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**Case Report**

# Multidisciplinary Esthetic Rehabilitation of a Traumatized Central Incisor

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**Abstract:** Management of anterior tooth fractures has progressively shifted toward minimally invasive strategies that preserve sound dental tissues while achieving optimal esthetic outcomes. When traumatic injuries are associated with enamel defects and gingival pigmentation, successful rehabilitation requires a comprehensive multidisciplinary approach addressing both dental and soft-tissue esthetics. A 22-year-old woman presented with esthetic concerns following trauma to the maxillary anterior region. Clinical examination revealed an uncomplicated enamel–dentin fracture of the maxillary right central incisor (tooth 11), enamel hypomineralization affecting both central incisors, and physiological gingival hyperpigmentation. A staged multidisciplinary treatment protocol was implemented. The fractured tooth was initially restored with a direct composite resin as a provisional restoration. Enamel microabrasion was subsequently performed to eliminate superficial hypomineralization defects and improve color uniformity. Gingival depigmentation using a rotary diamond bur was then carried out to optimize the appearance of the gingival tissues before definitive restoration. Finally, a lithium disilicate partial ceramic veneer was fabricated using a digital workflow and adhesively bonded following conventional hydrofluoric acid etching, silanization, and adhesive cementation protocols. The sequential therapeutic approach resulted in excellent integration of the restoration with the adjacent dentition and surrounding gingival tissues while preserving maximum sound enamel. The patient expressed high satisfaction with the esthetic outcome, which included improved tooth morphology, color harmony, and gingival appearance. This case illustrates that combining enamel microabrasion, gingival depigmentation, and adhesive rehabilitation with a lithium disilicate partial ceramic veneer provides a conservative and predictable treatment option for complex anterior esthetic rehabilitation. Careful treatment sequencing and multidisciplinary planning contribute to optimal functional and esthetic outcomes while adhering to the principles of minimally invasive dentistry. Although additional long-term clinical evidence is required, this approach represents a valuable therapeutic option for selected patients presenting with localized anterior trauma associated with enamel and gingival esthetic defects.

**Keywords:** Partial Ceramic Veneer, Lithium Disilicate, Minimally Invasive Dentistry, Enamel Microabrasion, Gingival Depigmentation, Anterior Tooth Fracture.



## INTRODUCTION

Dental trauma is one of the main causes of tooth Fracture, predominantly affects children and adolescents, with a reported global prevalence ranging from 4% to 33% [1]. Across multiple populations, maxillary central incisors are consistently the most frequently traumatized teeth [2]. Restoring a single maxillary central incisor (tooth 11) is esthetically demanding, especially when discolorations and soft-tissue issues coexist. A multidisciplinary, minimally

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invasive plan can integrate microabrasion, depigmentation, and a ceramic partial veneer to harmonize color, shape, and gingival contours while preserving tooth structure.

In recent years, minimally invasive treatment approaches have become increasingly attractive in restorative dentistry because contemporary adhesive procedures allow rehabilitation of anterior teeth with reduced sacrifice of sound dental structure [3-5]. Within this philosophy, ceramic partial laminate veneers have gained attention as a conservative treatment modality, since they restore only the compromised area of the tooth and often require minimal or no preparation [6, 7].

Ceramic materials are frequently preferred in the esthetic zone because they provide favorable optical properties, surface smoothness, and color stability, and can closely mimic the morphology and translucency of natural enamel [8]. Although direct composite restorations remain a conservative and practical option for limited fractures, indirect ceramic restorations are often chosen when superior esthetic integration, surface durability, and long-term stability are desired [9].

Porcelain laminate veneers are indicated for the correction of several anterior esthetic defects, including tooth fractures, discolorations, contour abnormalities, and small diastemas [6, 7]. In cases of fractured maxillary central incisors, partial ceramic veneers appear to be a suitable ultra-conservative alternative to conventional full veneers, particularly when the defect is localized and sufficient enamel is available for predictable adhesive bonding [7].

Available clinical and laboratory evidence suggests that partial laminate veneers can achieve favorable esthetic and functional outcomes, with good medium-term survival in selected anterior cases, although their success remains highly dependent on case selection, enamel-based margins, adhesive execution, and careful finishing of the tooth-ceramic interface [7, 8]. Therefore, ceramic partial veneer restorations represent a promising minimally invasive option for the rehabilitation of a single fractured maxillary central incisor in patients seeking optimal esthetics together with maximum preservation of sound tooth structure [7].

## CASE REPORT

A 22-year-old female patient, with no significant health issues, presented to the department of dentistry, Sahloul University Hospital of Sousse, with an esthetic concern in the anterior maxillary region, following a history of dental trauma. The patient was dissatisfied with her smile, mainly due to a crown fracture of the upper right central incisor. She had also some complaints concerning the discoloration of the adjacent tooth and the dark color of her gums.

**Clinical Examination**

Extraoral examination revealed no abnormal findings, a symmetrical lower facial third and a medium smile line.

