

# TREATMENT OF POST-ORTHODONTIC WHITE SPOT LESIONS BY RESIN INFILTRATION: A CASE SERIES

Marta Mazur<sup>1</sup>, Gianna Maria Nardi<sup>1</sup>, Denise Corridore<sup>1</sup>, Artnora Ndokaj<sup>1</sup>, Ewa Rodakowska<sup>2</sup>, Livia Ottolenghi<sup>1</sup>, Fabrizio Guerra<sup>1</sup>

<sup>1</sup>Department of Oral and Maxillofacial Sciences, "Sapienza" University of Rome, Italy

<sup>2</sup>Department of Restorative Dentistry, Medical University of Białystok, Poland

## ABSTRACT

**INTRODUCTION:** White spot lesions (WSLs) are the most common side effects found in orthodontically treated patients. Icon treatment has been reported to revert colorimetric alterations of WSLs and halt carious progression.

**MATERIAL AND METHODS:** Four young patients with post-orthodontic WSLs, who were treated with resin infiltration.

**RESULTS:** In all patients, existing WSLs were successfully treated by Icon resin application. Given the minimal substance loss due to the erosion infiltration procedure, all patients were extremely satisfied with the results, although some WSLs could still be seen.

**CONCLUSIONS:** Our case series shows the capability of treating WSLs due to orthodontic treatment with Icon resin infiltration. Longer observation periods in studies with larger patient populations are needed to validate the clinical significance found in these case series.

**KEY WORDS:** resin infiltration, white spot lesion, post-orthodontic side effect, aesthetic outcome.

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## INTRODUCTION

White spot lesions (WSLs) are the most common side effect of fixed appliances [1], which concern at least three teeth in 77% of orthodontic patients [2], and can seriously jeopardize the esthetic outcome of the treatment [3].

The prevalence of WSLs is reported to vary from 2% to 96%. Their prevalence in patients not undergoing orthodontic treatment is about 24%, which rises to 50% in those who underwent orthodontic therapy. These variations largely depend on the methods used for detection of WSLs, as well as on patient's compliance with the recommended preventive measures [2, 3].

The presence of enamel discolorations on the esthetically exposed teeth affects patient's quality of life [4, 5]. Clinically WSLs appear as an incipient non-cavitated carious lesion, with a chalky white, mat, opaque halo around the bracket position [1]. The white appearance of WSLs is caused by enamel demineralization, under a hyper-mineralized intact outer enamel layer of about 10 to 30 nm, while in the porous subsurface layer organic fluids replace the diminished interprismatic mineral phase [6]. As light refraction through enamel is directly related to the level of mineralization, the presence of multiple hydroxyapatite/organic fluid interfaces causes the deviation and deflection of incident light, thus causing WSLs to be perceived as white defects [2]. Light

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ADDRESS FOR CORRESPONDENCE: Marta Mazur, Department of Oral and Maxillo-Facial Sciences, "Sapienza" University of Rome, Via Caserta 6, 00161, Rome, Italy, phone: +39 346 84 11 546, e-mail: [marta.mazur@uniroma1.it](mailto:marta.mazur@uniroma1.it)



FIGURE 1. Rubber dam



FIGURE 2. Etching



FIGURE 3. Rising and drying



FIGURE 4. Ethanol application



FIGURE 5. Resin application

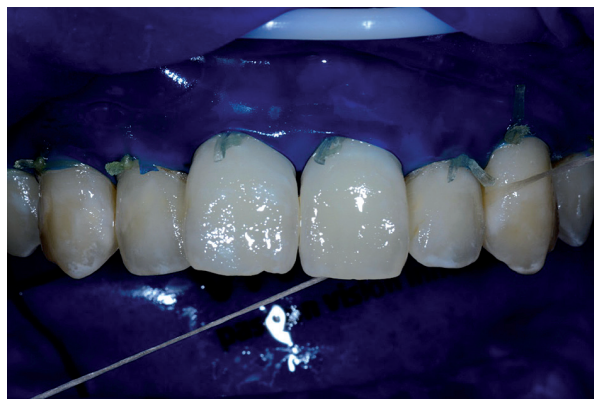


FIGURE 6. Excess removing

refraction determines the refractive index (RI) amount. Sound enamel presents a RI of 1.62, while WSLs' refractive index can vary from 1 to 1.33, depending on whether the enamel surface is dried or hydrated.

