Case Report

A novel clinical approach for long-term retention and durability of resin restorations bonded to multiple developmental defects of enamel

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Abstract

Dental enamel is a unique, highly mineralized tissue of ectodermal origin. It is characterized by lack of metabolic activity once formed, implying that disturbances during development can manifest as permanent defects in the erupted tooth. Although the etiology of enamel defects may be attributed to local, systemic, genetic, or environmental factors, most are likely to be multifactorial in nature. The time frame of exposure and the mechanism underpinning the causative factors determine the presentation of these defects. These developmental defects of enamel (DDE) may range from slight abnormalities of the tooth's color to a complete absence of the enamel, some of which may be sensed by an individual as being disfiguring and call for treatment to improve the appearance of the dentition. Molar incisor hypomineralization (MIH) is a relatively common condition that varies in clinical severity, remains localized to permanent incisors and first permanent molars, and whose prevalence varies between 2.8 and 25% depending upon the study. Adhesion and retention of resin restorations is challenging in long-term rehabilitation in these cases. This paper presents a novel approach in the functional and esthetic rehabilitation of a 13-year-old female child diagnosed with multiple DDEs.

Key words: *Casein phosphopeptide–amorphous calcium phosphate, developmental defects of enamel, linear enamel hypoplasia, molar incisor hypomineralization*

INTRODUCTION

Developmental defects of enamel (DDE) consist mainly of hypoplasia and diffuse and demarcated opacities.[1] The prevalence of DDE in the permanent dentition in developed countries has been reported to be in the range of 9–68%, with no gender predilection.[2] In India, Mittal *et al*. reported a prevalence of 6.31% in school children of the northern region, Yannam *et al*. reported a prevalence of 9.37% in the southern part of the country, Bhaskar and Hegde reported a prevalence of 9.46% in children of Udaipur, Mittal *et al*. reported a frequency of 7.11% in the children of Nagpur, Mittal and Bharat reported a prevalence of 10.48% in school children residing in Ghaziabad, and Anjum and Sudhan reported

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a prevalence of 14.9% in children from Jammu.[3-8] The secretory phase of the ameloblast is most susceptible to the external environmental factors resulting in a variety of defects. Thus, DDE once formed have a limited ability for alteration. Hence, enamel serves as a kymograph with a high degree of accuracy to predict the events that occurred during the life cycle of ameloblast.[9] Although the etiology of enamel defects may be attributed to local, systemic, genetic, or environmental factors, most are likely to be multifactorial in nature.[10] Molar incisor hypomineralization (MIH) is a result of synergistic action of environmental factors and genetic expression causing disturbance of enamel.[11] When a severe defect is found in a tooth, it is likely that the contralateral tooth is also affected. Frequently, a combination of enamel defects may be recognized in the same child (hypoplasia, diffuse, and demarcated opacities). The lesions in the permanent first molars are often seen together with those in the maxillary and, more rarely, in the mandibular incisors.[10] When more molars are affected, the relative risk of opacities in the incisors to show opacities is increased.[10] Weerheijm *et al*. defined the term MIH to describe a more specific pattern of DDE as hypomineralization of systemic origin of 1 to 4 permanent first molars frequently associated with affected incisors.[12] Opacities are usually seen on the facial surfaces of incisors and the cuspal third of the affected teeth. The enamel surface is often smooth and hypermineralized following posteruptive maturation; the subsurface enamel is soft and porous.[13]

Hypoplasia is defined as a quantitative defect of enamel visually and is histomorphologically identified as an external defect involving the surface of the enamel and associated with reduced thickness of enamel.[14] Linear enamel hypoplasia is a specific type of environmental hypoplasia characterized by multiple, symmetrical, and ring-like defects involving all the surfaces of the teeth, linking many teeth.[15] Early diagnosis of the type of DDE (e.g., MIH/fluorosis/AI/DI) is important for appropriate treatment planning and to prevent future complications. A correct diagnosis may improve clinician's care in several aspects, such as

- Assessing the patient's caries risk and
- Evaluating the quality of the adhesion that affects the retention and durability of restorations and orthodontic brackets.

