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Minimally invasive resin infiltration with DMG Icon for white spot lesions: A case report

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Abstract

White spot lesions (WSLs) which are frequent occurrences in dental orthopaedics and pediatric dental patients, often result from demineralisation of enamel due to poor oral hygiene and excessive sugar consumption. Patients with early-stage dental caries usually present with WSLs, which occur as a result of the deionisation of the outer covering of the teeth. The management of these early-stage carious lesions can be challenging, as the traditional approach involves invasive restorative procedures. Over the years, many treatment methods have been proposed, but none of them have shown good clinical results. However, the application of the DMG Icon, a minimally invasive treatment, resulted in the reversal and arrest of the progression of WSLs. This case report presents an 18-year-old female patient with the chief complaint of visible white spots on the upper anterior teeth for two months. Based on the clinical examination and history, the patient was diagnosed with WSLs on bilateral labial surfaces of the maxillary incisors and canines. The treatment plan involved using DMG Icon resin infiltration to prevent the WSLs and improve the structure of the anterior teeth. This case report presents a successful application of the DMG Icon in the treatment of WSLs in a young patient with WSLs on the anterior teeth. The report highlights the potential of DMG Icon as an effective alternative to conventional restorative methods.

Keywords: Resin infiltration, white spot lesion, hypo-mineralisation, enamel demineralisation, dental caries

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INTRODUCTION

Dental caries develop as a result of the deionisation of the outer covering of the teeth, known as enamel. Patients with this condition initially present as white spot lesions (WSL) on the tooth's enamel surface. Inadequate oral care, fluorosis, medicines, molar incisor hypo-mineralisation (MIH), and traumatic hypo-mineralisation are a few of the causes of dental caries [1]. The structural composition of enamel provides optical properties to this layer of teeth. Any developmental defects or external factors that can cause changes in this chemical composition of enamel can lead to WSLs. These WSLs typically appear as changes in colour and opacity of enamel. The changes in enamel composition give the characteristic opaque and discoloured appearance of the WSL [2]. These changes in enamel occur due to reduced ameloblastic activity during tooth development, which results in increased porosity on the hard surface of the tooth. WSLs that occur as a consequence of MIH may vary from mild opacities to complete breakdown of enamel after the eruption of teeth. Treating this condition poses a great challenge to dentists and patients. The dentin in the undersurface of the tooth is exposed following the breakdown of enamel. Exposure of dentin to the external environment increases the sensitivity, and thus, children fail to take proper oral hygiene. This makes teeth more prone to the rapid progression of caries [3]. The adherence of the filling material is weakened by increased enamel porosity.

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This makes teeth more sensitive to temperature changes and more prone to pulpitis. People who experience such changes frequently experience insecurity and avoid smiling because they are ashamed of their stained teeth. These factors may contribute to mental disorders, social disengagement, and dental fear in children due to inadequate anaesthesia [4].

The treatment method depends on the extent of cavitation of the lesion. The restorative approach is beneficial in treating cavitated lesions, and the preventive approach is suitable for the treatment of cavitated lesions [5]. Some of the treatment options that help in reducing the white spot lesions include remineralisation, abrasion of enamel, erosive infiltration, composite resin restoration, and bonding [6]. The resin infiltration technique has emerged as a highly appealing therapeutic approach in recent years since it may be employed without causing tooth tissue loss or requiring anaesthesia. The etched enamel surface can easily be penetrated by low-viscosity resin. Light curing of the teeth is done after the infiltration. The similarity between the refractive indices of resin and enamel helps explain why this procedure frequently yields favourable results [7]. To ensure adequate retention of resin and formation of strong bonds, deproteinisation of lesions using sodium hypochlorite should be carried out before the infiltration of resin. To improve the aesthetical appearance of anterior teeth, a minimally invasive color-masking procedure can be opted for. Procedures that help to stop enamel demineralisation and/or enhance tooth aesthetics include topical administration of remineralising chemicals and microabrasion [8]. Traditionally, invasive restorative procedures like drilling and filling have been employed to treat these lesions. However, advancements in dental materials have introduced minimally invasive options like DMG Icon (Icon® EDMG2204031; DMG Chemisch-Pharmazeutische Fabrik GmbH, approved by the food and drugs authority of India), a resin infiltration system designed to halt the progression of early-stage carious lesions. This case report highlights the application of the DMG Icon in treating WSLs.

