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Case Report

An aesthetic rehabilitation of fractured anterior maxillary teeth with multiple diastema

Galih Sampoerno[1], Kezia Sepdwiningtyas Santoso[2], Agustina Restu Nurkhotimah[2], Karina Awanis Adla[2], Sri Kunarti[1], Adioro Soetojo[1], Nirawati Pribadi[1], Kun Ismiyatin[1]
[1]Department of Conservative Dentistry, Faculty of Dental Medicine, Universitas Airlangga, Surabaya, Indonesia
[2]Conservative Dentistry Specialist Program, Faculty of Dental Medicine, Universitas Airlangga, Surabaya, Indonesia

ABSTRACT

Background: *Aesthetic issues on anterior maxillary teeth often require comprehensive treatment due to both functional and psychological impacts. This case report highlights the clinical approach and management for anterior maxillary teeth with crown fracture and multiple diastemas through restorative aesthetic procedures.* ***Purpose:*** *To describe a clinical approach and restorative aesthetic management for a 37 year-old female patient with a crown fracture and multiple diastemas on the anterior maxillary teeth, aiming to restore aesthetics and function through a carefully planned dental treatment.* ***Case:*** *A 37 year-old female patient presented to Dental Hospital of Airlangga University with a chief complaint of fractured upper anterior teeth and a history of intermittent pain. The patient also reported concern about the spacing between her upper front teeth. The clinical examination revealed involvement of teeth 13, 12, 11, 21, 22, and 23. The patient had no previous dental treatment and no systemic health issues.* ***Case Management:*** *A detailed clinical and radiographic examination was performed, followed by a comprehensive treatment strategy targeting tooth elements 13, 12, 11, 21, 22, and 23. The management focused on restoring tooth structure, closing the diastema, and improving smile aesthetics.* ***Conclusion:*** *Aesthetic and functional rehabilitation of the anterior maxillary teeth was planned and carried out through an integrative restorative approach. The case emphasizes the importance of proper diagnosis dan treatment planning in managing complex aesthetic cases.*

Keywords: *Crown fracture; multiple diastema; aesthetic complex restoration; indirect veneer; lithium disilicate crown*

Correspondence: Galih Sampoerno, Department of Conservative Dentistry, Faculty of Dental Medicine, Universitas Airlangga. Jl. Mayjen Prof. Dr. Moestopo No. 47, Surabaya 60132, Indonesia. Email: galih-s@fkg.unair.ac.id

INTRODUCTION

In modern dentistry, dental aesthetics play a crucial role in overall patient satisfaction. A harmonious and attractive smile contributes significantly to facial appearance, self-esteem, and social confidence. Fractures of the anterior teeth may significantly affect a patient's emotional well-being and quality of life, particularly among young adults who often place high value on their appearance and social confidence.

These injuries are often caused by accidents during sports, falls, or traffic-related incidents. Among all types of dental trauma, Crown fractures of permanent incisors account for about 18–22% of dental hard tissue injuries, among which 28–44% are uncomplicated (without pulp involvement) and 11–15% are complicated fractures involving the pulp tissue. Traumatic dental injuries most frequently involve crown fractures, with the highest incidence occurring in anterior teeth, particularly the maxillary incisors, due to their position in the dental arch, while fractures involving the mandibular central incisors are observed less frequently.[1]

In cases of dental trauma involving complicated crown fractures, especially in the anterior maxillary region, aesthetic and functional rehabilitation is often necessary. When the trauma occurs in patients who also present with multiple diastemas, the clinical challenge increases due to the need to restore both form and interproximal harmony. Multiple diastemas in the anterior region is a type of malocclusion that can affect a person's appearance and reduce self-confidence, especially when it involves the front teeth. Diastema can be aesthetically displeasing and often motivates patients to seek treatment to improve their smile. Management options may include restorative approaches such as composite resin bonding, veneers, or crowns, as well as orthodontic treatment.

Maxillary midline diastema is a common aesthetic concern reported by patients. It refers to a space greater than 0.5 mm between the mesial surfaces of the maxillary central incisors. During the primary and mixed dentition phases,

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this spacing may be considered a normal developmental feature. In most cases, the diastema spontaneously closes with the eruption of the permanent maxillary canines. However, in some individuals, the gap persists into adulthood, becoming a significant source of dissatisfaction with their dental appearance. The causes of diastema can vary, including dental abnormalities, missing teeth, large tongue size (macroglossia), genetic factors, and habits like thumb sucking or tongue thrusting.[2]

