Case Report

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Dentistry Section

Microinvasive Management of Enamel Hypomineralisation with Resin Infiltration Technique: A Case Report

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ABSTRACT

Enamel hypomineralisation exists as a developmental defect that produces white opacities which affect tooth appearance, mainly in front teeth. The current treatment methods for these lesions might be too invasive, while they succeed in hiding them to some extent. The microinvasive technique of resin infiltration enhances dental appearance by altering the optical properties of porous enamel. A 23-year-old female patient reported to the department with a complaint of white discolouration, affecting the front teeth. After clinical examination diagnosis was made as enamel hypomineralisation. The aesthetic issue and non cavitated status of the lesions led to the choice of resin infiltration (ICON®, DMG, Germany) as the treatment approach. The aesthetic results obtained after the treatment were maintained through the 12-month follow-up period with no evidence of relapse or reappearance of the pre-existing lesions. The patient experienced no postoperative tooth sensitivity and expressed complete contentment with the results. Resin infiltration represents an effective and conservative treatment option for the aesthetic management of enamel hypomineralisation. The selection of suitable cases along with protocol adherence will generate predicted outcomes that maintain most tooth structure and enable patients to reach their highest level of satisfaction.

Keywords: Developmental defects of enamel, Hypomineralised enamel, Microinvasive dentistry, Optical masking

CASE REPORT

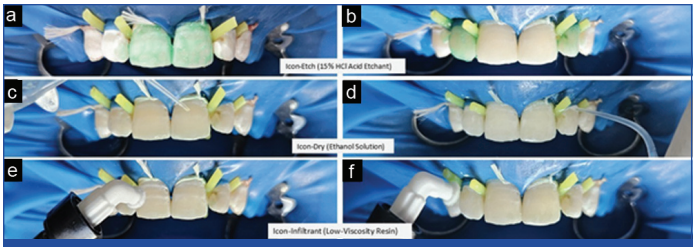
A 23-year-old female patient reported to the department with the primary concern of discoloured teeth characterised by white patches on multiple teeth involving both the maxillary and mandibular arches extending up to the first molars [Table/Fig-1]. The patient was from a region with high fluoride content in the drinking water. Personal history revealed long-term consumption of groundwater since childhood. Dietary habits were non contributory, with no history of systemic illness, childhood febrile episodes, or long-term medication use. Oral hygiene practices were satisfactory. An Orthopantomogram (OPG) was advised to assess the extent of involvement across both arches. The radiograph showed no dentinal, pulpal, or periapical abnormalities, confirming that the defects were confined to enamel [Table/Fig-2].

Although multiple teeth were affected, the aesthetic concern of the patient was primarily related to the maxillary anterior region, as these teeth were visible during smiling. Treatment of the remaining teeth was discussed but deferred based on patient preference. On clinical examination of the concerned maxillary anterior teeth, they exhibited well-demarcated white patches with soft, chalky enamel and normal tooth contour and morphology. Based on these clinical characteristics, a diagnosis of enamel hypomineralisation was established. The absence of altered tooth shape, pitting or surface irregularities helped differentiate the condition from enamel hypoplasia which typically presents with rough pitted enamel surface (contrasting to the soft chalky enamel seen with hypomineralised enamel) and altered crown morphology (contrasting to the normal tooth contour seen in hypomineralised enamel). Following diagnosis, various treatment options were evaluated. Considering the nature of the defect and the aesthetic concern of the patient, the lesion was managed using the resin infiltration technique.

[Table/Fig-1]: Preoperative intraoral photograph showing enamel hypomineralisation of maxillary anterior teeth (13-23).

[Table/Fig-2]: Orthopantomogram (OPG) showing normal dentition with no evidence of dentinal, pulpal, or periapical pathology, confirming that the observed defects were confined to the enamel.

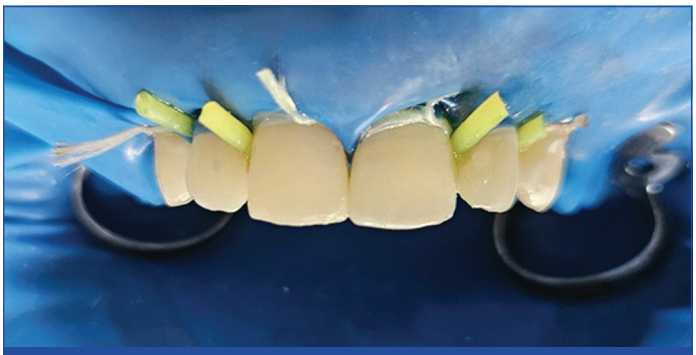
The manufacturer's instructions for the resin infiltration method (ICON®, DMG, Germany) were followed. For this, a rubber dam was used to isolate the maxillary anterior teeth from 13 to 23. The white spot patches were then treated with 15% hydrochloric acid (ICON®-Etch, DMG, Germany) for two minutes [Table/Fig-3a,b]. The tooth surface was rinsed with distilled water for 30 seconds and permitted to dry for an additional 30 seconds. Subsequently, 99% ethanol (ICON®-Dry, DMG, Germany) was administered for 30 seconds [Table/Fig-3c,d], followed by air drying. A Triethylene Glycol Dimethacrylate (TEGDMA) based resin infiltrant (ICON®-Infiltrant, DMG, Germany) was applied for 3 minutes and light-cured for 40 seconds [Table/Fig-3e,f]. Once more, infiltrating resin (ICON®-Infiltrant) was applied for one minute, followed by 40 seconds of photopolymerisation. Final finishing and polishing were performed using a finishing cup.