CASE

An 18-year-old female patient came to the Department of Endodontics with the chief complaint of visible white spots on the upper anterior teeth for two months. She was already given oral prophylaxis. WSLs were discovered during the intraoral evaluation. Clinical examination revealed multiple WSLs on the labial surfaces of bilateral maxillary incisors and canines. The patient had a history of irregular brushing

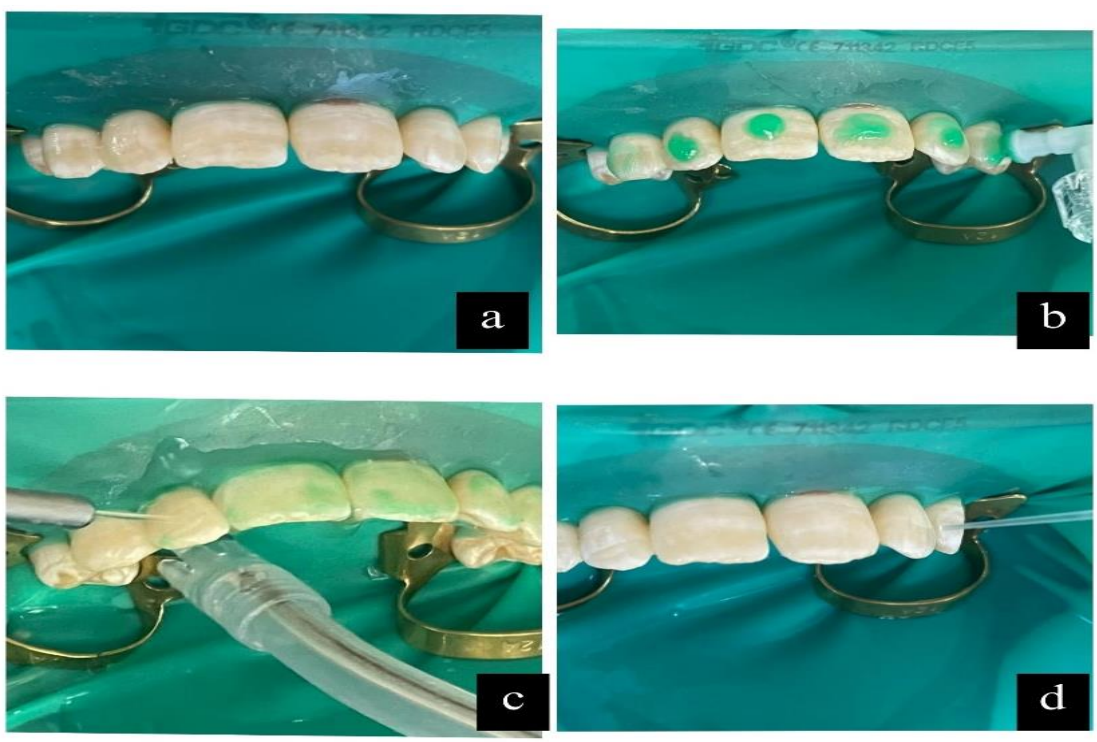

Figure 1. Isolation, cleaning, etching, acid rinsing, and drying.
a. Preparation and isolation of anterior teeth.
b. Etching of lesions using 15% HCL.
c. Rinsing of tooth surface with acid and drying with oil and water-free air.
d. Desiccation of teeth with Icon-dry.

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and high consumption of sugary snacks and beverages. The rest of her oral health was satisfactory, with no signs of cavities or gingival inflammation. Based on the clinical examination and history, the patient was diagnosed with WSLs on bilateral labial surfaces of the maxillary incisors and canines. The lesions seemed to be early-stage carious lesions, showing areas of enamel demineralisation. After being informed of all the treatment choices, the patient opted for the most conservative option, which was the resin infiltration procedure.