Consequences of DDE depend on the severity of the disease, interaction of etiological agents, and age at presentation of the patient to the dental clinic.[1]

Hypothesis tested

Casein phosphopeptide–amorphous calcium phosphate (CPP–ACP) is known to significantly reduce the sensitivity of the exposed teeth. This article attempts to prove the fact that utilization of 10% carbamide peroxide gel and CPP–ACP mousse may significantly reduce the esthetic defect caused by MIH opacities and increases the retention and durability of resin restorations bonded to the epigenetic developmental defects of enamel.

CASE REPORT

A 13-year-old girl reported to our outpatient department with the chief complaint of discolored upper and lower front teeth. She and her parents revealed that the teeth were discolored right from their eruption into the oral cavity. Her prenatal, natal, and postnatal histories were noncontributory, and she had not visited a dentist before. None of the family members were suffering from this type of problem, and she was the only child in the family. She hailed from a poor socioeconomic background. Her past medical history revealed that she had recurrent episodes of fever and hospitalization in the first year of life, for which she was under antibiotic medication. No abnormalities were detected upon extraoral examination. Intraoral examination revealed dentition corresponding to chronological age.

One of the interesting finding was that DDE were seen on multiple teeth. The distribution of hypoplasia showed a characteristic presentation which was symmetrical, chronological, and presented as a ring-like defect around the tooth (buccal, lingual. mesia, distal) seen in the incisal 1/3rd of 11, 21, 31, 32, 42, cusp tips of 33, 43 [Figure 1]. Demarcated opacities of yellow-to-brown discoloration along with hypoplasia was seen on the occlusal surfaces of 16, 26, 36, 46 [Figure 2]. Presence of localized ring-like hypoplastic defects and hypomineralized enamel of

Figure 1: Frontal view of anterior teeth

permanent anteriors, first permanent molars, and lower cuspids, as well as natal history confirmed the diagnosis of MIH with linear enamel hypoplasia. Dental fluorosis and amelogenesis imperfecta (AI) were taken into consideration for differential diagnosis. Teeth affected by MIH had well demarcated borders of hypomineralized enamel, in contrast to the opacities of fluorosis which were diffuse. In comparison with the caries-prone MIH affected enamel, fluorosed enamel is caries resistant. Furthermore, the difference between MIH and AI is one of definition. In AI, all teeth are affected and may be detected pre-eruptively on radiograph with a positive family history. In general, affected first permanent molars with MIH are asymmetrical.[10]

The clinical situation demanded the restoration of the form and function of the effected teeth. Since the patient was young, it was decided to restore the anterior teeth with composite raters rather than a veneer, followed by the placement of semi-permanent crowns in case of posterior teeth. Oral prophylaxis was done followed by pumice polishing. Pulp vitality test was performed for the affected teeth, which revealed that all the teeth were vital. The initial shade of tooth was noted with the aid of a VITA shade guide (VITAPAN Classical). Written informed consent was obtained from the patient and her parents. Carbamide peroxide and CPP–ACP individualized protocol was used.

Fabrication of custom trays

Alginate impressions of both the upper and lower arches were realized and working models were obtained with dental stone. Reservoirs produced by placement of spacer material of 2-mm thickness on the buccal and occlusal aspect of hypomineralized teeth, custom made trays were obtained using low density polyethylene plates of 2-mm thickness in a vacuum plasticizer. The reservoir helps patients with bulbous teeth and improves the flow of the material when its viscous.

The trays were customized by using vacuum former and trial was performed to check the fit of the trays. The patient was given a demonstration using the bleaching material (Opalescence 10% Whitening gel, Ultradent Products) [Figure 3a]. Instructions such as brushing and flossing the teeth daily before the procedure was explained to the patient. Prior to bleaching, shade was noticed using VITA shade guide (VITAPAN Classical). The patient was instructed to apply the bleaching agent for 4 hours a day, and she was asked to report to the department if there was any postoperative sensitivity. This first step was carried out for 2 weeks in order to obtain an obtrusive esthetic change of the enamel opacities. Post-bleaching the shade was again noted.

