

# Resin infiltration as a method for treatment of white spot lesions after fixed orthodontic treatment – a case report

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## Abstract

White spot lesions are defined as enamel superficial and subsurface demineralization. The resin infiltration technique has proved to be a valid micro-invasive alternative to traditional conservative therapy. This article aims to present the treatment of initial carious lesions after fixed orthodontic treatment by resin infiltration.

A 15-year-old clinically healthy girl without allergies or general diseases was admitted to the dental office for consultation and treatment. Intraoral examination revealed initial carious lesions on the vestibular surface of multiple teeth in the upper and lower jaw. The lesions were irregular in shape, located in the cervical, proximal, and bracket fixation areas. Their color ranged from chalky white to yellow-brown, with a loss of gloss and transparency and a lack of clear boundaries. A resin infiltration treatment was performed.

The resin infiltration technique can mask the enamel discoloration and achieve a satisfactory aesthetic result. It can be successfully used in patients with white spot carious lesions after fixed orthodontic treatment.

**Keywords:** resin infiltration, white spot lesions, non-invasive treatment, microabrasion

## Introduction

White carious lesions represent superficial and subsurface demineralization of tooth enamel without cavitation (1). They are the first clinical manifestation of carious disease and are usually reversible (2). They are characterized by a white, chalky color, lack of gloss and transparency, and an opaque appearance (3). They can be observed with a naked eye, and their characteristics are enhanced after the tooth is carefully dried (2). They are often found in patients with heavy plaque accumulation and poor oral hygiene, changes in salivary characteristics, at high caries risk, or after orthodontic treatment (4). The incidence of white enamel carious lesions after orthodontic treatment is between 40% and 70% (5).

Healthy enamel appears glossy and transparent due to light reflection and scattering (6). As a result of the carious process and demineralization of enamel, a loss of gloss and a change in color and microporosity occur (7). The micropores fill with water, which changes the refractive index of the light and makes these areas appear opaque compared to the surrounding sound structures (3, 8).

Successful treatment of white carious lesions requires early diagnosis, supported by a thorough clinical examination, photographs, and, in some cases, radiographs (9). Several approaches have been proposed

for the treatment of non-cavitated enamel carious lesions: remineralization of the lesion by topical application of fluoride and remineralizing agents, as well as the use of hydroxyapatite, fluoride, and xylitol pastes (10, 11). Another popular technique is microabrasion – treatment of the area with 18% hydrochloric acid and silicon carbide microparticles (12). Bioactive glass with inorganic calcium-sodium phosphosilicates is also used (13). These treatment options have limitations, as they sometimes do not give an immediate result and require the patient's active participation to achieve the desired clinical result (14). In addition, remineralization occurs only superficially, and the body of the carious lesion remains porous and demineralized, which leads to unpredictable and unacceptable aesthetic results of the treatment (15).

In recent years, there has been a growing utilization of a non-invasive treatment for these lesions involving infiltration with a hydrophobic resin material that possesses a refractive index comparable to that of healthy enamel (ICON, DMG, Hamburg, Germany) (15, 16). It has a low viscosity and molecular weight (triethylene glycol dimethacrylate, TEGDMA) and penetrates through the enamel pores. This leads to a delay or cessation of the demineralization processes (17). This technique increases the enamel's mechanical strength and acid resistance (18). The therapeutic infiltration procedure includes (19):

- First step – ICON Etch - Etching with 15% hydrochloric acid for 2 minutes, which removes about 58 µm of the enamel surface, opening access to the body of the carious lesion;
- Second step – ICON Dry - Drying with ethanol throughout the depth of the lesion;
- Step 3 – ICON Infiltrant – a resin infiltration step that allows the material to penetrate the pores and fill them, thereby completely masking them.

Another alternative in aesthetic dentistry is the treatment of enamel changes with microabrasives, such as Opalustre (Ultradent, Utah, USA) (20, 21). Microabrasives are pastes with fine abrasive particles used to polish and brighten tooth surfaces, which removes surface stains and smoothing irregularities in the tooth enamel (22, 23, 24). When used together, microabrasion and infiltration can complement each other in treating initial carious lesions and aesthetic defects of tooth enamel, thus achieving a longer-lasting and satisfactory final result.

## Aim

This article aims to present the treatment of initial carious lesions after fixed orthodontic treatment using a combination of microabrasion and resin infiltration.

