



Case Report

Rehabilitation of anterior enamel hypoplasia with layered zirconia crowns: A case report

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Abstract

This case report details the successful aesthetic rehabilitation of a young patient presenting with severe anterior enamel hypoplasia using layered zirconia crowns. The patient exhibited significant discoloration, irregular tooth morphology, and compromised aesthetics affecting their confidence and social interactions. A comprehensive treatment plan was developed, focusing on guided tooth preparation followed by the fabrication and cementation of custom-designed layered zirconia crowns. The patient reported high satisfaction with the improved appearance and function of their anterior teeth. This case highlights the predictability and aesthetic potential of layered zirconia crowns in addressing the challenges posed by anterior enamel hypoplasia, offering a durable and biocompatible solution for comprehensive aesthetic rehabilitation. Long-term follow-up will be necessary to assess the longevity and sustained aesthetic success of the restoration.

Keywords: Enamel hypoplasia, Layered zirconia crowns, Esthetic rehabilitation, Anterior teeth.

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1. Introduction

Enamel hypoplasia is a quantitative defect of enamel thickness that manifests in any tooth during enamel matrix secretion. Etiological factors include local, systemic, environmental, and genetic influences, with variable enamel matrix abnormalities depending on the stage of amelogenesis when aggression occurred.¹ It can affect both primary and permanent dentitions, leading to significant esthetic and functional problems, particularly in the anterior region. The presentation of enamel hypoplasia can vary, ranging from mild pitting to severe enamel deficiency.²

Linear Enamel Hypoplasia is a specific type of environmental hypoplasia characterized by symmetrical and ring like defects involving many teeth. A wide variety of complaints are associated with Linear Enamel Hypoplasia which include include-sensitivity to air, cold, warm and mechanical stimuli, inability to chew food, carious teeth and its sequelae.^{3,4}

The management of enamel hypoplasia aims to improve aesthetics, alleviate sensitivity and prevent further tooth damage. Treatment options vary depending on the severity of the condition and may include:

1. Bonded composite restorations: For mild to moderate cases.
2. Veneers: For more significant esthetic improvement.
3. Crowns: For severe cases with extensive enamel loss.

This case report describes the use of layered zirconia crowns to rehabilitate anterior teeth affected by linear enamel hypoplasia in a young patient. Layered zirconia crowns offer a combination of strength, durability, and excellent esthetics, making them a suitable option for long-term rehabilitation.

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2. Case Presentation

2.1. Patient information

A 19-year-old male patient, with concerns about the appearance of his anterior teeth, specifically with respect to, discoloration and irregularly shaped front teeth associated with sensitivity. He reported feeling self-conscious about his smile and its negative impact on his social interactions. While the patient's medical history was non-contributory, his dental history was significant for enamel hypoplasia, diagnosed at 17 years of age. Patient also revealed a history of trauma to his deciduous front teeth in early childhood.

2.2. Clinical findings

Intraoral examination revealed the following:

1. Anterior Teeth: Severe enamel hypoplasia was present on teeth 11, 12, 13, 21, 22, 23, 31, 33, 41 and 43. Congenitally missing 32 and 42. The enamel was thin, with deep horizontal grooves and exhibited significant discoloration. The incisal edges were irregular and worn. There was no clinical evidence of caries. Crowding in upper anterior teeth. Marginal Gingivitis was noted.
2. Other Findings: Mild enamel hypoplasia manifesting as irregular opacities limited to cervical region of all posterior teeth except 36 which had a PFM crown on an endodontically restored tooth. Composite restorations in 37 and 47. The patient had a Class I molar relationship with anterior deep-bite and a canine guided occlusion bilaterally. (**Figure 1**)

2.3. Diagnostic assessment

1. Diagnostic Methods:
 - a. Visual examination: Clinical examination of the teeth to assess the extent and severity of enamel defects.
 - b. Radiographic examination: Periapical radiographs were taken to assess root morphology and rule out any periapical pathology.
 - c. Pulp vitality test: Cold test was done to ascertain requirement of intentional RCTs as a preventive measure in affected teeth.
 - d. Photographs: Intraoral photographs were taken to document the pre-operative condition and aid in treatment planning and shade selection.
 - e. Diagnostic impressions: Alginate impressions were made to create study models for treatment planning and laboratory communication.
2. Differential Diagnosis: Amelogenesis imperfecta, fluorosis, and localized trauma were considered, but ruled out based on the clinical presentation and patient history.

2.4. Final diagnosis

1. The diagnosis of Linear enamel hypoplasia was based on the characteristic clinical findings of thin enamel, deep circumferential grooves, and discoloration, in the absence of a significant medical history or other factors that would suggest an alternative diagnosis.

2.5. Therapeutic intervention

1. Treatment Plan
 - a. Endodontic treatment for 11, 12, 31, 32
 - b. The patient's anterior teeth (11, 12, 13, 21, 22, 23, 31, 33, 41, 43) to be restored with full coverage crowns.