The next phase included tooth remineralization using remineralizing agent (CPP–ACP) (GC Tooth Mousse, GC Corporation) inside the trays for 2 hours/day [Figure 3b]. CPP stabilizes high concentration of calcium and phosphate that bind themselves to the pellicle and plaque.[16] CPP–ACP is a known remineralizing agent, and hence also results in esthetic improvement. This step lasted for 2 weeks in order to obtain a noticeable remineralization of the enamel opacities. Post-remineralization tooth shade was again noted. Shade selection of the composite was done. A bevel on the buccal surface was made with a tapered bur No. 2200 (KG Sorensen, Brazil). The anterior tooth surfaces were acid etched using 35% phosphoric acid for 30 s [Figure 4a], rinsed for 30 s, followed by placement of a two-component adhesive system (AdheSE, Ivoclar Vivadent AG, Schaan, Liechtenstein) [Figure 4b], and the tooth was light-cured for 10 s with an intensity of 1400 mW/cm^2 (Radii LED Curing Light, SDI, Australia) [Figure 4c]. A highly aesthetic nanohybrid composite resin, IPS-Empress (Ivoclar Vivadent AG), was used to fill the tooth using a combination of incremental and stratified layering technique. The occlusal adjustment was performed with fine and extrafine flame-shaped diamond burs, 3168 F and 3168 FF (KG Sorensen, Brazil). Finishing and polishing of

Figure 2: Occlusal view of maxillary and mandibular teeth

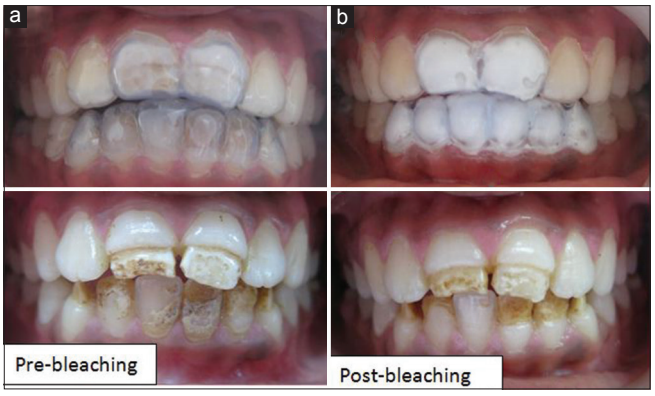

Figure 3: (a) Custom trays with 10% carbamide peroxide; (b) custom trays with CPP–ACP

the restoration were performed for dental contouring regularization; for smoothing, resin sanding discs Sof-Lex Pop-On (3M ESPE, USA) were employed followed by multilaminate burs on the buccal surface. For surface smoothness, abrasive silicone-based rubbers were used [Figure 4d]. Minimal crown preparation in accordance with the standard crown cutting norms for stainless steel crowns (SSC) was done on all permanent first molars. Number 5 size SSC (3M ESPE) of 16, 26, 36, 46 was found to be adaptive. Contouring was done with Johnsons contouring pliers (API Germany). Margins of the SSC were crimped to increase the retention with no. 800–417 crimping pliers (API Germany). The final fit of SSC was found to be very satisfactory. The SSC were cemented with luting glass ionomer cement (Fuji I) [Figure 5]. Periodic follow-up was done for every 6 months, and the restorations were intact even after 2 years.