Treatment plan and procedure

The treatment plan aimed to halt the progression of the WSLs and improve the aesthetic appearance of the affected teeth. The treatment plan involved using DMG Icon resin infiltration to prevent the WSLs and improve the structure of the anterior teeth. Informed consent was obtained from the patient and her parents before the treatment. Firstly, the anterior teeth were isolated, rinsed, and cleaned, as given in Figure 1a. Cleaning the teeth using pumice and water slurry helps remove plaque and stains from the surface. The teeth were then isolated with cotton rolls to ensure a dry field. A 15% hydrochloric acid etchant gel was applied to the white spot lesions for two minutes, as shown in Figure 1b. This step created microporosities in the demineralised enamel, allowing better penetration of the resin infiltrant. The etched teeth were then rinsed for thirty seconds. This helped to remove acid from the surface. The teeth were gently dried using oil-free air to ensure the etched surfaces were moisture-free, as shown in Figure 1c. The lesions were desiccated with Icon-dry (99% ethanol) for 30 seconds. The white spots on the teeth were still visible, and thus, the etching and drying steps were repeated. On the third Visual inspection, good masking of white lesions was achieved. The DMG Icon resin infiltrant was applied to the demineralised areas using a micro brush, as shown in Figure 2a. The infiltrant penetrated the porous enamel and improved the refractive index of the enamel, reducing the visibility of the white spots. Then, interdental flossing was done, as shown in Figure 2b. After application, the resin infiltrant was light-cured for 40 seconds per tooth to polymerise the material, as shown in Figure 2c. An aesthetically convincing result was seen after infiltration treatment with Icon, as shown in Figure 2d. The treated

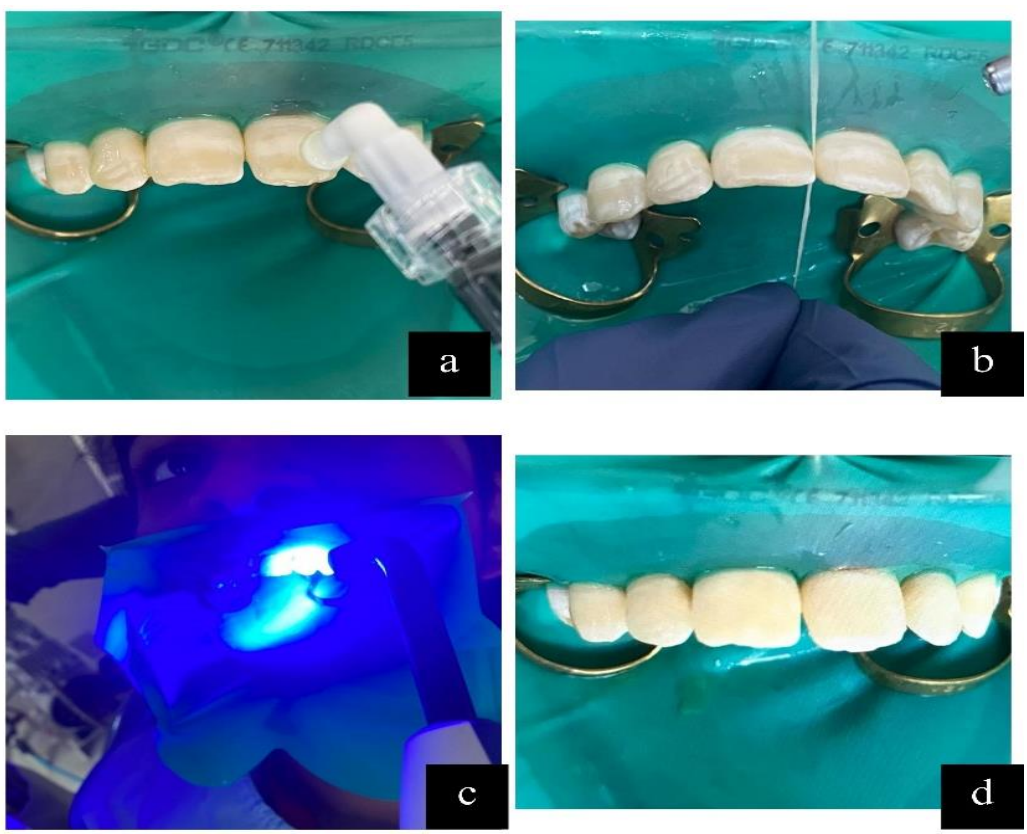

Figure 2. ICON resin application, interdental flossing, light curing, and final result.
a. ICON resin was applied for 3 minutes.
b. Interdental flossing after the application of resin.
c. Light curing of each tooth for 40 seconds.
d. Final result after infiltration.