Management of diastema cases often requires a multidisciplinary approach, depending on the underlying cause and aesthetic demands. One commonly used option is ceramic laminate veneers4, which are known for their natural appearance, long-term colour stability, biocompatibility, and adequate strength for anterior teeth. With the development of modern adhesive techniques, high-performance ceramics such as lithium disilicate and zirconia have become popular choices for achieving minimally invasive and aesthetically pleasing outcomes.[3] In cases where teeth have reduced structural integrity, such as those affected by trauma or previously treated endodontically, full-coverage ceramic crowns offer improved mechanical strength and long-term protection. Recent advances in adhesive dentistry have enabled the use of lithium disilicate crowns with more conservative tooth preparation, allowing clinicians to achieve durable and aesthetically pleasing results.[3,4]

Composite resin was previously considered a practical option for managing midline diastema, mainly due to its minimally invasive procedure, affordability, reversibility, and the straightforward application. Despite these advantages, its clinical longevity remains a concern. Several studies have reported common complications, including marginal staining, loss of anatomical form, fracture, secondary caries, and colour instability over time.[5]

In this case, the patient presented with a complicated crown fracture of tooth 21 accompanied by multiple diastemas in the anterior region. A conservative, aesthetic rehabilitation was planned using Digital Smile Design (DSD) to guide treatment, followed by minimally invasive restorations including composite direct veneer, lithium disilicate veneers and crowns. This approach aimed to restore anterior tooth structure, close the diastema, and achieve a balanced and natural smile with predictable outcomes.

Accurate diagnosis, treatment planning, and selection of appropriate restorative materials are essential to achieve a predictable and long-lasting result. With advances in adhesive dentistry and restorative materials, such cases can now be treated more predictably while preserving tooth structure and achieving excellent long-term results.

CASE

A 37-year-old female patient presented to the Department of Conservative Dentistry at the Dental Hospital of Airlangga University with the chief complaint of a fractured upper anterior tooth and a noticeable spacing between her front teeth. Informed consent and approval were given by the patient. The patient reported that the fracture occurred approximately one month prior due to a fall. She experienced mild discomfort at the time of injury, which resolved spontaneously. On initial examination, the patient reported no pain but expressed dissatisfaction with the appearance of her smile due to the diastema and requested an aesthetic treatment. The patient had no systemic conditions and expressed a desire to have the affected tooth treated.

Clinical examination revealed a complicated crown fracture on tooth 21 with a midline diastema in the maxillary anterior region. Vitality test on tooth 21 showed a negative response, while the adjacent teeth responded positively. Percussion and bite tests on tooth 21 were negative. Radiographic findings revealed a diffuse periapical radiolucency associated with tooth 21. The tooth was diagnosed with pulp necrosis and asymptomatic apical periodontitis, while other anterior teeth showed normal findings.

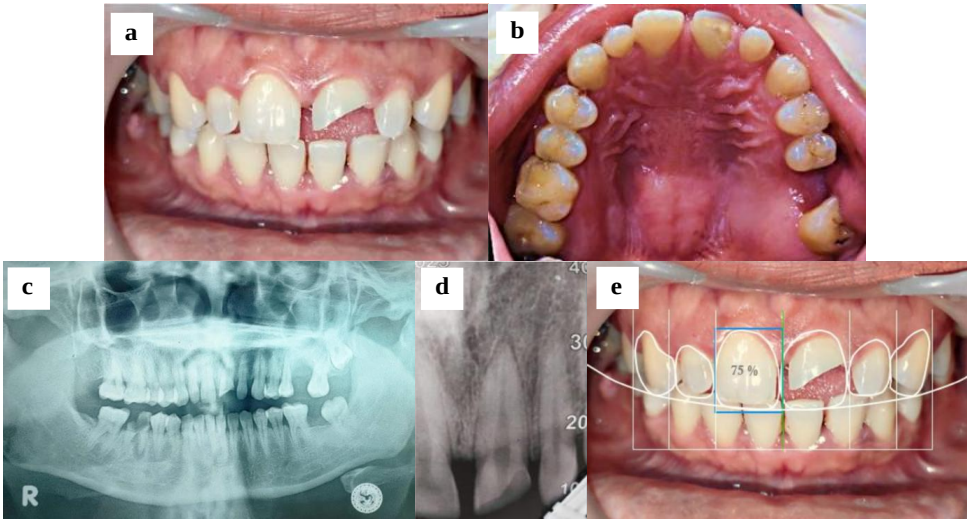

Figure 1. Pre-treatment condition: Clinical frontal view (a); Clinical occlusal view (b); Panoramic radiograph (c); Periapical radiograph (d); Digital smile design (e).