Treatment with resin infiltration has been recently developed by the dentistry equipe at Charité University of Berlin, Germany and was first proposed to halt the interproximal early stage non-cavitated caries lesions [7, 8]. The treatment has been subsequently extended to hypomineralized lesions on the vestibular enamel surface. Paris *et al.* [9] noted that lesions infiltrated by Icon took on the appearance of the surrounding sound enamel,



FIGURE 7. Light curing



**FIGURE 8.** Post-orthodontic white spot lesions on upper right incisors and canine



**FIGURE 9.** Post-orthodontic white spot lesions on upper left incisors and canine



**FIGURE 10.** Post-orthodontic white spot lesions on upper frontal teeth



**FIGURE 11.** Post-orthodontic white spot lesions on upper right incisors, canine and premolars



**FIGURE 12.** Post-orthodontic white spot lesions on upper left incisors, canine and premolars

masking the whitish appearance by filling the lesion's body with resin, which results in a rise of the RI of the lesion [10, 11].

## MATERIAL AND METHODS

Over 30 patients were treated with Icon from November 2014 to November 2016 by our group at the First Operative Unit, Sapienza University (Rome, Italy). Here

we present four postorthodontic patients with WSLs, who underwent Icon resin infiltration treatment.

## ICON PROCEDURE

Tooth surfaces were cleaned with a rubber cup and prophylaxis paste, before placing the rubber dam. Icon-Etch (DMG, Hamburg, Germany) 15% hydrochloric acid gel was then applied for two minutes for a maximum of three times. Then the etching gel was washed away thoroughly for 30 seconds using a water spray and then dried with air spray.

The lesions were desiccated using ethanol (Icon-Dry; DMG) for 30 seconds followed by air drying (Figures 1-4).

After desiccation, the infiltrant low viscosity resin (Icon-Infiltrant; DMG) was applied on the surface and allowed to penetrate for three minutes. The excessive material was then removed using air spray from the vestibular surface and using dental floss from the proximal spaces before light curing, which was applied for 40 seconds. The application of resin was then repeated another time before polishing of the roughened enamel surface using a rubber point and finishing strips (Figures 5-7).



**FIGURE 13.** Post-orthodontic white spot lesions on upper incisors



**FIGURE 14.** Post-orthodontic white spot lesions on upper incisors and canine



**FIGURE 15.** Post-orthodontic white spot lesions on upper and lower arch, on a pre-existing mild fluorosis



**FIGURE 16.** Post-orthodontic white spot lesions and a pre-existing mild fluorosis on the lower arch



**FIGURE 17.** Post-orthodontic white spot lesions and a pre-existing mild fluorosis on the lower arch



**FIGURE 18.** Post-orthodontic white spot lesions and a pre-existing mild fluorosis on the lower arch

## CASE REPORTS

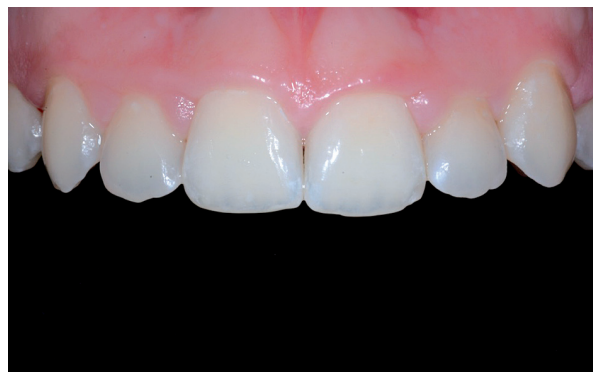
Patient 1 is a 22-year-old female, who asked for cosmetic treatment of multiple anterior WSLs on the upper six teeth, due to orthodontic fixed appliances (Figures 8 and 9). Patient 2 is a 17-year-old female who presented with small WSLs on upper lateral incisors and premolars, discovered after orthodontic debonding (Figures 10-12). Patient 3 is a 20-year-old female with slight WSLs on upper incisors after orthodontic therapy (Figures 13 and 14). Patient 4 is a 23-year-old female who presented requesting laminate veneers to



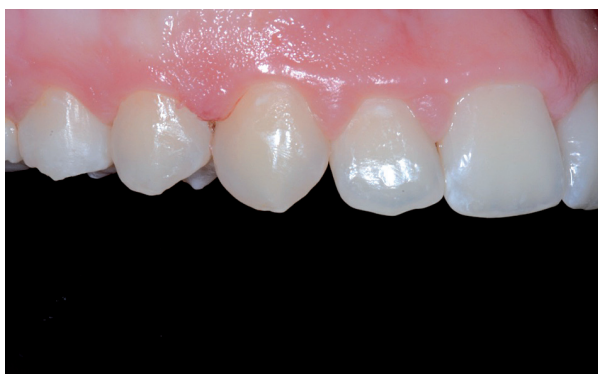
**FIGURE 19.** Post-orthodontic white spot lesions and a pre-existing mild fluorosis on the lower arch