DISCUSSION

For accurate diagnosis, examination for MIH should be undertaken on clean wet teeth at an age of 8 years, as at this age all permanent first molars and most of the incisors are erupted. Judgements related to individual teeth should be recorded for the absence or presence of demarcated opacities, posteruptive enamel breakdown, atypical restorations, extraction of molars due to MIH, and failure of eruption of a molar or an incisor.[10] Aesthetics and function are the main clinical problems associated with MIH. Treatment of teeth affected by MIH is quite challenging, ranging from restoration to extraction.[17] There is no consensus on the exact treatment protocol in MIH affected cases. A variety of conservative treatment approaches such as vital tooth bleaching using various concentrations of hydrogen peroxides have been proposed to address the esthetic concerns of discolored teeth.[18] Removal of the yellow-brown stain typically causes the previously stained enamel to take on the optical character of the adjacent enamel. Usually, these hypomineralized and stained lesions will have a white-mottled appearance after bleaching that is much more esthetically acceptable.[19] A novel approach was done in this case by bleaching followed by remineralization and placement of restoration. The use of CPP–ACP concomitantly with hydrogen peroxide had been shown to be effective and safe on teeth with opacities allowing to preserve the integrity of the tooth.[16] Treatment of enamel that has a high organic content using bonding technologies can be problematic due to the organic material present within the enamel that prevents effective etching.[19] Daily application of CPP–ACP in oral care products is reported to promote remineralization. Surface hardening and reduced enamel demineralization and tooth sensitivity as well as esthetic improvement of opacities may occur.[1] The large size of the immature pulp chamber and pulp horns, and the immature gingival contour of the adolescent patient contraindicates the use of porcelain veneers. Composite resin offers a satisfactory alternative and should be used in child and adolescent patients.[20] The studies published in the field of adhesion of resin materials to hypomineralized enamel lack (1) calibrations of bonding and adhesive systems used and (2) vary in storage media, testing apparatus, specimen preparation, bonded surface area (fissures, ground cut, or uncut enamel surface), and the severity of enamel defects.[21] The permanent molars should be covered with SSCs as early as possible to conserve tooth integrity and vitality, diminish tooth sensitivity, establish correct interproximal, and occlusal relationships. SSCs improve oral hygiene and function because they are not as technique sensitive or high-priced as cast restorations, call for little time to insert, and preserve arch length and vertical dimensions. Glass ionomer cement (GIC) is recommended for cementing due to its: (1)

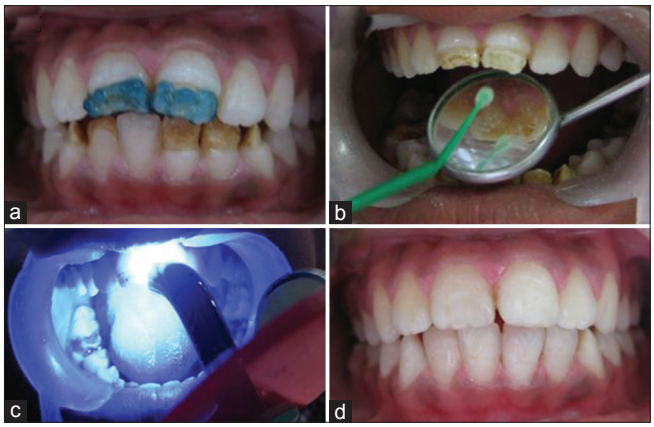

Figure 4: (a) Etching of teeth; (b) application of bonding agent; (c) curing of composite restoration; (d) composite restoration of anterior teeth

Figure 5: Stainless steel crowns placed on all permanent first molars

fluoride-releasing and fluoride-recharging properties at a later date and (2) improved adhesion characteristics. These properties may be an asset in cases of severe hypomineralization, enhancing the resistance to secondary caries and decreasing thermal sensitivity.[1]

