

Content available at: <https://www.ipinnovative.com/open-access-journals>

IP Indian Journal of Conservative and Endodontics

Journal homepage: <https://www.ijce.in/>

## Case Report

# Resin infiltration technique: Minimally invasive maximal approach to treat white spot lesions

Purushothama R<sup>1</sup>, Rakshith V R<sup>b1,\*</sup>, Samrat M R<sup>1</sup>, Sujith R<sup>1</sup>, Kavitha G<sup>1</sup>, Balaji D R<sup>1</sup>

<sup>1</sup>Dept. of Conservative and Endodontics, Sharavathi Dental College and Hospital, Shimoga, Karnataka, India



### ARTICLE INFO

#### Article history:

Received 20-09-2022

Accepted 15-10-2022

Available online 14-01-2023

#### Keywords:

Demineralization

ICON

Refractive index

Minimally invasive

Resin infiltration technique

### ABSTRACT

Operative procedure considered to be a challenging for operator technically in order to provide favourable outcome. Minimally invasive procedure has been carried out frequently over the decade but none of them have shown better prognosis including esthetic treatment. Treatment of initial demineralisation of enamel surface could lead to caries progression. So, it's very difficult to understand the buffering activity and ph of oral environment which differ from one person to another.

To overcome initial demineralisation operator should have thorough knowledge of tooth anatomy, diagnosis and histopathology of caries. Previous diagnostic methods are bit cumbersome but future techniques are yet to be introduced into clinical usage recently resin infiltration was introduced as therapeutic treatment to prevent further subsurface demineralization of enamel. Present clinical procedure considered to be a non-invasive method. So early detection and proper diagnosis considered to be important than treatment protocol.

This is an Open Access (OA) journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License](https://creativecommons.org/licenses/by-nc-sa/4.0/), which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: [reprint@ipinnovative.com](mailto:reprint@ipinnovative.com)

## 1. Introduction

Esthetic concern and appearance are more important criteria than functional consideration in young adult patient. Most demanding aspect of enchantrass depends upon the natural structure and as well as man-made artificial efforts.

Esthetic treatment is a class of art and science, where operator should reach patient stipulation. Among them treatment of mild small incipient carious lesion is challenging one. Where early diagnosis and treatment plan is major concern for both.

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.<sup>1-3</sup>

The traditional methods of detecting early lesions include visual inspection and radiography. In visual observation, reflected light is used to detect changes in colour, texture, and translucency of the tooth substance. However, these traditional methods for early caries diagnosis have been found to be inaccurate and insensitive. Unfortunately, radiographs have the added risk of exposure of ionizing radiation to the patient.<sup>4</sup>

A novel technology involving optical coherence tomography (OCT), Polarization-sensitive optical

\* Corresponding author.

E-mail address: [rakshithvr1100@gmail.com](mailto:rakshithvr1100@gmail.com) (Rakshith V R).

coherence tomography (PSOCT), Frequency-domain photothermal radiometry (FD-PTR or PTR) and modulated luminescence. Gomez et al. concluded that electrical conductance (EC) and QLF seemed to be promising for the detection of early lesions. Visual methods remained the goal standard for clinical assessment in dental practice keeping in mind both cost and practicality considerations.<sup>5-9</sup>

Whilst there is a wide array of treatments available, whether to go with a remineralisation process.

Or with a restorative method for white spot lesions is still a dilemma. A new technique using resin infiltration has been introduced.<sup>10</sup> Our main aim is providing minimally invasive treatments that maintain a conservative approach to patients.

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.<sup>11</sup>

## 2. Case Report

Two patients between 22 and 26 years of age came to the department of conservative dentistry & endodontics, Sharavathi dental college and hospital, Shivamogga with a chief complaint of whitish discolouration (case 1) and yellowish stain (case 2) on the upper front tooth region. After clinical examination and taking the patient's medical history, the stains were diagnosed as follows: in the first case, white spot lesion due to initial demineralisation (Figure 1) and in second case, fluorosis stains (Figure 8). Informed 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 included.

### 3. Case 1

After the tooth were cleaned using prophylaxis paste conventional rubber dam was applied to protect soft tissues (Figure 1) and achieve clean and dry working conditions the surface layer was eroded by application of a 15% hydrochloric acid gel (Icon-etch) for 120 seconds (Figure 2). 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.

The etching procedure removed superficial discolorations and the more highly mineralized surface



**Fig. 1:** Pre operative under rubber dam application.



**Fig. 2:** Application of etchant.

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 3) 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 4) and light polymerization was carried out. After light curing, it is recommended that the application (allowing the material to set for 1 minute) and light polymerization (40 seconds) (Figure 5) of the resin infiltrant should be repeated once to minimize enamel porosity so that the infiltrant should completely filled inside enamel porosity. Finally, the roughened restored surface was polished using disks and silicone polishers to avoid re-discoloration by food stains.

An improvement in the esthetic appearance was achieved in first two cases and remained stable until 6 months follow up.