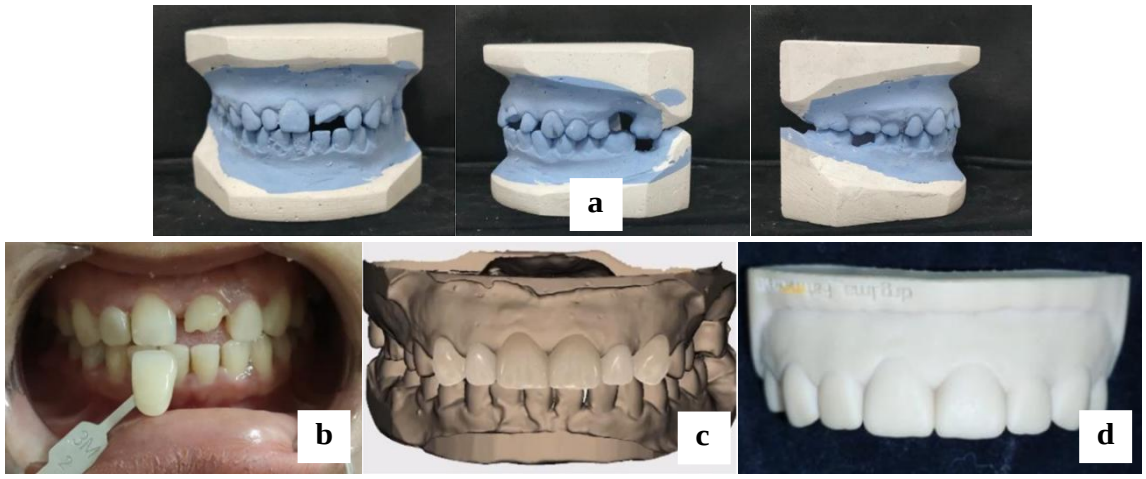

Figure 2. Diagnostic cast (a); Shade selection using shade guide (b); Wax-up model design (c); Wax up 3D printing (d).

Figure 3. Mock up fabrication

CASE MANAGEMENT

Clinical and radiographic examinations confirmed a complicated crown fracture on tooth 21 with pulp necrosis and multiple diastemas involving the anterior maxillary region (Figure 1a and 1b). In response to the patient's desire for an aesthetic improvement without orthodontic treatment, a comprehensive and minimally invasive restorative plan was designed. The treatment plan was established based on the clinical findings of a complicated crown fracture on tooth 21, multiple diastemas, and pulp necrosis, alongside the patient's psychosocial concern regarding her smile.

The first visit began with infection control by rinsing with 1% povidone iodine solution for 30 seconds. A thorough clinical examination, radiographic evaluation (Figure 1c and 1d), and diagnostic assessments were performed, followed by oral hygiene instruction (KIE) and dental health education (DHE). Informed consent was obtained. Initial records were taken, including extraoral and intraoral photographs and Digital Smile Design (DSD) was used to assess smile proportions and plan restorative procedures (Figure 1e). This allowed precise visualization and improved patient-clinician communication.

Diagnostic impressions of the upper and lower arches were made using irreversible hydrocolloid to produce study models (Figure 2a), tooth shade was selected using the Vita 3D Master (3M2) (Figure 2b). A wax-up model design was done (Figure 2c) and 3D printing was made (Figure 2d). Supragingival scaling was completed for both arches.

At the second visit, a general review of symptoms and dental examination showed no abnormalities. Rubber dam isolation was applied, and mock-up fabrication was carried out using the diagnostic wax-up. The patient approved the proposed aesthetic changes based on the mock-up trial (Figure 3).

At the third appointment, the treatment began with the fabrication of a silicon guide based on the previously approved mock-up. Composite shade selection was carried out using the button try technique to ensure an optimal aesthetic match (Figure 4a). The working area was isolated with a rubber dam to maintain a clean and dry field during the procedure.

Depth cuts were created using a depth cutting marker bur, with reductions of 0.5 mm at the gingival third, 0.7 mm at the middle third, and 1 mm at the incisal third of the tooth surfaces (Figure 4b). Direct veneer preparation was then performed on teeth 11, 12, and 13 using a feather design and a round-end tapered bur. The preparations were further refined with a fine finishing bur (Figure 4c-d).

Etching was done with 37% phosphoric acid applied to the labial and incisal surfaces (Figure 4e-f), followed by thorough rinsing and air-drying. A bonding agent was applied evenly, gently air-thinned, and light-cured for 20 seconds. Palatal and proximal walls were formed with the aid of a palatal putty guide and anterior matrix (Figure 5a and 5b).