Intraoral examination showed an oblique enamel-dentin fracture of tooth 11 with no pulp exposure, asymptomatic, reaching the middle third of the crown on the distal edge, hypomineralization of tooth 21 and the mesial edge of tooth 11and gum hyperpigmentation (Figure 1).

**Figure 1: Initial situation**

**Diagnosis:**

* Oblique enamel-dentin fracture of tooth 11 with no pulp exposure reaching the middle third of the crown on the distal edge.
* Hypomineralization of tooth 21 and the mesial edge of tooth 11.
* Physiological gum hyperpigmentation.

**Treatment Plan:** For the first session, crown restoration with composite resin was performed as a temporary solution (Figure 2).

**Figure 2: Temporary crown restoration of tooth 11 with composite resin**

Then, enamel microabrasion was considered for tooth 21 and tooth 11. This first requires the placement of a rubber dam, the lesion was isolated by a liquid dam and then an abrasive paste (Opalustre$^{TM}$, ULTRADENT, Dardilly, France) were applied on discolored areas. Moderate pressure was applied by slow-speed handpiece with a polishing cup, followed by rinsing (Figure 3).

**Figure 3: Enamel microabrasion procedure**

After completion of the treatment, a fluoride was applied and a temporary composite resin restoration was restored.

Gingival depigmentation represents a minimally invasive esthetic intervention to harmonize gingival coloration. In the reported case, local anesthesia was administered in the maxillary anterior region. A tapered diamond bur facilitated removal of the pigmented gingival epithelium, after which saline irrigation was performed on the exposed connective tissue (Figure 4).

**Figure 4: The procedure of gum depigmentation using tapered diamond bur**

Parosept® (STODERMA, Tunisia) spray was prescribed postoperatively, and uneventful healing was achieved within 10 days.

The prosthetic decision was a ceramic partial veneer on tooth 11. The temporary restoration was removed, and a smooth preparation was done. A digital impression was taken and the permanent restoraion was tried in. For the bonding of the restoration, the rubber dam was placed. First, the treatment of the prosthetic surface was ensured through those steps: applying a 5% hydrofluoric acid gel (CERAM ETCH®, ITENA, ville

print, France). Then, after rinsing with water and drying, a thin layer of silane (Monobond Plus®, Variolink N, Professional Set, Zurich, Switzerland) was applied to the pretreated surface.

Variolink N® kit was used for bonding. Then, the treatment of the tooth surface was carried out by following those steps: etching with a 37% phosphoric acid gel (DENTOETCH, phosphoric acid 37%, ITENA, Villepint, France) performed to the enamel for 30 seconds, followed by etching of the dentine for 15 seconds, rinsing thoroughly with water then drying until the enamel surfaces have a chalky white appearance, applying Syntac Primer® for 20 seconds, then Syntac Adhesive® for 10 seconds, and finally applying a thin layer of Heliobond®.

For the final step, resin bonding was applied on the internal surface of the restoration. Then, the ceramic partial veneer was held in place by OptraStick®. The excess material was eliminated after being exposed to a polymerization light for 3 seconds. This step ended with a final light-curing for 40 seconds (Figure 5).

**Figure 5: Bonding procedure of the ceramic chip prepared for tooth 11**

The patient was satisfied with the results: a minimal invasive esthetic anterior restoration, a brighter smile, healthy and pink gums (Figure 6).

**Figure 6: The final result with the ceramic chips**

## DISCUSSION

The management of anterior esthetic defects caused by dental traumas currently relies on a minimally invasive and multidisciplinary approach aiming not only to restore lost dental tissues, but also to achieve harmonious integration between the gingival and dental esthetic components. In the present case, the coexistence of an enamel–dentin fracture of the maxillary central incisor, enamel hypomineralization, and gingival hyperpigmentation was considered etiologically relevant rather than incidental. This perspective shifted the treatment approach from a single-tooth restoration toward a comprehensive smile enhancement strategy aimed at achieving optimal functional and esthetic outcomes. Managing fractures in the aesthetic zone on structurally compromised teeth requires careful clinical reasoning.

Microabrasion was initially performed to manage the superficial enamel defects related to hypomineralization that may yiel inferior bonding strength. This technique is a minimally invasive technique that combines controlled chemical erosion and mechanical abrasion to remove superficial enamel discolorations and defects. The procedure involves the application of an acidic agent, typically hydrochloric acid, in conjunction with abrasive particles such as silicon carbide. The acid selectively demineralizes a thin superficial enamel layer, while the abrasive component mechanically removes the altered enamel reducing discolorations and surface defects and producing a smoother, more esthetic enamel surface. In this case,

microabrasion was performed on both maxillary central incisors (11 and 21) before the restoration of the tooth 11. This bilateral approach was chosen as tooth 11 required harmonisation with the contralateral tooth [10, 11].

The esthetic outcome was further enhanced through gingival depigmentation. In fact, gingival appearance plays a major role in smile perception in the anterior region particularly when patients present with a high or medium smile line exposing the gingival margin. In prosthodontic practice, gingival colour is systematically evaluated as part of smile analysis alongside tooth colour, shape, and gingival architecture.

