

Enamel Microabrasion for the Minimally Invasive Management of Generalized Enamel Hypoplasia in an Adolescent: A Case Report

Anusha Dixit¹, Anuradha Agrawal², Ashish Saxena³

¹MDS 3rd year, Department of Pediatric and Preventive Dentistry, Government College of Dentistry, Indore, Madhya Pradesh, India

²Associate professor, Department of Pediatric and Preventive Dentistry, Government College of Dentistry, Indore, Madhya Pradesh, India

³Professor and Head, Department of Pediatric and Preventive Dentistry, Government College of Dentistry, Indore, Madhya Pradesh, India

Corresponding author: Anusha Dixit, Department of Pediatric and Preventive Dentistry, Government college of Dentistry, Indore, Madhya Pradesh, India.

Abstract

Aim and background: Generalized enamel hypoplasia is a developmental, quantitative enamel defect that compromises esthetics and, when superficial, can be managed conservatively without sacrificing sound tooth structure. Enamel microabrasion removes superficial enamel discoloration and defects through simultaneous erosion and abrasion, conserving enamel. This report describes the use of enamel microabrasion with a 6.6% hydrochloric acid slurry for generalized enamel hypoplasia in a 13-year-old girl, together with the concurrent management of a traumatized immature non-vital mandibular incisor.

Case description: A 13-year-old girl presented with generalized hypoplastic enamel affecting the permanent dentition, along with fractured, non-vital mandibular central incisors (teeth 31 and 41) with an open apex following a fall 3 months earlier, and maxillary anterior spacing. The hypoplastic enamel was treated by enamel microabrasion using a 6.6% hydrochloric acid slurry under rubber-dam isolation with a gingival barrier, performed over four applications with neutralization, polishing, and topical fluoride. The defects and opacities improved progressively while conserving sound enamel. Concurrently, the immature incisors were managed by mineral trioxide aggregate (MTA) apexification, obturation, post-and-core, and acrylic jacket crowns, and the maxillary spacing was closed with fixed orthodontics.

Conclusion: Enamel microabrasion with a 6.6% hydrochloric acid slurry provided a simple, conservative, and effective improvement of generalized superficial enamel hypoplasia while preserving sound enamel, and was successfully integrated with the concurrent endodontic, restorative, and orthodontic management of the patient.

Clinical significance: Enamel microabrasion is a minimally invasive first-line option for superficial enamel hypoplasia in children and adolescents. It conserves tooth structure, avoids or defers restorative intervention, and can be readily combined with other treatment when a young patient presents with multiple concurrent needs.

Keywords: Enamel hypoplasia, Enamel microabrasion.

Date of Submission: 25-09-2026

Date of Acceptance: 03-10-2026

I. INTRODUCTION

Developmental defects of enamel are commonly encountered in the pediatric and adolescent dentition. Enamel hypoplasia is a quantitative defect resulting from disturbed enamel matrix formation, producing reduced enamel thickness that may present clinically as pits, grooves, or generalized thinning, often with associated discoloration and esthetic concern in young patients.¹

Enamel microabrasion is a minimally invasive technique that removes superficial enamel discoloration and defects through the simultaneous erosion and abrasion (“abrosion”) of a very thin surface layer using an acid–abrasive slurry, while conserving the underlying sound enamel.² Introduced by Croll and Cavanaugh as a controlled hydrochloric acid–pumice technique, it has become a well-established conservative option for superficial enamel defects. Its indications include mild-to-moderate fluorosis, post-orthodontic white-spot lesions, localized or idiopathic enamel hypoplasia, post-traumatic enamel opacities, and superficial stains.³

Traumatic dental injuries are also common in this age group, and when trauma affects an incompletely formed permanent incisor, root development may cease, leaving an immature tooth with a wide, open apex and thin dentinal walls that complicate conventional endodontic treatment. In non-vital immature teeth, apexification

aims to create an apical barrier before obturation, with mineral trioxide aggregate (MTA) being a commonly used material for this purpose.⁴

This article presents a case of a 13-year-old girl with generalized enamel hypoplasia managed conservatively by enamel microabrasion, in whom a coexisting traumatized immature non-vital mandibular incisor and maxillary anterior spacing were treated concurrently, illustrating how microabrasion can be integrated within the comprehensive care of the adolescent patient.

II. CASE PRESENTATION

A 13-year-old girl reported to the Department of Pediatric and Preventive Dentistry. Her presenting concern was pain in the lower front teeth region of 5 days' duration, related to a fall sustained 3 months earlier while climbing stairs, which had caused direct impact of the lower front teeth with transient pain and bleeding that subsided spontaneously. On presentation, in addition to the traumatized incisors, clinical examination drew attention to a generalized enamel defect affecting the permanent dentition. The medical and family histories were non-contributory.