Composite was applied using a layering technique adapted to the natural anatomy of each tooth. Shade A3 was used for the cervical third and part of the middle third, while A2 was applied to the incisal third. Each layer was light-cured for 20 seconds. The labial contour and transitional lines were first marked with a pencil and then sculpted using a fine finishing bur (Figure 5c) and Sof-Lex discs (Figure 5d). Polishing was completed with Soft-Lex and Eve Diacomp discs (Figure 5e). Finally, the rubber dam was removed, and occlusion was evaluated (Figure 5f).

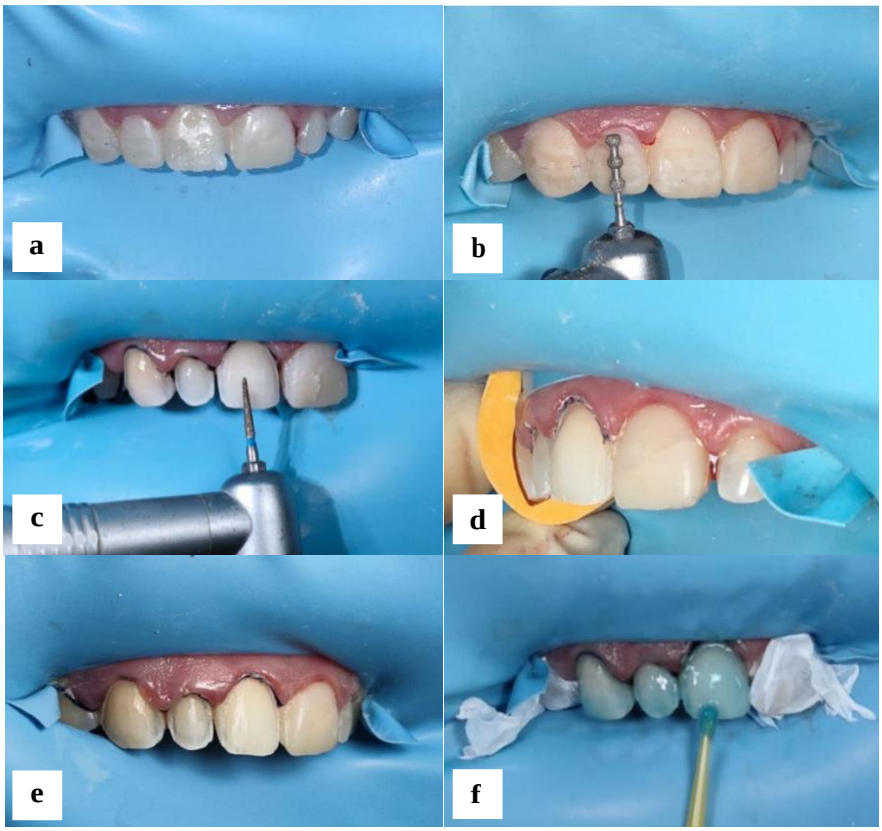

Figure 4. Composite shade selection (a); Preparation using depth cutting bur (b); Tooth preparation of 11, 12, 13 (c); Preparation depth measurement (d); Final preparation of tooth 11,12,13 (e); Etching (f).