**Fig. 3:** Application of icon dry



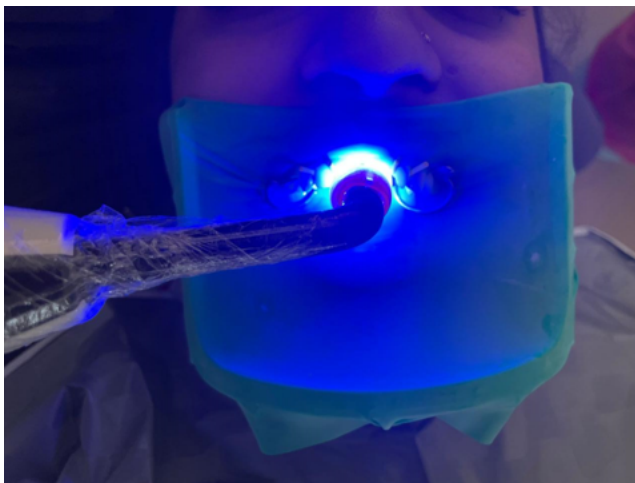
**Fig. 6:** Immediate post op



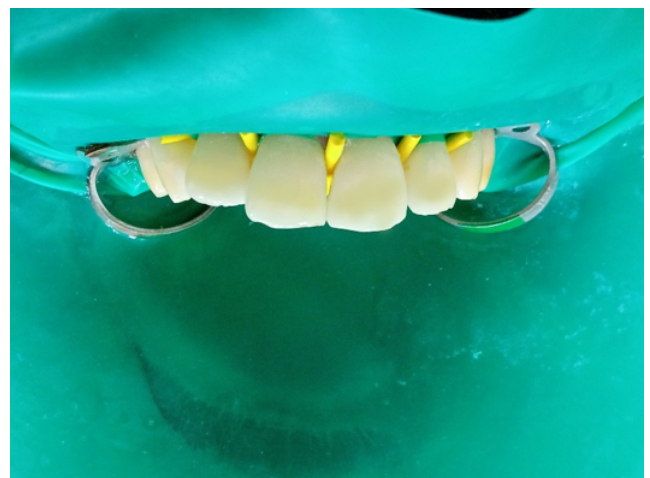
**Fig. 4:** Application of infiltrant



**Fig. 7:** 6 month follow up



**Fig. 5:** Curing



**Fig. 8:** Preoperative under rubber dam application

#### 4. Case 2



**Fig. 9:** Post operative



**Fig. 10:** 6 month follow up

## 5. Discussion

Success of operative treatment depends upon proper diagnosis and decision making process.<sup>12</sup> The various treatment options for treating these cases have been advocated. The most conservative of these methods includes microabrasion and remineralisation. Clinically, the degree of remineralization seems to be limited, and this has been attributed to the presence of organic substances attaching to the enamel surface and possibly occluding the underlying pores in the carious lesion. Moreover, the role of possible remineralization inhibitors is not clearly understood; the ability of albumin to bind and to inhibit growth of calcium phosphate crystals raises the question as to the possible role of such molecules in the development of carious lesions.<sup>13</sup> But microabrasion also results in loss enamel surface.<sup>14</sup>

The treatment of white spot lesions based on 3T'S Test Trace and treat. Originally resin infiltration technique

is developed to stop incipient carious lesions. In the demineralized caries lesion, the tiny porous openings and widened intercrystalline spaces act as diffusion pathways for acids and dissolved minerals. Based on these insights, it is possible to infiltrate low viscosity resin into these porous openings.

According to Munoz et al resin infiltration technique have shown good results in masking hypoplasia in mild and moderate cases of fluorosis. 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.<sup>15</sup> when infiltrants with differing penetration coefficients were used.<sup>14,15</sup> This has been corroborated with natural lesions, thus indicating that resin infiltrants with high penetration coefficients are able to penetrate more deeply into subsurface lesions.<sup>16</sup>

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. 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 low viscosity resin. The erosion depth of the hydrochloric acid was twice the depth of the phosphoric acid.<sup>17</sup>

The main aim of resin infiltration is to prevent the further progression of enamel lesion. Generally, microporosities are filled with either water or air medium (RI 1.33 – RI 1.0). The difference in the medium inside the porosity and enamel crystals causes light scattering which results in whitish opaque appearance of tooth. Refractive index of sound enamel is 1.62 and the refractive index of low viscous resin is closely to that of sound enamel (Table 1). The infiltration technique allows to reduce the microporosities by hampering the access of acids for further dessolution and by preventing further progression of carious process.<sup>17,18</sup>

**Table 1:** The refractive indices of porous enamel, normal enamel and resin infiltrated enamel<sup>18</sup>

Type of Enamel	Refractive Index
White spot lesion enamel	1–1.33
Normal enamel	1.65
Resin-infiltrated enamel	1.475

Caries related clinical decision making remains a centerpiece of restorative dentistry. However traditional core skills, along with the manual dexterity and technical competence, have less to offer to oral health than many of us have been accustomed to think. From the foregoing literatures it seems clear that the resin infiltration technique has several advantages like mechanical stabilization of demineralized enamel, retardation of lesion progress, no risk of postoperative sensitivity and pulpal inflammation, and improved aesthetical outcome.<sup>13</sup>

Earlier due to unavailability of material it was difficult to treat such white spot lesions the dentist has to ‘Wait and Watch’ until it’s time to ‘Drill and Fill’. But recently due to newer material like ICON it is possible to treat enamel lesion as early as possible hence it might be a minimal invasive approach to treat white spot lesions.