On extraoral examination the face was symmetrical, and soft-tissue examination revealed no abnormality, with healthy gingiva. Hard-tissue examination showed a patient in the permanent dentition (dental age 12–13 years) whose enamel exhibited generalized hypoplastic, quantitatively reduced enamel with mild extrinsic staining and associated opacities, most evident on the anterior teeth (Figure 1). Teeth 31 and 41 were fractured, with the fracture involving enamel, dentin, and pulp, and both tested non-vital on pulp vitality testing. Mild occlusal caries was present in relation to teeth 37 and 47, and there was a high papillary labial frenum with generalized interdental maxillary anterior spacing. An intraoral periapical radiograph of teeth 31 and 41 revealed a fracture involving enamel, dentin, and pulp, with an open apex and periapical changes, confirming a non-vital immature tooth.

On the basis of the generalized, quantitative (reduced-thickness) appearance of the defect, a diagnosis of generalized enamel hypoplasia was made. Hypoplastic amelogenesis imperfecta, molar–incisor hypomineralization, dental fluorosis, chronological enamel hypoplasia, and localized Turner's hypoplasia were considered in the differential diagnosis. The traumatized incisors were diagnosed as Ellis Class IV fractures in relation to teeth 31 and 41 with open apices.

Following pain relief and preventive care (oral hygiene instructions, dietary counseling, and topical fluoride varnish), the generalized enamel hypoplasia was managed by enamel microabrasion. The teeth were isolated with a rubber dam (Optradam) and a gingival barrier was applied to protect the soft tissues; a 6.6% hydrochloric acid slurry was applied to the hypoplastic enamel surfaces (Figure 2A) and gently abraded using a rubber cup in a slow-speed handpiece (Figure 2B). The slurry was rinsed, the acid was neutralized with a sodium-bicarbonate paste, and the surfaces were then polished and treated with topical fluoride. The procedure was repeated over four applications, producing a visible, progressive reduction in the hypoplastic opacities and surface irregularities while sound enamel was conserved (Figures 3A to D).

The coexisting problems were addressed concurrently. Root canal treatment was completed in tooth 31; as tooth 41 had an open apex, an MTA apical plug (apexification) was placed, followed by obturation, and a post and core were placed for coronal rehabilitation, each stage being confirmed radiographically. Acrylic jacket crowns were placed on teeth 31 and 41 after endodontic and post-and-core rehabilitation (Figure 3D), and glass-ionomer cement restorations were placed in relation to teeth 37 and 47. A labial frenectomy was planned for the high papillary frenum, and fixed orthodontic treatment was undertaken to close the maxillary anterior interdental spacing.

The hypoplastic enamel defects improved progressively over the four microabrasion applications, with conservation of sound tooth structure and no need for additive restoration of the treated surfaces. The traumatized incisors were restored with acrylic jacket crowns, the maxillary anterior spacing was closed orthodontically, and the patient remained asymptomatic with a satisfactory functional and esthetic result. This case is reported after the patient's parents provided informed consent.



Figure 1. Preoperative intraoral frontal view showing generalized hypoplastic enamel with opacities on the anterior teeth, the fractured mandibular central incisors (teeth 31 and 41), and maxillary anterior interdental spacing.

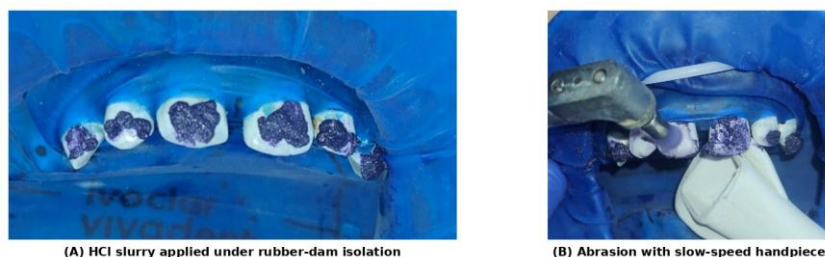


Figure 2. Enamel-microabrasion technique. (A) 6.6% hydrochloric acid slurry applied to the hypoplastic enamel under rubber-dam isolation with a gingival barrier; (B) abrasion of the enamel surface with a rubber cup in a slow-speed handpiece.