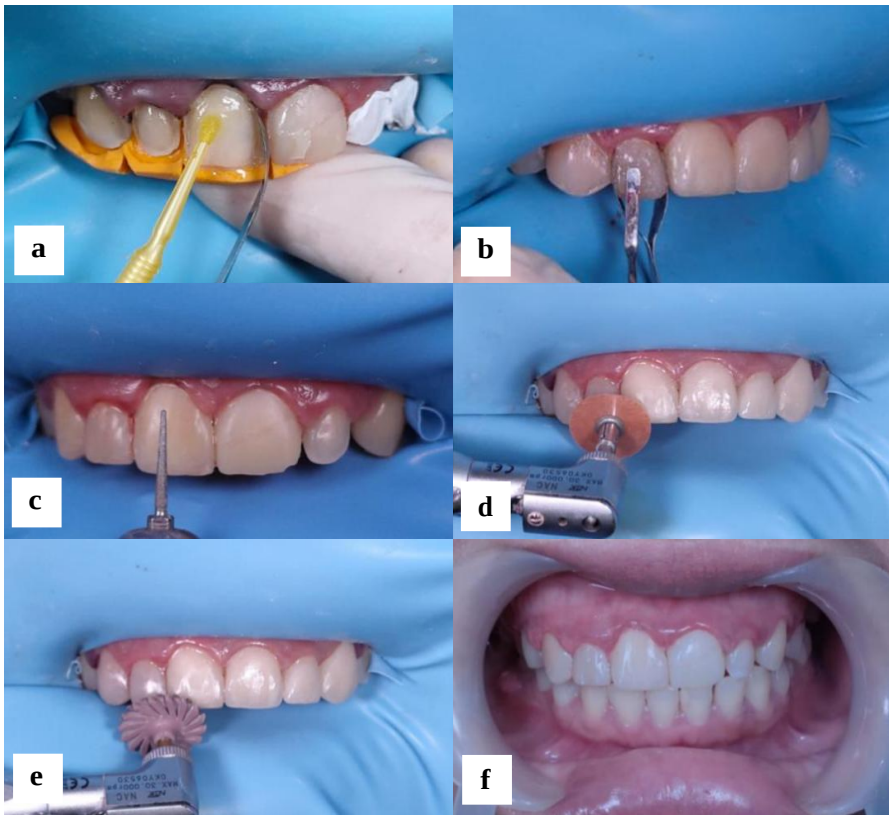

Figure 5. Bonding application and matrix anterior placement (a); Composite application (b); Finishing using fine finishing bur (c); Polishing using Soft-lex disc (d); Polishing using Eve Diacomp (e); Final result of direct veneer (f).

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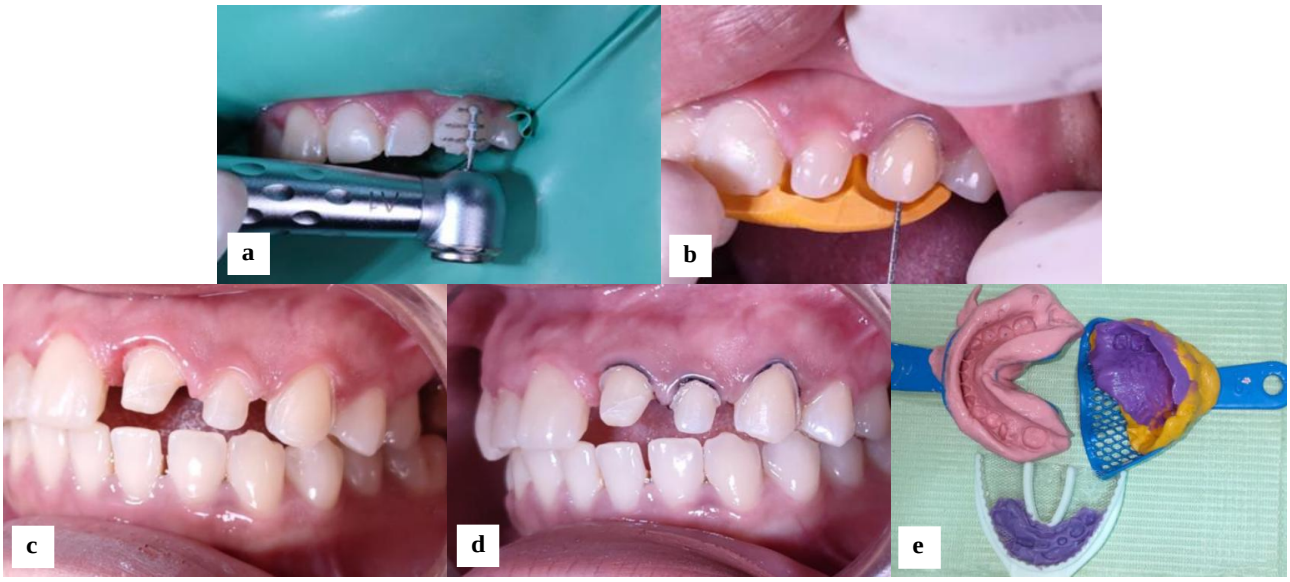

Figure 6. Preparation using depth cutting bur (a); Evaluation of the preparation (b); Final preparations for crown and veneer (c); Gingival management (d); Final impressions result (e).

Figure 7. Try-in of crown and veneer.

At the fourth clinical appointment, the patient reported no discomfort or complaints. Extraoral examination revealed no abnormalities, and intraoral assessment showed normal gingival conditions with negative percussion responses on teeth 12, 11, 21, and 22.

Local anaesthesia was administered in the mucobuccal fold area of teeth 21, 22, and 23. The operative field was isolated using a rubber dam to ensure proper moisture control. A silicone index was fabricated from the previously prepared wax-up to serve as a guide for veneer preparation.

Tooth 23 was prepared for a lithium disilicate veneer using a depth-cutting technique. A depth cutting bur was used to create reductions of 0.5 mm at the gingival third, 0.7 mm at the middle third, and 1.0 mm at the incisal third (Figure 6a). An incisal overlap preparation design with a chamfer finish line was used to enhance both retention and aesthetic integration (Figure 6b).

