer to the articulator.

The maxillary cast was mounted on a Hanau semi-adjustable articulator (Whip Mix Corporation, Louisville, KY, USA) to facilitate comprehensive diagnostic analysis, three-dimensional evaluation of the maxillomandibular relationship, and fabrication of the diagnostic wax-up.



Figure 4: Maxillary Arch



Figure 5: Mandibular Arch



Figure 6: Frontal View



Figure 7: Right Lateral View



Figure 8: Left Lateral View



Figure 9: Facebow Transfer

Diagnostic wax-up:

A diagnostic wax-up was performed on a Hanau articulator to establish the proposed tooth morphology, proportions, occlusal relationships, and spatial distribution of the planned restorations. The wax-up served as a reference for subsequent tooth preparation and provisionalization. The diagnostic wax-up was also utilized to provide the patient with a visual representation of the anticipated treatment outcome, facilitating communication of the proposed esthetic changes and enabling the patient to visualize the expected final result prior to definitive treatment.



Figure 10: Diagnostic Wax Up

Periodontal Treatment

Initial periodontal therapy comprising oral hygiene instructions and professional scaling was performed to establish a healthy periodontal environment prior to prosthodontic treatment.

Post and Core Restoration

The mandibular right first premolar (44), which exhibited extensive loss of coronal tooth structure, was restored with a post-and-core foundation to provide adequate retention and resistance for the definitive restoration. The mandibular right second premolar (45) was subsequently incorporated as an additional abutment to enhance the support of the planned fixed prosthesis.

Three-Dimensional Model Fabrication for Guided Tooth Preparation

A digital scan was taken of the diagnostic wax up to determine the required reduction of the abutment teeth for the fabrication of the definitive prosthesis. A three-dimensional printed model derived from superimposing the patient's intra-oral scan and the diagnostic wax-up was utilized as a preparation guide.. This facilitated controlled reduction of the abutment teeth in accordance to the predetermined restorative contours.



Figure 11: Tooth Preparation Mock Up Guide

Tooth Preparation

The planned abutment teeth were prepared according to the guide, with appropriate tooth reduction and proper geometry. Adequate space was made for the definitive restorations while maintaining biological and mechanical principles.



Figure 12: Maxillary Tooth Preparation



Figure 13: Mandibular Tooth Preparation



Figure 14: Tooth Preparation with respect to Maxillary and Mandibular Arch

Digital Temporization

The diagnostic wax-up was transferred to a digital workflow, and provisional restorations were designed using a CAD/CAM technique. The provisional restorations were used to assess aesthetics, tooth proportions, phonetics, occlusion and patient acceptance before proceeding with definitive rehabilitation.



Figure 15 : 3D Printed Provisional Restorations fabricated using CAD/CAM

Definitive Prosthetic Rehabilitation

Following satisfactory evaluation of the provisional restorations, the definitive prosthesis were fabricated and clinically evaluated for marginal adaptation, proximal contacts, occlusion, tooth morphology and overall aesthetic integration. After satisfactory verification, the definitive restorations were cemented using the appropriate luting protocol.



Figure 16: Final Restoration



Figure 17: Post Operative Photograph

Discussion

Esthetic rehabilitation of patients with congenitally missing anterior teeth presents a complex prosthodontic challenge, particularly when accompanied by generalized spacing. The absence of lateral incisors alters the distribution of anterior tooth width and interproximal spaces and may compromise dental symmetry and smile harmony. In such situations, treatment planning should extend beyond replacement of the missing teeth and should consider the relationship between tooth dimensions, spacing, gingival architecture, incisal position, and the surrounding facial structures. The present case demonstrates a comprehensive approach to smile rehabilitation in a patient with congenital absence of the maxillary and mandibular lateral incisors and generalized anterior spacing.^{1,2,3}