## 6. Conflict of Interest

None.

## 7. Source of Funding

None.

## References

1. Aoba T, Fejerskov O. Dental fluorosis: chemistry and biology. *Crit Rev Oral Biol Med.* 2002;13(2):155–70.
2. Denbesten PK. Biological mechanisms of dental fluorosis relevant to the use of fluoride supplements. *Community Dent Oral Epidemiol.* 1999;27(1):41–7.
3. Robinson C, Connell S, Kirkham J, Brookes SJ, Shore RC, Smith AM, et al. The effect of fluoride on the developing tooth. *Caries Res.* 2004;38(3):268–76.
4. Ashley PF, Blinkhorn AS, Davies RM. Occlusal caries diagnosis: An in vitro histological validation of the Electronic Caries Monitor (ECM) and other methods. *J Dent.* 1998;26(2):83–8. doi:10.1016/s0300-5712(97)00007-9.
5. Ko AC, Choo-Smith LP, Hewko M, Leonardi L, Sowa MG, Dong CC, et al. Ex vivo detection and characterization of early dental caries by optical coherence tomography and Raman spectroscopy. *J Biomed Opt.* 2005;10(3):31118. doi:10.1117/1.1915488.
6. Jones RS, Darling CL, Featherstone JD, Fried D. Remineralization of in vitro dental caries assessed with polarization-sensitive optical coherence tomography. *J Biomed Opt.* 2006;11(1):014016. doi:10.1117/1.2161192.
7. Jeon RJ, Matvienko A, Mandelis A, Abrams SH, Amaechi BT, Kulkarni G, et al. Detection of interproximal demineralized lesions on human teeth in vitro using frequency-domain infrared photothermal radiometry and modulated luminescence. *J Biomed Opt.* 2007;12(3):34028. doi:10.1117/1.2750289.
8. Ferreira RI, Haiter-Neto F, Tabchoury CP, De Paiva G, Bóscolo FN. Assessment of enamel demineralization using conventional, digital, and digitized radiography. *Braz Oral Res.* 2006;20(2):114–9. doi:10.1590/s1806-83242006000200005.
9. Gomez J, Tellez M, Pretty IA, Ellwood RP, Ismail AI. Non-cavitated carious lesions detection methods: A systematic review. *Community Dent Oral Epidemiol.* 2013;41(1):54–66. doi:10.1111/cdoe.12021.
10. Greenwall L. White lesion eradication using resin infiltration. *Int Dent - Afr Edi;*3(4):54–62.
11. Meyer-Lueckel H, Paris S, Kielbassa AM. Surface layer erosion of natural caries lesions with phosphoric and hydrochloric acid gels in preparation for resin infiltration. *Caries Res.* 2007;41(3):223–30.
12. Reston EG, Corba DV, Ruschel K, Tovo MF, Barbosa AN. Conservative approach for esthetic treatment of enamel hypoplasia. *Oper Dent.* 2011;36(3):340–3.
13. Kielbassa A, Muller J, Gernhardt C. Closing the gap between oral hygiene and minimally invasive dentistry: a review on the resin infiltration technique of incipient (proximal) enamel lesions. *Quintessence Int.* 2009;40(8):663–81.
14. Akpata ES. Occurrence and management of dental fluorosis. *Int Dent J.* 2001;51(5):325–33. doi:10.1002/j.1875-595x.2001.tb00845.x.
15. Munoz MA, Arana-Gordillo LA, Gomes GM, Gomes OM, Bombarda NH, Reis A, et al. Alternative Esthetic Management of Fluorosis and Hypoplasia Stains: Blending Effect Obtained with Resin Infiltration Techniques. *J Esthet Restor Dent.* 2013;25(1):32–9.
16. Meyer-Lueckel H, Paris S. Infiltration of natural caries lesions with experimental resins differing in penetration coefficients and ethanol addition. *Caries Res.* 2010;44(4):408–14. doi:10.1159/000318223.
17. Paris S, Hopfenmuller W, Meyer-Lueckel H. Resin infiltration of caries lesions: an efficacy randomized trial. *J Dent Res.* 2010;89(8):823–6.
18. Sampson V, Sampson A. Diagnosis and treatment options for anterior white spot lesions. *Br Dent J.* 2020;229(6):348–52.

## Author biography

**Purushothama R**, Professor

**Rakshith V R**, Post Graduate  <https://orcid.org/0000-0002-4744-4368>

**Samrat M R**, Professor and HOD

**Sujith R**, Professor

**Kavitha G**, Reader

**Balaji D R**, Senior Lecturer

**Cite this article:** Purushothama R, Rakshith V R, Samrat M R, Sujith R, Kavitha G, Balaji D R. Resin infiltration technique: Minimally invasive maximal approach to treat white spot lesions. *IP Indian J Conserv Endod* 2022;7(4):177–181.