Following this, teeth 21 and 22 were prepared for full lithium disilicate crowns. Incisal reduction was carried out at 1.5 mm, with palatal and labial surfaces reduced by 1.0 mm. Axial walls were tapered approximately 6° toward the incisal edge to facilitate proper crown seating. A chamfer finish line was applied circumferentially on both teeth (Figure 6c).

Gingival management was achieved using a retraction cord to displace the soft tissues and expose the preparation margins clearly (Figure 6d). An impression of the maxillary arch was taken using an elastomeric material with the double-mix (putty and light body) impression technique, while the mandibular arch was recorded using irreversible hydrocolloid. Maxillo-mandibular relationship was captured using bite registration material made of polyvinyl siloxane (Figure 6e). Provisional restorations, comprising temporary crowns and veneer, were fabricated and placed to maintain aesthetics and protect the prepared teeth during the laboratory phase.

At the one-week follow-up appointment, the patient still reported no complaints or discomfort. Extraoral examination revealed no abnormalities. Intraorally, the provisional crowns and veneer were intact and in good condition. Percussion tests on teeth 21, 22, and 23 were negative, and the surrounding gingival tissues appeared healthy. The provisional restorations were gently removed. A clinical try-in of the definitive lithium disilicate crowns and veneer was performed to assess marginal adaptation, contour, and occlusion. The restorations demonstrated satisfactory fit and aesthetic harmony with the adjacent dentition (Figure 7).

Since the restorations were not yet glazed, they were not definitively cemented at this appointment. The provisional crowns were reapplied to protect the prepared teeth while the definitive restorations were returned to the laboratory for final glazing. Detailed laboratory instructions were provided to ensure appropriate finishing and surface characterization prior to cementation.

At the sixth visit, which served as the final cementation appointment, the anamnesis revealed no subjective

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complaints, and extraoral examination showed no abnormalities. Intraoral examination indicated that the provisional crowns and veneer were intact, with no signs of discomfort. Percussion tests on teeth 21, 22, and 23 were negative, and the surrounding gingival tissues appeared healthy and free of inflammation. The provisional restorations were carefully removed, and a clinical try-in of the definitive lithium disilicate crowns and veneer was performed. The restorations were evaluated for marginal adaptation, shade match, morphology, and occlusion. A neutral-shade try-in paste was applied to assess final aesthetics under simulated cementation conditions. After patient and clinician approval, the try-in paste was thoroughly rinsed and cleaned from the restorations and tooth surfaces.

Pretreatment of the internal surfaces of the restorations was carried out by etching with 9% buffered hydrofluoric acid for 90 seconds (Figure 8a), followed by thorough rinsing and air drying. A ceramic primer was applied and left in place for 60 seconds (Figure 8b). The operative field was isolated using a rubber dam to ensure moisture control. Tooth surfaces were then etched with 37% phosphoric acid

