

RESIN INFILTRATION TECHNIQUE: THE MINIMAL INVASIVE APPROACH TO TREAT WHITE SPOT LESIONS

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Abstract

In today's era of minimal invasive dentistry the resin monomer penetration in the porous lesions of hypomineralised lesions provides an alternative esthetic management. New light-polymerized resin composites optimized for rapid infiltration of enamel lesions with resin light curing monomers are commercially available today to prevent enamel lesions from further demineralization and provide a highly conservative therapy and could successfully be applied in blending hypoplastic stains.

Aim: This clinical report describes cases in which the minimally invasive infiltrant resin technique was used for blending, mild-to-moderate fluorosis, and hypoplasia stains related to traumatic dental injuries.

Results: results showed that resin infiltration technique is successful in mild to moderate fluorosis stains

Conclusion: Based on the results obtained, it could be concluded that the resin infiltration technique is a minimally invasive procedure for treating mild-to-moderate fluorosis and hypoplasia stains.

Key Words: Minimal invasive, White lesions, Resin Infiltration technique.

Introduction

Smiles are instinctive, a universal sign of friendliness. Smile is a major expression of emotions like happiness, love and excitement. It can enhance personal and professional relationships and inspire others in many ways. White marks and white lesions commonly found on anterior teeth can be unsightly. They ruin the looks through discoloration. Patients often seek treatment to have these marks eradicated. White spot lesions are defined as the enamel lesions that look chalky white and opaque. It can arise from developmental cause such as fluorosis, idiopathic cause or early caries lesion.

Dental fluorosis is a condition of enamel hypomineralization because of the effects of excessive fluoride on ameloblasts during enamel formation resulting in surface and subsurface porosities and subsequent optical and physical changes.¹⁻³

Traumatic dental injuries (TDIs) are considered an emerging public health problem. TDI to primary teeth may compromise both primary teeth and their permanent successors.^{4,5}

Whilst there is a wide array of treatments available, which includes whitening as a first choice and bonding over the mark as a last option, a new technique using resin infiltration has been introduced.⁶ In today's dental world, we are conscious of providing minimally invasive treatments that maintain a conservative approach to patients. Until now, our choices have been limited to invasive methods of varying degree to treat white spots.

A new material for infiltration is an alternative therapeutic approach for masking these hypocalcified areas. The goal of this treatment is to occlude the microporosities within the lesion body by infiltration with low-viscosity light-curing resins that have been optimized for rapid penetration into the porous enamel.⁷

With the aim of improving the esthetic appearance of three patients, this clinical case report presents and describes the

minimally invasive infiltrant resin technique for blending different microporous lesions and its effectiveness in different clinical cases.

Case report

Three patients between 21 and 24 years of age were attended at the department of conservative dentistry & endodontics, National Dental College & Hospital, Dera Bassi. After clinical examination and taking the patient's medical history, the stains were diagnosed as follows: in the first two cases, as mild-to-moderate enamel fluorosis (Figure 1a & Figure 2a) and in third case, as hypoplasia related to TDI (Figure 3a). Full written consent was obtained from both the subjects and their parents. Treatment planning was based on alternative minimal intervention, avoiding treatments with more predictable that would require greater tooth structure reduction, such as microabrasive or macroabrasive procedures. Thus, the enamel infiltration technique with resin infiltrant (ICON, DMG, Hamburg, Germany) was selected for the treatment of all cases presented.

CASE 1



Figure 1 a) Preoperative; b) Rubber dam application

The conventional rubber dam was applied to protect soft tissues (Figure 1b) and achieve clean and dry working conditions. After the teeth were cleaned using prophylaxis paste, the surface layer was eroded by application of a 15% hydrochloric acid gel (Icon-etch) for 120 seconds (Figure 1c). To achieve a homogeneous etching pattern, the manufacturer's recommendation to stir the gel from time to time was followed during application, using the smooth

surface-tips included in the respective product kit. Subsequently, the etching gel was thoroughly washed away for 30 seconds using water spray (Figure 1d).



Figure 1 c) Application of etchant; d) Rinse

The etching procedure removed superficial discolorations and the more highly mineralized surface layer, which otherwise might hamper resin penetration. To remove the water retained within the microporosities of the lesion body, lesions were desiccated by application of ethanol for 30 seconds (Icon-dry) (Figure 1e) and subsequent air-drying. To maximize water removal, this step should be repeated at least once. After air-drying, the whitish appearance of enamel lesions was more pronounced. A resin infiltrant (Icon-infiltrant) was applied on the lesion surface using smooth surface-tips and allowed to penetrate for 3 minutes (Figure 1f). Because the aim of infiltration is to create a diffusion barrier inside the lesion and not on top of the lesion surface, resin surplus on the tooth surface was wiped away using a cotton roll before light polymerization for 40 seconds. Excess resin was cleaned out of the proximal spaces using dental floss. After light curing, it is recommended that the application (allowing the material to sit for 1 minute) and light polymerization (40 seconds) (Figure 1g) of the resin infiltrant should be repeated once to minimize enamel porosity. Finally, the roughened enamel surface was polished using disks and silicone polishers to avoid re-discoloration by food stains.



Figure 1: e) Application of Icon Dry; f) Application of infiltrant



Figure 1: g) Light curing of Icon Infiltrant; h) Postoperative

An improvement in the esthetic appearance was achieved in first two cases and remained stable until 5 months follow up, however, in the case of TDI, the hypoplasia stains were not completely masked rather caused pronounced dark spots (Figure 1h, Figure 2b, Figure 3b). Later on composite laminate was planned for hypoplasia related TDI (Figure 3c).