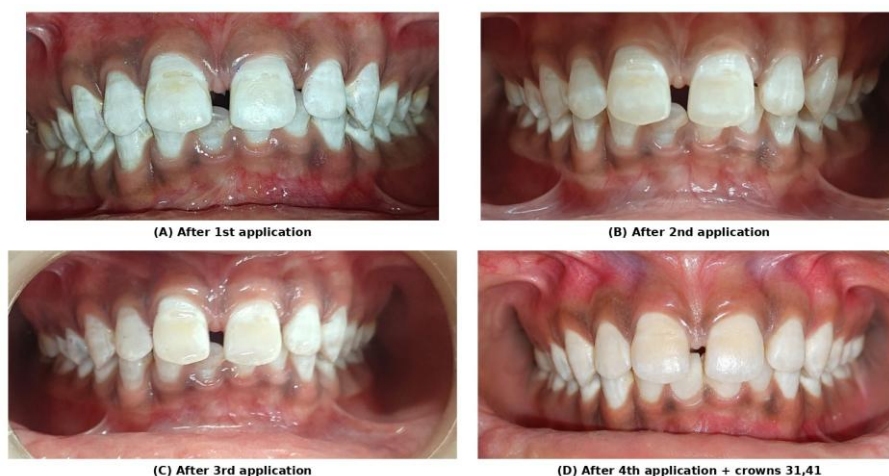


Figure 3. Progressive improvement of the generalized hypoplastic enamel over successive enamel-microabrasion applications with a 6.6% hydrochloric acid slurry. (A) After the first application; (B) after the second; (C) after the third; (D) after the fourth application, with acrylic jacket crowns placed on teeth 31 and 41.

III. DISCUSSION

Generalized enamel hypoplasia is a quantitative developmental defect characterized by reduced enamel thickness. Diagnosis depends primarily on the distribution, symmetry, surface morphology, and severity of the defect, together with exclusion of developmental enamel conditions with overlapping clinical appearances.¹ In the present case, the enamel defect was generalized across the permanent dentition and was predominantly quantitative, with reduced thickness, surface irregularity, mild staining, and associated opacities. The absence of a characteristic distribution for other developmental enamel defects supported generalized enamel hypoplasia as the most appropriate diagnosis.

Differential diagnosis. Amelogenesis imperfecta (AI) is a group of inherited enamel disorders that may be generalized and symmetrical, and hypoplastic forms may present with enamel of reduced thickness. A positive family history can support the diagnosis, although its absence does not exclude AI. In the present patient, however, there was no reported hereditary pattern, and the clinical history did not suggest a generalized inherited disorder affecting enamel formation throughout the dentition. The localized clinical presentation and absence of other characteristic features of AI made hypoplastic AI less likely.⁵ Molar–incisor hypomineralization (MIH), in contrast, is primarily a qualitative enamel defect characterized by well-demarcated opacities affecting one or more first permanent molars, with or without involvement of the incisors. The enamel is generally of normal thickness but has reduced mineralization and may undergo posteruptive breakdown.⁶ The present case did not show the characteristic demarcated molar–incisor pattern; instead, the defect was generalized and associated with reduced enamel thickness, making MIH less likely.^{1,6} Dental fluorosis results from excessive fluoride exposure during enamel development and typically produces diffuse, symmetrical white opacities or, in more severe cases, chalky and porous enamel with posteruptive discoloration.⁷ In this patient, there was no documented history of excessive fluoride exposure and the clinical appearance was predominantly hypoplastic rather than the diffuse, symmetric fluorotic pattern. Chronological enamel hypoplasia (linear enamel hypoplasia) is characterized by multiple, symmetrical, linear or ring-like defects corresponding to a particular period of enamel formation and therefore has a recognizable chronological pattern.⁸ No such matching chronological bands were identified in the present case. Finally, Turner’s hypoplasia is typically localized to one or a small number of permanent teeth and represents a developmental disturbance of the permanent successor associated with trauma or infection of the primary

predecessor.⁹ The patient's enamel defect was generalized rather than localized, and the history of trauma to teeth 31 and 41 occurred only three months before presentation, after the enamel of the permanent dentition had already formed; therefore, this trauma could not account for the generalized enamel defect. Taken together, the distribution, quantitative nature, and clinical pattern of the defect favored generalized enamel hypoplasia over these differential diagnoses. A similar emphasis on defect distribution in diagnosis has been reported in cases of enamel hypoplasia and Turner's hypoplasia.^{9,10}

Enamel microabrasion was selected as the first-line, tooth-conserving treatment because the defects appeared superficial. The technique removes a thin superficial enamel layer by combined chemical erosion and mechanical abrasion and is therefore particularly appropriate when the defect is confined to the outer enamel.² The present outcome is consistent with the findings of Ashkenazi et al., who reported marked and stable improvement after hydrochloric acid–pumice microabrasion in children with generalized enamel discoloration.³ Similar esthetic improvement has also been reported for fluorotic enamel treated with microabrasion. In the present case, four applications of a 6.6% hydrochloric acid slurry produced progressive improvement in the opacities and surface irregularities while preserving sound enamel and avoiding additive restoration of the treated surfaces.