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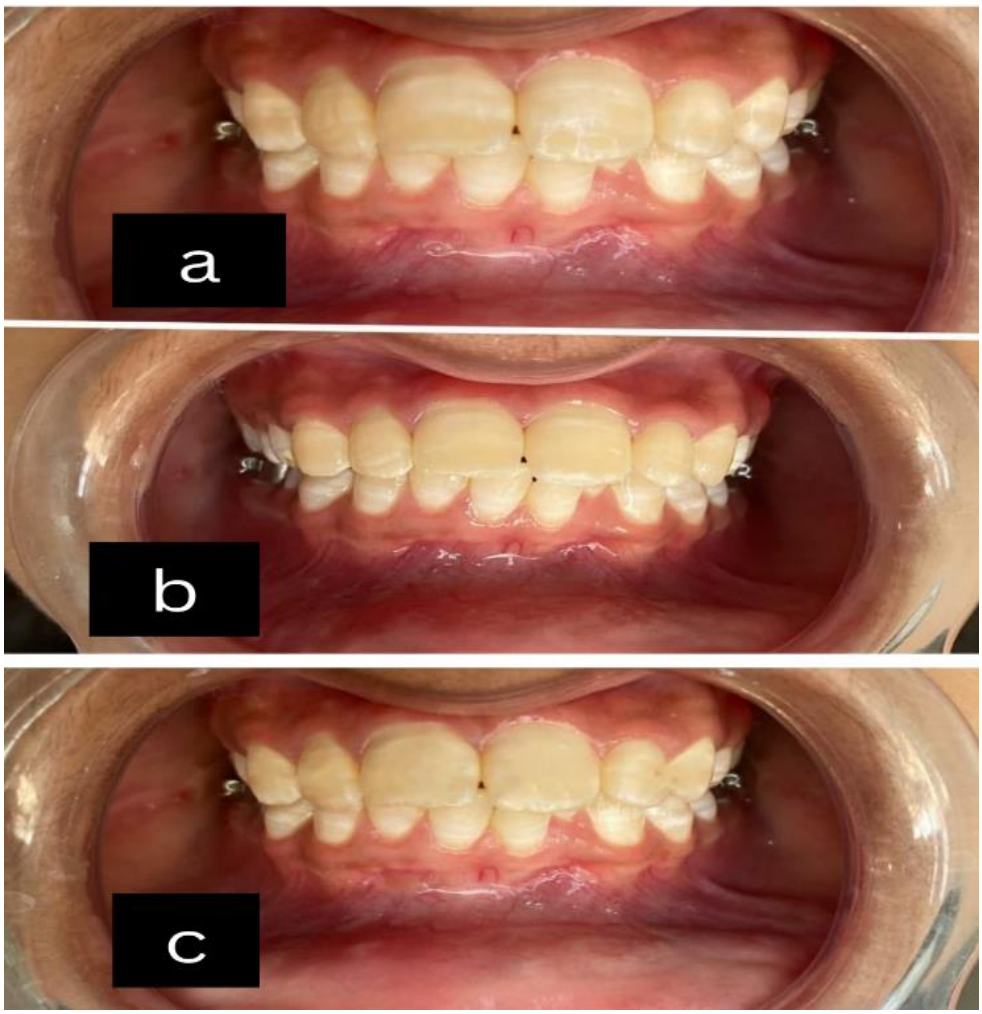

Figure 3. Follow up in the fourth week.
a. Appearance of anterior teeth before the treatment.
b. Appearance of anterior teeth immediately after the treatment.
c. Appearance of anterior teeth after the treatment.

surfaces were polished to achieve a smooth and natural appearance. The removal of water from the pores of the lesion is given in Figure 1d.