The patient was explained about the different options available for the choice of dental material in the final prosthesis. Among those, Layered Zirconia crowns were chosen to be the best fit. The zirconia core would provide adequate strength and support, while the layered porcelain provides optimal esthetics.
2. Procedure
 - a. Composite build-up: Due to severity of enamel loss with 11 and 21 a preliminary build-up with composite was done to act as a scaffold while RCTs were undertaken. (**Figure 2**)
 - b. Primary Cast: Alginate impressions were made and primary cast poured in dental stone, to serve as base for the wax mock-up.
 - c. Diagnostic Mounting: Orientation relation was recorded on a facebow and transferred to the semi adjustable articulator. Patient's centric relation and protrusive records were utilized for articulating the upper and lower casts and thereafter programming the articulator.
 - d. Wax Mock-up: Ideal tooth contours were established on the primary cast by a combination of subtractive and additive layering processes. (**Figure 3**)
 - e. Indexing: Condensation Silicone Putty consistency was used to make complete (for temporization purposes) and partial (as tooth reduction guides) indices.
 - f. Tooth preparation: The teeth were prepared for full-coverage crowns, with a 1.8 to 2mm incisal reduction and 1.0mm circumferential rounded shoulder preparation with equigingival margins.
 - g. Gingival Displacement: A dual cord technique with #000 and #0 braided cords soaked in 12% Aluminum Chloride solution was employed. (**Figure 4**)
 - h. Master Casts: Final impression was recorded using polyvinyl siloxane impression material in a two-step putty-wash technique to ensure accurate reproduction of the prepared teeth. (**Figure 5**,

Figure 6). Master casts were poured in Die Stone. **(Figure 7)**

- i. Provisionalization: Temporary crowns made with bisacrylate material and polished to a smooth finish were luted to the prepared teeth using non-eugenol temporary cement.
- j. Crown fabrication: Shade selection was performed using a Vita shade guide – 3D Master. Layered zirconia crowns were fabricated by a CAD-CAM milling process.
- k. Bisque trial: Fit of the prosthesis, incisal contacts at centric and eccentric movements, and shade match were assessed at this stage.
- l. Cementation: The final crowns were cemented using dual cure resin cement following the manufacturer's instructions. **(Figure 8)**



Figure 1: Pre-operative photograph



Figure 2: Composite build-up with 11 and 21 prior to endodontic treatment



Figure 3: Anterior wax mock-up



Figure 4: Tooth preparation and gingival retraction



Figure 5: Maxillary final impression



Figure 6: Mandibular final impression



Figure 7: Master casts in occlusion



Figure 8: Post-operative intraoral photograph



Figure 9: Post-operative extraoral photograph.

2.6. Follow-up and outcome

1. Outcomes

- a. **Esthetics:** The patient's smile was significantly improved, with a more natural and esthetically pleasing appearance. The layered zirconia crowns provided excellent shade matching, translucency, and lifelike contours.
- b. **Function:** The restorations restored proper tooth function, allowing for normal chewing and speech along with establishing anterior and canine guidance.
- c. **Patient satisfaction:** The patient expressed high satisfaction with the treatment outcome and reported increased self-confidence.

2. Follow-up results

- a. **1-week follow-up:** The patient reported no post-operative sensitivity in lower teeth. The gingival tissues were healthy, with no signs of inflammation. The occlusion was stable.
- b. **6-month follow-up:** The crowns remained stable and functional. The patient maintained good oral hygiene.
- c. **1-year follow up:** The restorations continued to exhibit excellent esthetics and function. Marginal integrity was maintained, and there was no evidence of secondary caries. (Figure 9)

3. Discussion

This case report demonstrates the successful use of layered zirconia crowns for the rehabilitation of anterior teeth affected by linear enamel hypoplasia in a young patient. Enamel hypoplasia presents a significant challenge for dental professionals, particularly in the esthetic zone. The use of layered zirconia crowns in this case offered several advantages as mentioned in the treatment outcome.

1. **Esthetics:** Layered zirconia restorations provide excellent esthetics, mimicking the natural translucency and shade variation of teeth.
2. **Strength and Durability:** Zirconia is a strong and durable material, capable of withstanding the forces of mastication.

3. **Biocompatibility:** Zirconia is a biocompatible material, minimizing the risk of adverse tissue reactions.^{5,6}

Alternative treatment options for this patient could have included composite veneers or porcelain veneers. However, in this case, the severity of the enamel hypoplasia, with significant enamel loss, made full-coverage crowns a more predictable and durable solution.

Of equal importance is the selection of a suitable bonding protocol to ensure longevity of the restorations. In this case, a dual cure resin cement, as recommended has been used. Resin cements have several advantages over other cements, such as a lower solubility and higher optical properties.^{7,8}

The long-term prognosis for layered zirconia crowns in patients with enamel hypoplasia is generally good, provided that proper case selection, tooth preparation, crown fabrication and cementation techniques are followed. Regular follow-up and maintenance are essential to monitor the restorations and ensure long-term success.

4. Limitations

This case report describes the treatment of a single patient. Further studies with larger sample sizes are needed to evaluate the long-term outcomes of layered zirconia crowns in patients with enamel hypoplasia.

5. Conclusion

Layered zirconia crowns are a viable treatment option for the esthetic and functional rehabilitation of anterior teeth affected by enamel hypoplasia in young patients. This treatment modality provides a durable, esthetic, and biocompatible solution, improving patients' quality of life and self-esteem.

6. Patient Perspective

The patient reported being extremely satisfied with the outcome of the treatment. He expressed increased confidence in his smile and reported that the restorations felt natural and comfortable.

7. Informed Consent

Informed consent was obtained from the patient for the publication of this case report, including the use of clinical photographs and other relevant information.

8. Conflict of Interest

None.

9. Source of Funding

None.

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