[Table/Fig-3]: Step-wise clinical procedure of resin infiltration in teeth 13-23: (a,b) Application of ICON® Etch (15% HCL) for surface etching and lesion access; (c,d) Application of ICON® Dry (ethanol) to desiccate & evaluate lesion masking effect; (e,f) Application of ICON® infiltrant (low viscosity resin) for lesion infiltration and aesthetic improvement.

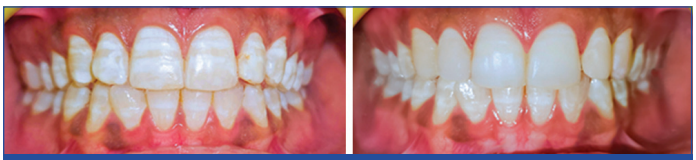
The immediate postoperative assessment showed the masking of white spot lesions on the maxillary anterior teeth (13-23) [Table/Fig-4].

The overall aesthetic outcome immediately after resin infiltration demonstrated harmonious colour integration of the maxillary anterior teeth with the surrounding enamel [Table/Fig-5]. A side-by-side comparison of preoperative and postoperative photographs further demonstrates the reduction in opacity and improved colour uniformity of the maxillary anterior teeth following resin infiltration [Table/Fig-6].



[Table/Fig-4]: Immediate postoperative image showing masking of white spot lesions.

[Table/Fig-5]: Immediate postoperative intraoral photograph showing improved colour uniformity and aesthetic integration of the maxillary anterior teeth (13-23) after resin infiltration.



[Table/Fig-6]: Comparative intraoral photographs showing the maxillary anterior teeth before (left) and immediately after (right) resin infiltration, demonstrating effective masking of white spot lesions and improved colour uniformity.

At the 12-month follow-up, the patient remained satisfied with the aesthetic outcome and reported no discomfort or sensitivity. Clinical examination demonstrated stable masking of the white spot lesions with sustained colour integration of the maxillary anterior teeth, confirming the durability of the resin infiltration outcome [Table/Fig-7].

[Table/Fig-7]: 12-month follow-up showing stable aesthetic outcome after resin infiltration of maxillary anterior teeth (13-23).

DISCUSSION

In clinical practice, dentists often see cases of Developmental Defects in Enamel (DDE), which can cause both functional and cosmetic problems, especially in the anterior teeth [1]. Thus, it is important to clearly differentiate between enamel hypoplasia and enamel hypomineralisation, as the treatment options depend on whether the enamel is intact. Enamel hypomineralisation is a qualitative defect, while enamel hypoplasia is a quantitative defect, both caused by defects during the formation of enamel. Enamel hypoplasia involves a loss of structural enamel due to insufficient production of the enamel matrix, while hypomineralisation refers to a problem with mineral content without any loss of enamel structure. Therefore, recognising the differences between these two conditions is vital [2].

In the present case, a history of long-term consumption of high-fluoride groundwater- a recognised etiological factor for enamel hypomineralisation- was elicited. Excess fluoride interferes with the maturation phase of amelogenesis, resulting in enamel of normal thickness but reduced mineral content and increased subsurface porosity [3,4]. Clinically, the presence of well-demarcated chalky opacities with preserved tooth contour supported a diagnosis of hypomineralisation rather than hypoplasia.

Resin infiltration (ICON®) is specifically indicated for non cavitated hypomineralised enamel with an intact surface and porous subsurface, typically presenting as white-cream or yellow-brown demarcated opacities. These lesions contain microporosities filled with water and air that permit penetration of a low viscosity resin after etching, allowing refractive index matching and optical masking of the defect [5,6]. Clinical studies and evidence-based reviews have shown that resin infiltration offers substantial and stable aesthetic improvement in hypomineralised, non cavitated enamel opacities, including lesions associated with Molar-Incisor Hypomineralisation (MIH), by reinforcing the compromised enamel and improving translucency [7-9]. Conversely, resin infiltration is contraindicated for defects exhibiting true enamel loss, surface pitting, cavitation, or exposed dentin which are characteristics commonly associated with enamel hypoplasia, since it fails to restore lost enamel structure and requires an intact enamel surface for optimal penetration [5,6,10].