Follow-up and outcome

The patient was advised to follow good oral sanitation, reduce sugar intake, and avoid consumption of acidic and staining foods or beverages to prevent the formation of new white spot lesions. Regular follow-up appointments were scheduled to monitor the treated areas and overall oral health. Figure 3 shows pre-operative (Figure 3a), immediate postoperative (3b), and one-month follow-up findings (3c). The immediate postoperative examination revealed that the WSLs appeared less prominent, and the teeth exhibited a more uniform colouration, blending with the surrounding enamel, as shown in Figure 3b. At the one-month follow-up visit, the white spot lesions showed noticeable improvement in both size and appearance. The patient expressed satisfaction with the treatment outcome. Visual examination under daylight revealed stable results with no signs of lesion progression Figure 3c.

DISCUSSION

The application of DMG resin infiltration, in this case, offered a minimally invasive and aesthetically pleasing alternative to conventional restorative methods for treating WSLs. The procedure helped to halt the development of early-stage lesions and improved the aesthetics of the affected teeth, resulting in a more confident and satisfied patient. Furthermore, maintaining a healthy tooth composition is essential, especially in children undergoing orthodontic treatment, to maintain long-term dental health

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[9]. The resin infiltration technique was developed in the 1970s when resin materials with lower viscosity were used to improve enamel calcification. Further studies established the benefit of etching and the production of infiltrant with a higher penetration coefficient in the 2000s, broadening the concept of the infiltration method in clinical practice for masking and halting caries [10]. The resin infiltration method also helps in instant masking the WSLs in the deeper layer of the lesion [11]. Additionally, mechanical strength is increased for enamel as a result of this resin infiltration [12].

The Icon system is a pioneering method that has crossed the gap between caries restoration and prevention for one-third of dentine (D-1) [13]. It has many benefits, including maintaining the composition of teeth, instant results, mechanically stabilising the demineralised enamel, reducing the likelihood of filling leak from the pores, preventing secondary caries, having a better aesthetic result, and is widely accepted by patients [14]. The capillary reaction is what allows the resin to permeate porous enamel according to the resin infiltration rule. In this way, removing micropores, which enable acid diffusion pathways and melting materials, slows disease progression [15]. The use of the traditional Icon application method can result in partial etching without complete infiltration.

To overcome this problem, several recommendations were given, including longer etching duration, prior preparation of tooth structure, and a longer infiltration period. A prolonged application period leads to a deeper infiltration of the substance [16]. The application of etchant assists the resin penetration into the lesion through a hyper-mineralised enamel surface, and 15% HCl was thought to be a suitable etchant for adequate penetration. The water in the pores can be eliminated using 99% ethanol, and thus, capillary forces are created in the pores that aid the infiltration of infiltrant into them [17]. However, MIH teeth are frequently challenging to treat. The average bonding power of composites is decreased by resin infiltration on its own. The Icon system of resin infiltration prevents the acids and bacteria from reaching the structures located in the deeper layers of the teeth and thereby enhances the bonding strength of filling material with hypo-mineralised enamel. Thus, the use of the Icon system can be effective in treating even worse dental abnormalities [18].

Conclusion

The application of DMG Icon in treating white spot lesions is a promising minimally invasive approach that offers improved aesthetics and preservation of healthy tooth structure. This case report demonstrates the successful use of the DMG Icon in a young patient with WSLs, highlighting its potential as an effective treatment option for managing early-stage carious lesions. Further research and long-term studies are warranted to assess the long-term efficacy and stability of this treatment modality. The treatment process with the DMG Icon was straightforward and painless.

DECLARATIONS

Ethical considerations

The ethical clearance for this case report was obtained from the Departmental Review Committee, NIMS University, under the reference number NIMSDC&H/DOSP/42. Written and oral informed consent was obtained from the patient.

Consent to publish

All authors agreed on the content of the final paper.

Funding

None

Competing Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

Author contributions

AM conceptualised the paper. AM and IJ participated in the study design, Literature review, and experimental and clinical studies. PK, SA, and RM participated in editing and reviewing the manuscript. AG supervised and approved the manuscript for publishing.

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Availability of data

Data is available upon request to the corresponding Author

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