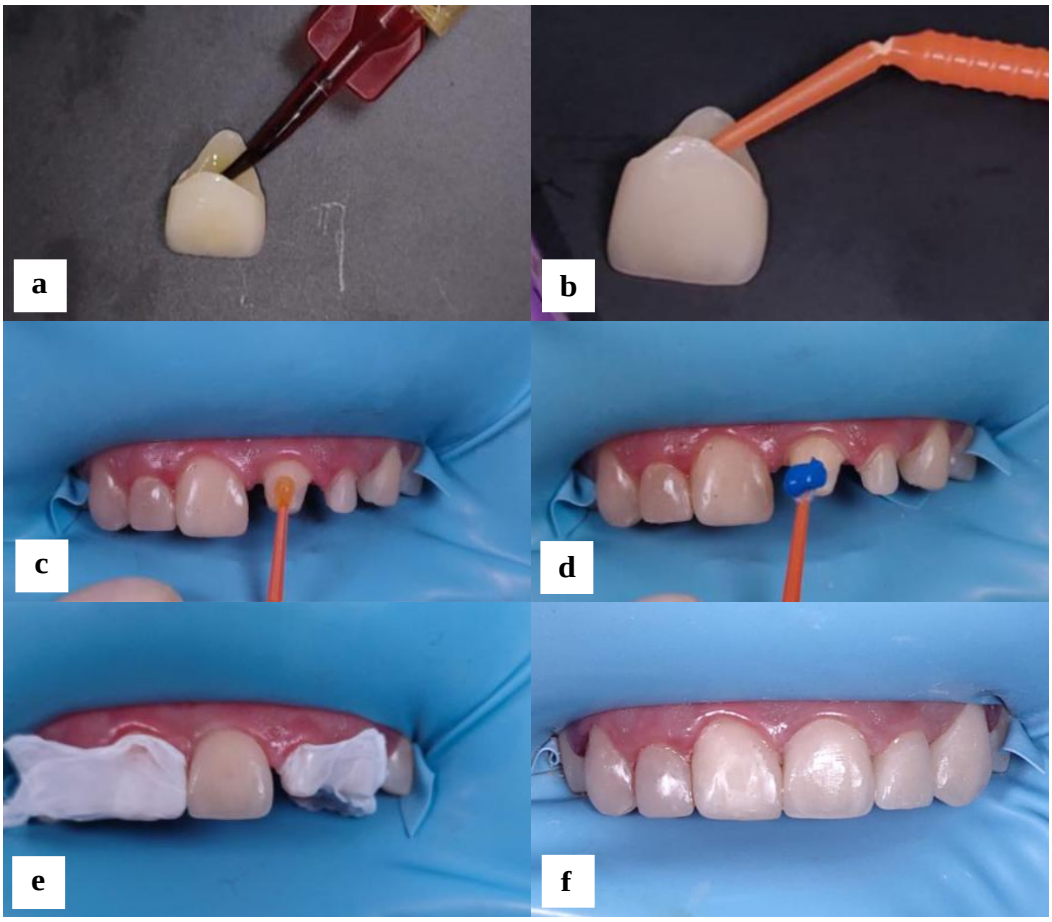

Figure 8. Porcelain etching (a); Silane application (b); Etching application (c); Bonding application (d); Crown cementation (e); Insertion of crown and veneer (f).

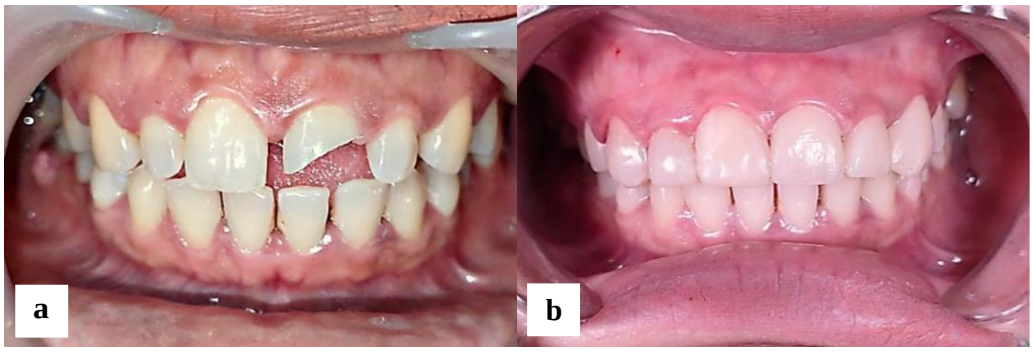

Figure 9. Pre-treatment clinical view (a); Post treatment clinical view (b).

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for 20 seconds, rinsed, and gently air-dried (Figure 8c). A silane coupling agent was applied and light-cured for 10 seconds to enhance the bond between the ceramic and resin cement (Figure 8d).

The restorations were cemented using a neutral-shade adhesive resin cement. Initial light curing was performed for 2 seconds per segment to facilitate cleanup of excess cement, followed by thorough removal of excess material. Final polymerization was completed with an additional 20 seconds of light curing for each segment (Figure 8e). After rubber dam removal, occlusion, marginal adaptation, and proximal contacts were evaluated and adjusted as needed. The restorations were found to be well-integrated functionally and aesthetically (Figure 8f).

At the one-week post-cementation follow-up, the patient reported no discomfort or functional issues. Extraoral examination revealed no abnormalities. Intraoral examination revealed that the definitive lithium disilicate crown and veneers were intact and well-adapted. Percussion tests on teeth 21, 22, and 23 were negative, and the surrounding gingiva appeared healthy without signs of inflammation. There were no occlusal or esthetic issues, suggesting a stable and satisfactory clinical outcome in comparison to the pretreatment (Figure 9a and Figure 9b).

DISCUSSION

Fractured maxillary anterior teeth and midline diastema are common aesthetic concerns that can significantly impact a patient's appearance, confidence, and overall quality of life. In addition to the cosmetic implications, fractured anterior teeth also pose functional and restorative challenges. Both conditions require a comprehensive approach that considers biological, functional, and aesthetic outcomes.