**FIGURE 20.** Patient No. 1. Post-operative view



**FIGURE 21.** Patient No. 2. Post-operative view of the upper arch



**FIGURE 22.** Patient No. 2. Post-operative view of the upper arch



**FIGURE 23.** Patient No. 2. Post-operative view of the upper arch



**FIGURE 24.** Patient No. 3. Post-operative view of the upper arch



**FIGURE 25.** Patient No. 3. Post-operative view of the upper arch

hide WSLs due to orthodontic fixed appliance and pre-existing mild fluorosis (Figures 15-19).

## RESULTS OF ICON TREATMENT

In all patients, existing WSLs were successfully treated by Icon resin application. Illustrative cases are shown in Figures 20 to 31. Given the minimal substance loss due to the erosion infiltration procedure, all patients were extremely satisfied with the results, although some WSLs could still be seen.

## DISCUSSION

We, herein, presented four young patients with post-orthodontic WSLs on the labial surface of aesthetically relevant teeth, who were treated using Icon infiltrative resin with restoration of the defects that took on the appearance of the surrounding sound enamel.

White spot lesions, which are classified as non-cavitated carious lesions, are the most common and unpleasant side effects of orthodontic fixed therapy, most frequently found in patients with concomitant poor oral hygiene and low compliance with the advocated preventive measures. Like other enamel hypomineralization defects, WSLs can seriously jeopardize the esthetic outcome of orthodontic treatments.



**FIGURE 26.** Patient No. 4. Post operative view of the smile



**FIGURE 27.** Patient No. 4. Post operative view of the smile



**FIGURE 28.** Patient No. 4. Post operative view of the smile



**FIGURE 29.** Patient No. 4. Post operative view of the upper and lower arch

Recently, Icon treatment has been proposed as a therapy that can halt carious progression and mask the whitish halo typically found in WSLs. Icon treatment has changed dentistry's approach to the management of hypomineralized enamel lesions. Until recently, crowns, laminate veneers, restorations and micro-abrasion have been used to treat teeth presenting with tooth color abnormalities [12, 13]. Tooth preparations for the above-mentioned therapies require removal of enamel extending to the demineralized zone and in some cases penetration into dentin [14]. On the other hand, none of the existing treatments such as fluoride and casein phosphopeptide provide a certain esthetic outcome [15]. By contrast, resin infiltration requires no mechanical enamel removal, as it erodes approximately 40  $\mu\text{m}$  of the outer enamel layer to expose the lesion [7]. This technique leads to a good, real and fast improvement in labial tooth surface appearance [7, 16]. Because orthodontic WSLs predominantly affect the young patient population, long-term prognosis of the restored teeth is a significant concern and a less invasive restorative technique is preferable [17].

We performed Icon resin infiltration treatment in four young patients presenting with post-orthodontic WSLs on the upper and lower arch. Etching was repeated up to three times, according to the manufacturer's instructions. Three of the patients showed a complete esthetic resolution of the enamel color abnormalities.



**FIGURE 30.** Patient No. 4. Post operative view of the lower arch



**FIGURE 31.** Patient No. 4. Post operative view of the lower arch

In one case, where a combination of severe fluorosis and WSLs was present, and laminate veneers could be indicated, some of the WSLs were still visible at the end of treatment.

The two main open questions regarding the esthetic outcome of therapy of WSLs are color stability of the treated teeth over time and the capability of predicting patients' responses based on the underlying etiology of the treated lesions. According to the findings of Denis *et al.* [2] pathological diagnosis of enamel hypomineralization is a mandatory prerequisite to start Icon treatment. Moreover, when the location of the defect is beyond the enamel layer, greater caution should be advised.

As reported in a recent systematic review of the published literature [3], the follow-up period for color stability of the treated WSLs is usually very short (12 months) and the effect of aging on such restorations is unknown. This suggests the need for studies to assess this parameter during a long-term follow-up.

In conclusion, our case series illustrates the possibility of treating WSLs due to orthodontic treatment with Icon resin infiltration, which can mask tooth color abnormalities. Studies with longer observation periods and involving larger patient populations are needed to validate the clinical significance found in our case series.

## CONFLICT OF INTEREST

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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