The predictability of microabrasion depends on appropriate case selection. When the defect is superficial, microabrasion alone may be sufficient; however, deeper or residual defects may require combination with other minimally invasive procedures such as bleaching, resin infiltration, or direct composite restoration. Pini et al. and Sabino-Silva et al. described combined approaches for hypoplastic or hypomineralized esthetic defects, whereas Reis et al. used direct composite restoration when the defect was too deep for surface treatment alone.^{10,11,12} In the present case, the superficial nature of the enamel defect permitted microabrasion alone to achieve a satisfactory esthetic result, highlighting the importance of assessing lesion depth before selecting a conservative or additive treatment approach.

Finally, the staged multidisciplinary sequence—preventive care, conservative esthetic treatment, endodontic and restorative rehabilitation, and orthodontic space closure—was appropriate for the multiple concurrent needs of the adolescent patient. A multidisciplinary, phase-wise approach has also been described in the rehabilitation of children with developmental enamel defects.¹³ Current traumatic dental injury guidance also emphasizes appropriate follow-up to assess healing and the long-term status of injured immature teeth.¹⁴ Accordingly, continued recall is important in this patient to monitor the stability of the microabrasion result, periapical healing, root integrity, and the long-term function and esthetics of the treated incisors.

IV. CONCLUSION

Enamel microabrasion with a 6.6% hydrochloric acid slurry offered a simple, conservative, and effective means of improving generalized superficial enamel hypoplasia in an adolescent while preserving sound enamel. Performed over four applications with appropriate isolation and soft-tissue protection, it achieved a satisfactory esthetic result without restorative intervention on the treated surfaces, and was readily integrated with the concurrent endodontic, restorative, and orthodontic management of the patient. With correct case selection and long-term follow-up, microabrasion is a valuable minimally invasive option in pediatric and adolescent dentistry, and the case is presented for clinicians' consideration.

References

- [1]. Seow WK. Developmental defects of enamel and dentine: challenges for basic science research and clinical management. *Aust Dent J*. 2014;59(Suppl 1):143–154.
- [2]. Croll TP, Cavanaugh RR. Enamel color modification by controlled hydrochloric acid–pumice abrasion. *Quintessence Int*. 1986;17(2):81–87.
- [3]. Ashkenazi M, Sarnat H. Microabrasion of teeth with discoloration resembling hypomineralization of enamel: 4-year follow-up. *J Clin Pediatr Dent*. 2000;25(1):29–34.
- [4]. Witherspoon DE, Ham K. One-visit apexification: technique for inducing root-end barrier formation in apical closures. *Pract Proced Aesthet Dent*. 2001;13(6):455–460.
- [5]. Sabandal MMI, Schäfer E. Amelogenesis imperfecta: review of diagnostic findings and treatment concepts. *Odontology*. 2016;104(3):245–256.
- [6]. Dulla JA, Meyer-Lueckel H. Molar-incisor hypomineralisation: narrative review on etiology, epidemiology, diagnostics and treatment decision. *Swiss Dent J*. 2021;131(11):886–895.
- [7]. Fejerskov O, Manji F, Baelum V. The nature and mechanisms of dental fluorosis in man. *J Dent Res*. 1990;69 Spec No:692–700.
- [8]. Jayam C, Bandlapalli A, Patel N, Choudhary RSK. Chronological hypoplasia: aesthetic management. *BMJ Case Rep*. 2014;2014:bcr2013202892
- [9]. Solanki D, Fulzele P, Thosar N, Shirbhate U. Management of Turner's hypoplasia using resin infiltration: a case report. *Cureus*. 2023;15(11):e48870.
- [10]. Reis PPG, Vieira-Junior WF, et al. Esthetic reconstruction of teeth with enamel hypoplasia. *Oper Dent*. 2020;45(6):617–623.
- [11]. Pini NIP, Sundfeld-Neto D, Aguiar FHB, et al. Dental bleaching, microabrasion, and resin infiltration: case report of minimally invasive treatment of enamel hypoplasia. *Int J Prosthodont*. 2020;33(1):105–110.
- [12]. Sabino-Silva R, Wong HM, et al. In-office bleaching, microabrasion, and resin infiltration for the correction of hypomineralized esthetic defects: a case report. *F1000Res*. 2019;8:989.

- [13]. Bonilla-Represa V, Abalos-Labruzzo C, et al. Noninvasive and multidisciplinary approach to the functional and esthetic rehabilitation of amelogenesis imperfecta: a pediatric case report. Case Rep Dent. 2014;2014:764860.
- [14]. Bourguignon C, Cohenca N, Lauridsen E, et al. International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: 1. Fractures and luxations. Dent Traumatol. 2020;36(4):314–330.