CONCLUSION

Within the limitations of the present case report, we can conclude that bleaching and remineralization decreases the enamel opacities and increases the retention and durability of composite restorations bonded to the hypomineralized enamel. However, more long-term studies should be carried out to correlate the effect.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Sapir S, Shapira J. Clinical Solutions for Developmental Defects of Enamel and Dentin in Children. Pediatr Dent 2007;29:330-6.
2. Rugg-Gunn AJ, al-Mohammadi SM, Butler TJ. Effects of fluoride level in drinking water, nutritional status, and socio-economic status on the prevalence of developmental defects of dental enamel in permanent teeth in Saudi 14-year-old boys. Caries Res 1997;31:259-67.
3. Mittal NP, Goyal A, Gauba K, Kapur A. Molar incisor hypomineralisation: Prevalence and clinical presentation in school children of the northern region of India. Eur Arch Paediatr Dent 2014;15:11-8.
4. Yannam SD, Amarlal D, Rekha CV. Prevalence of molar incisor hypomineralization in school children aged 8-12 years in Chennai. J Indian Soc Pedod Prev Dent 2016;34:134-8.
5. Bhaskar SA, Hegde S. Molar-incisor hypomineralizaztion: Prevalence, severity and clinical characteristics in 8-13 year old children of Udaipur, India. J Indian Soc Pedod Prev Dent 2014;32;332-9.
6. Mittal R, Chandak S, Chandwani M, Singh P, Pimpale J. Assessment of association between molar incisor hypomineralization and hypomineralized second molar. J Int Soc Prev Community Dent 2016;634-9.
7. Mittal N, Bharat SB. Molar incisor hyopmineralization: Prevalence and defect characteristics in Indian school children. J Craniomaxillary Dis 2015;4:49-56.
8. Anjum R, Sudhan ZA. The prevalence of molar incisor hypomineralization (MIH) in a group of children coming to indira Gandhi govt. Dental college, Jammu. Int J Clin Cases Invest 2015;6:140-45.
9. Wong HM. Aetiological Factors for Developmental Defects of Enamel. Austin J Anat 2014;1:1003.
10. Weerheijm KL. Molar-incisor hypomineralization (MIH). Eur J Pediatr Dent 2003;4:114-20.
11. Krishnan R, Ramesh M. Molar incisor hypomneraalization. A review of its current concepts and management. SRM J Res Dent Sci 2014;5:248-52.
12. Weerheijm KL, Jalevik B, Alaluusua S. Molar-incisor hypomineralization. Caries Res 2001;35:390-1.
13. Jälevik B, Odelius H, Dietz W, Norén J. Secondary ion mass spectrometry and X-ray microanalysis of hypomineralized enamel in human permanent first molars. Arch Oral Biol 2000;46:239-47.
14. Priya PRG, John JB. Indumathi Elango Turner's hypoplasia and non-vitality: A case report of sequelae in permanent tooth. Contemp Clin Dent 2010;1:251-4.
15. Skinner MF, Pruetz JD. Reconstruction of periodicity of repetitive linear enamel hypoplasia from perikymata counts on imbricational enamel among dry-adapted chimpanzees (Pan troglodytes verus) from Fongoli, Senegal. Am J Phys Anthropol 2012;149:468-82.
16. de Vasconcelos AA, Cunha AG, Borges BC, Vitoriano Jde O, Alves-Júnior C, Machado CT, *et al.* Enamel properties after tooth bleaching with hydrogen/carbamide peroxides in association with a CPP-ACP paste. Acta Odontol Scand 2012;70:337-43.
17. Lygidakis NA. Treatment modalities in children with teeth affected by molar-incisor enamel hypomineralisation (MIH): A systematic review. Eur Arch Paediatr Dent 2010;11:65-74.
18. Heymann HO, Swift EJ, Bayne SC, May KN, Wilder AD, Mann GB, *et al.* Clinical evaluation of two carbamide peroxide tooth-whtening agents. Compend Contin Educ Dent 1998;19:359-74.
19. Wright JT. The etch-bleach-seal technique for managing stained enamel defects in young permanent incisors. Pediatr Dent 2002;24:249-52.
20. Harley KE, Ibbetson RJ. Anterior Veneers for the Adolescent Patient. Part I. General indications and Composite Veneer. Dent Update 1991;18:55-6.
21. Whigham R, Salama F, Barenie J, Fairhurst C, Hanes C. Sealant bond strength on dysplastic molars. Pediatr Dent 1989;11:246-7.