In the present case, gingival depigmentation was undertaken prior to definitive restoration based on the clinical principle that periodontal soft tissue optimisation should precede the finalisation of tooth-coloured restorations.

Otherwise, Post-restoration depigmentation would risk altering the chromatic reference used for shade selection and would require re-evaluation of the aesthetic outcome under modified gingival conditions. This sequencing is therefore not arbitrary but clinically driven [12].

Several techniques have been proposed for gingival depigmentation, including surgical stripping with a scalpel, abrasion using rotary instruments, electrosurgery, cryosurgery, radiosurgery, and laser therapy. Although these approaches effectively remove pigmented epithelial tissues, repigmentation remains a common long-term challenge regardless of the technique employed. Consequently, Long-term follow-up is therefore mandatory, and the patient should be counselled accordingly as part of the informed consent process. Within this context, gingival depigmentation provides a significant aesthetic enhancement by improving the integration and overall harmony of the prosthetic restoration with the surrounding soft tissues; however, the long-term stability of the outcome remains dependent on individual biological and melanocytic factors [13].

Recent developments in adhesive dentistry and the emergence of enamel-preservation preparation philosophies have promoted the widespread adoption of minimally invasive aesthetic treatments focused on achieving optimal structural conservation. Dental ceramics are recognised as among the most biocompatible restorative materials available, exhibiting negligible on release, no monomer leaching, and a surface energy profile that minimises bacterial adhesion and plaque accumulation.

In the present case, the lithium disilicate ceramic partial veneer technique was chosen for the upper right incisor because of its higher intrinsic mechanical resistance. It is a minimally invasive indirect restoration, designed to cover exclusively the fractured zone without extending to sound tooth structure what the literature describes as a 'no-preparation' or 'preparation-free' partial ceramic restoration.

This provided a better reproduction of the characteristics of the homologous tooth through the artistically developed sculpture. Another purpose for this tooth was to allow adequate finishing and polishing at the ceramic–resin cement–enamel interface, a fundamental requirement in this partial veneer. Because it contains more glass and fewer crystals, feldspathic ceramic facilitates the finishing steps in the mouth of the beveled end of the partial ceramic veneer [14-20]. The anterior sector is subjected to complex loading patterns including tensile, shear, and oblique forces during incision and excursive movements. Dental ceramics, particularly lithium disilicate (flexural strength 360–400 MPa) exhibit mechanical properties that provides a substantial functional advantage.

Finite element analysis studies have further demonstrated that the elastic modulus of ceramic (60–70 GPa for lithium disilicate) more closely approximates that of enamel (80 GPa) resulting in a more physiological stress distribution at the restoration-tooth interface and reduced risk of adhesive failure under functional loading [20, 21].

It offers superior mechanical properties through adhesive bonding rather than mechanical retention. This demonstrates that adhesively lutted ceramics do not require mechanical retention preparation when the bonding protocol is correctly executed: the HF–silane–resin cement system generates bond strengths that are clinically sufficient for anterior partial restorations under functional loading [22, 23].

Feldspathic ceramics, leucite-reinforced ceramics, and lithium disilicate glass-ceramics (e.g., IPS e.max) exhibit optical properties—including translucency, opalescence, fluorescence, and light diffusion—that closely mimic those of natural enamel and dentin. Furthermore, these ceramic systems can be extensively characterised at the laboratory level to reproduce the complex optical stratification and biomimetic appearance of natural dentition [24, 25].

The therapeutic sequence adopted in this case reflects the therapeutic gradient approach, in which the least invasive procedures should be considered before more aggressive prosthetic alternatives. A conservative multidisciplinary protocol was chosen, enabling significant esthetic improvement while maintaining maximum enamel preservation. This approach highlights the growing role of minimally invasive dentistry in contemporary prosthodontic practice.

From a didactic standpoint, the therapeutic sequence documented adopted in the present case may be conceptualised as a reproducible decision-making framework for the management of comparable aesthetic presentations: (i) identification and management of the underlying etiological substrate (hypomineralisation), (ii) periodontal and peri-gingival tissue optimisation to establish a stable soft-tissue environment, and (iii) implementation of the definitive restorative rehabilitation.

Furthermore, this case emphasises the central role of the prosthodontist in orchestrating multidisciplinary aesthetic rehabilitation. Although the individual therapeutic modalities employed—including enamel microabrasion, laser-assisted gingival depigmentation, and adhesive ceramic bonding—originate from distinct domains of dental practice, their biologically driven integration within a structured, sequenced, and patient-specific treatment protocol exemplifies the comprehensive strategic role of the specialist in fixed prosthodontics [26- 28].

## CONCLUSION

The multidisciplinary protocol described in this case illustrates how conservative management combining enamel microabrasion, gingival depigmentation, and a lithium disilicate partial ceramic veneer can successfully rehabilitate a fractured maxillary central incisor while preserving healthy tooth structure. Careful treatment sequencing and adherence to minimally invasive principles contributed to satisfactory esthetic integration of both dental and gingival tissues. Although long-term clinical studies are still needed, this approach represents a predictable and biologically respectful option for selected anterior esthetic cases.

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