## Case description

A 15-year-old clinically healthy girl without allergies or general diseases was admitted to the dental office for consultation and treatment. The main complaint was the presence of unaesthetic white and brown spot lesions on the permanent anterior teeth obtained after fixed orthodontic treatment. The extraoral examination did not reveal any swelling, asymmetry, lymphadenopathy, or other abnormalities. Intraoral examination revealed initial carious lesions on the vestibular surface of multiple teeth in the upper and lower jaw. The lesions were irregular in shape and covered the cervical, proximal, and bracket fixation areas. Their color ranged from chalky white to yellow-brown with a loss of gloss and transparency and lack of clear boundaries. The patient did not report pain, tooth sensitivity, or spontaneous bleeding from the gums (Figure 1).

Several treatment strategies were proposed for the management of similar enamel caries lesions. Based on recent studies, we decided to use the resin infiltration technique, which is the most promising approach. Furthermore, this minimal intervention technique benefits as a tissue-preserving approach and can arrest and control incipient caries lesions.



**Figure 1. Preoperative photograph of initial carious lesions on upper and lower teeth**

The lesions were managed following the instructions of the manufacturer (DMG, Hamburg, Germany). The clinical protocol included the following steps:

- Clinical oral hygiene with a brush and paste;
- Isolation with a rubber dam, to retract the soft tissues and achieve a dry and clean operative field;
- Microabrasion of each vestibular surface with Opalustre paste for 5 s per tooth;
- Placement of celluloid matrices in the interdental areas;
- Application of a 15% hydrochloric acid gel using a special brush tip for 2 minutes;
- Washing of the etching gel with a water-air spray for a period of 30 seconds;
- Drying of the lesions with ethanol for 30 seconds;
- Re-etching for 2 minutes and subsequent cleaning;
- Re-drying;
- Application of the infiltrant on all etched enamel lesions using a microbrush and squeezing for 2 minutes to penetrate the resin deep into the body of the lesion;
- Removal of excess resin using a microbrush and dental floss;
- Light curing for 40 seconds;
- Reapplication of infiltrant and light curing;
- Polishing and cleaning of the enamel surface with polishing discs (SofLex, 3M, Minnesota, USA) and silicone polishing brush.

The patient was instructed to avoid staining foods and beverages and to follow good oral hygiene practices. The final result is presented in Figure 2.



**Figure 2. Postoperative photograph**

## Discussion

White spot enamel lesions are frequently found and can be problematic for patients with high aesthetic demands. Various techniques have been proposed to improve the appearance of these spots. Our clinical case shows the treatment of initial carious lesions after orthodontic treatment with a combination of resin infiltration and microabrasion.

Dental caries prevention techniques mainly try to stop the process and remineralize the affected tooth surface in its early phases. The use of preventive materials to treat initial enamel lesions can delay or avoid the development of caries. Initial carious lesions have a reduced microhardness compared to the sound enamel surface due to the dissolution of enamel crystals and the formation of micropores (25). The microhardness of enamel lesions treated with resin infiltration increases. This can be explained by the fact that due to its low viscosity, the resin fills the pores between the remaining crystals, forming a diffusion barrier not only on the surface but also in the body of the lesion, causing re-hardening of the demineralized tissues and increasing its mechanical strength (26).

Resin materials with high concentrations of TEGDMA show better inhibition of lesion progression than those with high concentrations of bisphenol A-glycidyl methacrylate due to the better penetration capabilities of the material after drying with ethanol (27). It has been found that the progression of infiltrated enamel lesions is significantly slower compared to untreated lesions in high caries risk patients (28). In addition to stopping progression by blocking the micropores that provide diffusion pathways for acids and mineral dissolution, resins block the entry of any nutrients and mask the white color of the lesion (18, 29). The principle of action is based on changes in light scattering in the lesion (30).

From an aesthetic point of view, the application of ICON® for treating white enamel lesions currently offers a very satisfactory and conservative technique due to its shorter manipulation time, minimal invasiveness, and lack of discomfort for patients (15). This technique is considered micro-invasive and fills the gap between non-invasive and minimally invasive treatment of incipient dental caries, delaying surgical restoration (17).

## Conclusion

Infiltration is a new minimally invasive technique that has the potential to fill, reinforce, and stop the progression of incipient carious lesions. By masking the enamel discoloration, it can achieve a satisfactory

aesthetic result and can be successfully used in patients with white spot carious lesions after fixed orthodontic treatment.

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