Conventional management for enamel discolourations include microabrasion, bleaching, direct composite restorations, veneers and crowns. Microabrasion effectively removes superficial stains via acid and abrasion but fails for deeper defects, often needing adjuncts like bleaching, which can weaken enamel through porosity and demineralisation up to 132 µm. Research indicates demineralisation depths ranging from 63.71 µm to 132.06 µm post-bleaching, with honeycomb-like pores identified via scanning electron microscopy [11]. This process undermines enamel hardness and predisposes teeth to caries risk. Even though restorative methods can successfully mask defects, they are invasive, technique-sensitive, and need to be replaced on occasion, especially in younger patients [12]. Gugnani N et al., stated that resin infiltration significantly improved the aesthetics of non pitted fluorosis and white spot lesions, achieving

superior colour masking compared to microabrasion alone [8]. The goal of non invasive and microinvasive techniques like bleaching, microabrasion, and resin infiltration is to improve aesthetics while preserving enamel structure. Resin infiltration offers more effective masking of subsurface enamel opacities [7,13].

Alternative aesthetic treatment options such as bleaching, microabrasion, and restorative procedures were considered but not pursued. Bleaching was avoided due to its limited ability to mask well-demarcated hypomineralised opacities and the risk of accentuating colour contrast. Microabrasion was unsuitable as the defects extended beyond the superficial enamel layer, while veneers and crowns were deferred to preserve intact enamel in a young patient. Consequently, resin infiltration was chosen as a microinvasive, enamel-preserving approach tailored to the defect characteristics in the present case.

The aesthetic masking effect of resin infiltration is based on modification of the optical and structural properties of hypomineralised enamel. These lesions contain subsurface microporosities beneath a hypermineralised surface layer, which scatter light because of differences in Refractive Indices (RI) between enamel, water, and air, causing the lesion to appear opaque [14-16]. Sound enamel has an RI of approximately 1.62-1.65, whereas water has an RI of 1.33 and air an RI of 1.0 [14,15]. Etching with 15% hydrochloric acid removes the superficial hypermineralised layer, and ethanol dehydration eliminates water from the pores, enabling penetration of a low-viscosity TEGDMA-based resin infiltrant by capillary action [5,6]. After polymerisation, the resin replaces air and water within the enamel porosities and increases the RI of the lesion toward that of sound enamel, resulting in optical blending of the opacity with surrounding tooth structure and mechanical reinforcement of the weakened enamel [9,14-17]. Accordingly, the clinical effectiveness of resin infiltration in the present case was evaluated by comparing standardised pre- and postoperative photographs along with patient-reported satisfaction, as objective spectrophotometric analysis was not performed.

Even while resin infiltration delivers a noticeable and immediate improvement in appearance, surface staining or insufficient penetration into deeper porosities can eventually result in a slight colour relapse. Follow-up studies have reported that the aesthetic improvement achieved after resin infiltration is largely maintained over time and remains superior to that obtained with bleaching or remineralisation procedures [14,16]. Tirlet G et al., in 2013 confirmed infiltration's long-term stability versus microabrasion's relapse risks and veneers' replacement needs [17]. When relapse occurs, the lesion can be retreated straightforwardly, by repeating infiltration steps without additional enamel removal, and this approach has shown good patient acceptance [9,17]. In contrast to veneers and crowns, which require irreversible tooth preparation and higher long-term costs, resin infiltration represents a more economical and biologically conservative treatment option [12,13].

The two important reasons that led to a successful outcome in this case were making the correct diagnosis and appropriate case selection. This allowed for effective masking of subsurface enamel opacities while preserving the integrity of the enamel structure, resulting in favourable aesthetic outcomes and high patient satisfaction. The findings and results of the present case are consistent with the previous reports by Gugnani N et al., and Paris S et al., which demonstrated significant aesthetic improvement of non-pitted fluorosis and white-spot lesions following resin infiltration. The result of this instance further supports resin infiltration as a biologically conservative, clinically successful therapeutic option for hypomineralised enamel lesions that are not cavitated [8,18].

CONCLUSION(S)

The microinvasive method of resin infiltration is an excellent option for fixing aesthetic problems caused by enamel hypomineralisation, especially in teeth that have healthy and intact enamel but underlying subsurface defects. The results in the present case show that it is possible to improve a tooth's appearance without using more invasive restorative treatments. To make the results more reliable, future research should analyse and explore the longevity of clinical outcomes, the degree of colour stability under dietary challenges and staining resistance. Using tools to measure colour accurately can also help predict the outcomes better. Furthermore, investigations and studies comparing resin infiltration with other techniques and guidelines for diagnosis and application of resin infiltration would help in the evolving field of aesthetic dentistry.

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