Multiple treatment alternatives were considered, including orthodontic space redistribution followed by prosthetic replacement, implant-supported rehabilitation, and fixed prosthodontic treatment. Orthodontic therapy can provide favorable space distribution and alignment before prosthetic intervention; however, it increases treatment duration and requires an additional phase of therapy. Orthodontic space closure or redistribution and space opening for subsequent prosthetic replacement are the principal treatment approaches described for congenitally missing maxillary lateral incisors. The selection between these approaches should be individualized according to the patient's occlusion, facial profile, smile characteristics, tooth morphology, periodontal considerations, and treatment expectations.^[5-7]

Implant-supported rehabilitation offers independent replacement of missing teeth and preservation of adjacent tooth structure, but the proposed implant treatment in the present case would have required extraction of the central incisors followed by implant placement and subsequent four-unit rehabilitation. This would have involved additional surgical intervention and extraction of otherwise maintainable teeth.^[6]

In contrast, the selected fixed prosthodontic approach allowed the existing spaces to be managed through controlled modification of tooth dimensions and prosthetic contours while avoiding additional surgical intervention. The treatment decision was therefore based on the individual clinical circumstances, esthetic requirements, treatment complexity, and informed preference of the patient.

A diagnostic wax-up played a fundamental role in the present treatment protocol. It provided a three-dimensional representation of the proposed tooth arrangement and enabled evaluation of tooth proportions, symmetry, occlusal relationships, and distribution of the available spaces before irreversible tooth preparation. Importantly, the wax-up also served as a communication tool, allowing the patient to visualize the anticipated outcome and participate in the treatment-planning process. This is particularly relevant in esthetic rehabilitation, where patient expectations and subjective perception of an acceptable smile play an important role in treatment success.

The incorporation of digital technology further enhanced the predictability of the prosthodontic workflow. Digital applications, including virtual treatment simulation and digital wax-ups, are increasingly being incorporated into prosthodontic diagnosis and treatment planning, with reported applications in visualization, communication, and transfer of the planned design to the clinical workflow.^[4] The use of a digitally derived preparation guide in the present case facilitated controlled reduction of the abutment teeth according to the predetermined restorative contours and assisted in maintaining adequate restorative space. This approach permitted the planned restorative contours to be transferred from the diagnostic phase to the clinical preparation phase, thereby facilitating controlled and conservative reduction of the abutment teeth. Such a digitally assisted workflow can improve communication between the clinical and laboratory stages and reduce discrepancies between the planned and executed restorative design.

Digital CAD/CAM fabrication was also employed for the provisional restorations. Provisionalization served not merely as an interim replacement but as a diagnostic and evaluative phase of treatment. The provisional restorations allowed assessment of tooth morphology, proportions, phonetics, occlusion, and overall smile appearance before fabrication of the definitive prostheses. Patient feedback obtained during this stage was particularly valuable in confirming the acceptability of the proposed esthetic design and allowed the definitive restorations to be fabricated according to an already clinically validated form.

An important consideration in the present case was the integration of esthetic principles with functional requirements. Rather than applying fixed numerical concepts of dental proportion in isolation, the definitive tooth arrangement was developed by considering the patient's existing facial and dental characteristics, available restorative space, occlusal relationships, and desired esthetic outcome. The use of provisional restorations provided an opportunity to evaluate these parameters dynamically and to establish a balance between esthetics, phonetics, and function.^[3,4]

The present case highlights the potential of combining conventional prosthodontic principles with digital technologies in the management of complex anterior esthetic rehabilitation. The sequential use of diagnostic records, articulator-based wax-up, digital scanning, three-dimensional printing, guided tooth preparation, and CAD/CAM provisionalization established a structured workflow from diagnosis to definitive rehabilitation. Such an approach may enhance treatment predictability and facilitate patient communication, although the applicability of a particular workflow remains dependent on individual clinical circumstances, available technology, operator expertise, and laboratory support.

The principal limitation of a single case report is that the outcome cannot be generalized to all patients presenting with congenital tooth agenesis and spacing. Long-term follow-up is also necessary to assess the periodontal, biological, mechanical, and esthetic stability of the definitive rehabilitation. Nevertheless, this case demonstrates how individualized treatment planning, combined with diagnostic visualization and digitally assisted prosthodontic procedures, can be used to address both the functional and esthetic demands of a patient with multiple congenitally missing anterior teeth and generalized spacing.

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