CASE 2



Figure 2: a) Preoperative; b) Post-operative

CASE 3

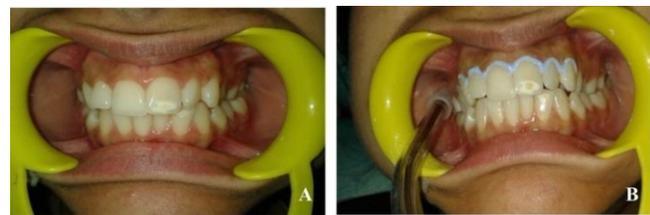


Figure 3: a) Preoperative; b) No effect after Resin Infiltration



Figure 3c Composite laminate done

Discussion

Correct diagnosis according to lesion depth and prognosis of the technique are crucial factors in the treatment decision-making process and in the success of the case.⁸ The goal of clinical management of tooth discoloration is to produce an acceptable cosmetic result as conservatively as possible. The various options for treating these cases have been advocated. The most conservative and effective of these methods includes microabrasion. But microabrasion also results in loss enamel surface.^{9,10} The alternative approach in treating such cases is Resin infiltration technique. Studies have shown good results of resin infiltration technique in masking hypoplasia in mild and moderate cases of fluorosis.¹¹ When compared with enamel microabrasion or conventional restorative techniques, resin infiltration is much less invasive, and only negligible tooth substance must be sacrificed by etching and polishing.

With this technique, only 30 to 40 μm are eroded¹² in contrast with enamel microabrasion with enamel removal of around 360 μm when applied in 5-second intervals and repeated 20 times¹³. The esthetic outcome of resin infiltration cannot be precisely predicted. Robinson *et al.* reported that about $60 \pm 10\%$ of the lesion's pore volume had been occupied by resin.¹⁴ According to Kielbassa *et al.*, resin infiltrates into subsurface lesions and produces resin infiltrated parts of the lesion and the depth of resin infiltration was over 100 μm .¹⁵

Originally this technique is developed to stop incipient carious lesions. With an initially demineralized caries lesion, the tiny porous openings and widened inter-crystalline spaces act as diffusion pathways for acids and dissolved minerals. Based on these insights, it is possible to infiltrate incipient lesions with other liquids, i.e. with low viscous resins.

The microporosities of enamel caries lesions are filled with either a watery medium (RI 1.33) or air (RI 1.0). The difference in refractive indices between the enamel crystals and medium inside the porosities causes light scattering that results in a whitish opaque appearance of these lesions, especially when they are desiccated. The principle of masking enamel lesions by resin infiltration is based on changes in light scattering within the lesions. Sound enamel has a refractive index (RI) of 1.62. The microporosities of infiltrated lesions are filled with resin (RI 1.46) that, in contrast to the watery medium, cannot evaporate. The infiltration technique allows for reducing the microporosities (and therefore will hamper access of acids), and is capable to strengthen the demineralized tissue by mechanical support.¹⁶

It has been reported that active lesions show only thin and porous surface layers that are easier to infiltrate than inactive lesions. If more inactive lesions are supposed to be infiltrated, the application of ethanol can be used to confirm the complete erosion of the surface layer. The color of desiccated lesions should change during ethanol penetration. If color does not change, ethanol will not reach the lesion body because of surface layer remnants. The depth of hypoplastic lesions, thicker surface layer, and infiltration behaviour are similar to those of an inactive lesion, which could probably justify the result of partial blending of the hypoplasia stain.

Repetition of HCl erosion was thought of for these cases, but it was decided to follow the manufacturer's recommendation strictly. The effect of the hydrochloric acid on the enamel was evaluated in a study by Paris *et al.* These researchers evaluated the etching effect of the hydrochloric acid vs phosphoric acid on deciduous teeth. They evaluated 36 pairs of primary molars enamel lesions and etched for two minutes both the phosphoric acid and hydrochloric acid they examined the results under confocal microscopy. They reported that there was a difference between the two acids on the surface of the teeth and that the hydrochloric acid caused higher erosion on the enamel thus allowing deeper penetration of the resin infiltrant. The

erosion depth of the hydrochloric acid was twice the depth of the phosphoric acid. The phosphoric acid at etching time of two minutes cannot erode the surface of the enamel. Different application times should be analyzed in future studies.¹⁷

The first two cases of fluorosis showed good esthetic results. In a study undertaken by Munoz *et al.* (2013) where suitable cases were infiltrated with resin, they found that the most successful cases were the ones with fluorosis stains. These cases showed visibly perceptible differences. The hypoplasia areas were not completely eradicated. The researchers reported that the patients recovered their self-esteem as a result of the treatment and thus this was considered as a success.¹¹

Unfortunately, resin infiltration technique could not remove white spot lesions completely in TDI case and was later on corrected by composite veneer. The reason why some lesions are left after treatment could be thought that the depth of white spot lesion is not restricted to superficial part of enamel. It is reported that 200 μm of superficial enamel is removed by microabrasion and the depth of resin infiltration is about 60 μm . If the depth of white spot lesion is deeper than that of microabrasion or resin infiltration technique, it could still be detected.¹⁸ Therefore, caution should be taken for case selection.

Conclusion

In the limitation of this study, the findings of the present case report showed that the minimally invasive —resin infiltration technique || seems to be effective, less aggressive and more time saving for correction of white spot lesion and caution should be taken for case selection.

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