In anterior teeth fractures complicated by aesthetic concerns such as multiple diastemas, a combination of restorative strategies may be required to address both structural loss and smile disharmony. In this case, the fractured tooth 21 with pulpal involvement was managed using a full-coverage lithium disilicate crown to restore strength and function. Teeth 22 and 23 received lithium disilicate veneers to close diastema and reestablish incisal harmony, while other minor diastema were treated using direct composite veneers to maintain a conservative approach.

Direct composite veneers offer the benefits of minimal invasiveness, immediate aesthetic improvement, and reversibility. They are especially useful for managing small gaps or cases where cost and time are limiting factors. However, limitations such as surface degradation, staining, and reduced longevity compared to ceramic materials should be considered. Conversely, indirect ceramic restorations such as lithium disilicate crowns and veneers, provide superior aesthetic outcomes, excellent marginal compatibility, and enhanced fracture resistance, making them more suitable for structurally compromised or highly aesthetic zones.[6]

The treatment plan in this case combined both direct and indirect techniques to achieve a balance between function, aesthetics, and tooth preservation. This multidisciplinary and conservative approach allowed for individualized treatment based on each tooth's clinical condition, while also fulfilling the patient's aesthetic expectations and age, economic situation, operation time, and ensuring long-term clinical success.[7]

In this case, diastema closure was achieved using direct composite restorations and ceramic veneers rather than orthodontic treatment. As reported by Sonar et al. (2023), adult patients often decline orthodontic treatment due to its extended duration and prefer prosthetic solutions like veneers to achieve immediate aesthetic results.[8] Additionally, composite resin has demonstrated predictable diastema closure in direct applications, offering a conservative and cost-effective alternative to orthodontics.[9]

A combination of restorative methods was employed to address varied clinical conditions across the anterior segment. Direct composite veneers were utilized for minor diastema closure due to their conservative nature, immediate aesthetic results, and cost-effectiveness. However, long-term data have shown potential drawbacks: a 7-year retrospective study reported an annual failure rate of approximately 1.4%, with issues like chipping, discoloration, and marginal degradation occurring over time.[10]

For anterior teeth with elevated aesthetic demands, indirect lithium disilicate veneers were selected, owing to their excellent optical characteristics, superior marginal integrity, and favourable mechanical behavior.[11] According to a recent systematic review and meta-analysis, lithium disilicate laminate veneers demonstrated a pooled 10-year survival rate of 96.8%, with a significantly lower incidence of technical complications compared to other ceramic systems.[12] These restorations have been shown to maintain aesthetic and structural stability even under functional loads.

Ceramic veneers have increasingly been recognized as a reliable and long-term solution for the aesthetic management of anterior diastemas. In a randomized clinical trial published in 2024, the performance of indirect ceramic veneers was compared to that of direct composite veneers in patients with multiple diastemas. After a two-year observation period, both treatment modalities showed high survival rates (95% for ceramic and 93.4% for composite veneers). However, ceramic veneers demonstrated superior clinical outcomes, particularly in terms of surface smoothness and colour retention, whereas composite restorations were more prone to marginal staining and surface degradation. These findings underscore the clinical advantage of ceramic veneers in delivering stable and aesthetically pleasing results over time.[13]

In contrast, tooth 21, which experienced structural compromise due to trauma and pulpal involvement, a full-coverage lithium disilicate crown was indicated to provide enhanced strength and protection. Monolithic single crowns fabricated from lithium disilicate displayed a fracture rate below 1% at 4 years, underscoring their

reliability in structurally compromised scenarios.[14] This makes them a favourable option compared to another alternative restorations.

In this clinical case, a Digital Smile Design (DSD) and mock-up were created prior to initiating treatment. DSD serves as a versatile clinical tool, offering several benefits including enhanced aesthetic diagnosis, improved communication between the clinician and the dental laboratory, greater predictability throughout treatment phases, and increased patient understanding and motivation.[15,16] Additionally, DSD facilitates clearer case presentation to the patient. Despite these advantages, mock-ups remain an essential component for effectively communicating treatment plans.[17]

To achieve optimal aesthetic outcomes in similar cases, careful diagnostic planning, wax-up analysis, and close communication between the clinician, laboratory, and patient are essential. The use of digital technology, such as CAD/CAM, may efficiently streamline restorative workflow.[18] But this technology is sometimes considered costly.[19] Ensuring minimal tooth preparation and accurate shade selection further enhances long-term success and patient satisfaction.[20,21]

This case illustrates how a conservative restorative approach using ceramic veneers can successfully address both functional and aesthetic challenges in anterior teeth with diastemas and structural damage, while maintaining the integrity of natural tooth tissue.

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