

The Effectiveness of Bleaching on White Spot Lesion Treated with Resin Infiltration Technique

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Abstract: *This study, conducted in the dental department at King Hussein Medical City in Amman, Jordan, involved twenty patients with white spot lesions treated using resin infiltration and bleaching techniques. Patients were divided into four groups: Nonbleached NB n=5, Bleached B n=5, Resin Infiltrated Nonbleached RNB n=5, and Resin Infiltrated Bleached RB n=5. Baseline color measurements were performed using a Vita shade guide. A 35% hydrogen gel was applied for 20 minutes in the B and RB groups, while resin infiltration was performed in the RNB and RB groups. Color changes (ΔV) were calculated before and after treatment. Statistical analysis using one-way ANOVA and Tukey's test showed significant differences among groups in ΔV values, with the NB group exhibiting the least color alteration. Results showed that resin infiltration enhanced the appearance of white spot lesions by masking them, while bleaching alone was less effective. Combining both techniques did not significantly improve outcomes compared to using resin infiltration alone. These findings suggest that while resin infiltration is beneficial for improving tooth aesthetics, its combination with bleaching may not offer additional benefits.*

Keywords: bleaching, resin infiltration, dental aesthetics, white spot lesions, hydrogen peroxide

1. Introduction

Initial carious lesions of tooth enamel appear whitish due to underlying internal porosity, even when the surface layer seems intact¹. Laboratory test showed some degree of remineralization in images that contains white spot lesions of various shapes. The use of fluoride^{2,3} has been proven through clinical studies to maintain the stability of white spot lesions in the long term. Both demineralization and remineralization processes, along with fluoride, significantly impact these lesions.^{4,5} This means that the initial decay of tooth enamel can be stopped, and the clinical presentation of chalky and rough can be changed to more shiny and smooth natural appearance, signifying an inactive lesion that rarely disappears clinically.^{4,6} One issue still can appear, that the white spots may develop during the retention process, causing further damage and aesthetic deterioration.⁷

Caries infiltration is a known therapeutic technique which is used to stop the progression of these lesions. This process includes the use of a low-viscosity resin that penetrates the porosity of tooth enamel, blocking the spread of cariogenic acids and mineral loss.^{8,9} A further benefit of the caries infiltration technique is its capability to diminish the whitish appearance of a lesion by infiltrating and hardening a low-viscosity resin within the lesion's structure, which helps restore the natural look of the enamel. This technique not only prevents the progression of early carious lesions but also enhances aesthetics by effectively camouflaging white spot lesions.^{7,8}

Color is a crucial factor influencing the aesthetics of teeth; affected by both the natural tooth color and the presence of external stains.¹⁰ In recent years, the popularity of teeth whitening agents has surged due to the increasing desire to address unwanted aesthetic spots on teeth. These products commonly feature hydrogen peroxide or carbamide peroxide as their main active ingredients, effectively targeting discoloration and enhancing the overall appearance of teeth.¹¹

Stained enamel opacities (SEO) are frequently encountered in dental practice. These are defects in the dental enamel quality, presenting as yellow to brown discolorations and are histologically identified as hypo mineralized. In contrast to unstained enamel opacities, which exhibit a bright, opaque appearance without any pigmentation in the hypo mineralized enamel, SEOs are distinguished by their distinct pigmentation.^{12,13} The underlying etiologies of SEO are varied, but they can be broadly categorized into post eruptive and pre eruptive damages. Pre eruptive damage results from dysfunctions in the enamel organ caused by various agents, leading to conditions such as fluorosis, traumatic hypo mineralization, and molar-incisor hypo mineralization (MIH).^{14,16} Post eruptive damage, however, is a result of the early stages of the carious process, leading to lesions known as brown spots.^{17,18}

From an aesthetic perspective, conservatively treating SEO with the resin infiltration procedure is complex and often ineffective, as it can lead to stain reemergence and an unpleasant aesthetic outcome. Consequently, aesthetic management of SEO using only the resin infiltration technique is generally avoided. More invasive treatments, such as composite restorations, veneers, or crowns, are typically employed to correct the aesthetic defects^{18,20}. Biologically, however, resin infiltration is a preferred therapeutic option for aesthetically managing SEO, as it corrects the aesthetic defect in a minimally invasive manner while improving the mechanical properties of the lesions.^{16,18,21,22}

There is limited research on the aesthetic management of stained enamel opacities (SEO) using the resin infiltration technique. The purpose of this study is to compare the effectiveness of resin infiltration and bleaching techniques in treating white spot lesions, evaluating their impact on the aesthetics of the treated teeth. The whitening effect is achieved through the application of hydrogen peroxide directly to the tooth surface, which serves as the primary mechanism of action for these agents. When carbamide

peroxide is applied, it releases hydrogen peroxide, which diffuses into the tooth enamel and dentin, causing oxidation of chromogenic molecules and leading to tooth brightening.^{23, 24} When the white spot is obscured by the caries infiltration technique, the chalky white appearance is removed, and the area is restored to its original enamel color. However, this can cause confusion for patients accustomed to the presence of white spots and may motivate them to seek whitening treatments. Penetration of the resin infiltrates can act as a blocking agent in white spot lesions, potentially altering the permeability of tooth enamel to bleaching agents and complicating whitening treatments.

Resin infiltration into labial white spot lesions may be desirable for improving aesthetics. However, if a general change in tooth color is desired, whitening treatment should be conducted before resin infiltration due to the presence of light-curing resin in the infiltration technique. The null hypothesis tested was that the application technique of infiltration resin for treating white spot lesions does not interfere with the whitening effect.

2. Materials and methods

The study was conducted in the dental department at King Hussein Medical City in Amman, Jordan, involving twenty patients with white spot lesions treated using resin infiltration and bleaching techniques. The patients were divided into four groups: Nonbleached NB n=5, Bleached B n=5, Resin Infiltrated Nonbleached RNB n=5, and Resin Infiltrated Bleached RB n=5. Baseline color measurements were performed using a Vita shade guide. For the bleached groups, a 35% hydrogen gel was applied in-office for 20 minutes, and color measurements were taken after bleaching.

The 35% hydrogen gel was used as an in-office bleach for 20 minutes for the B and RB groups. The resin infiltration technique was performed on the RNB and RB groups. Color measurements were done with a Vita shade guide before and after the treatment for each patient. The change in color was calculated as a value, representing the perception of how many shades changed, with the abbreviation ΔV as the parameter. However, the comparison between the RB and RNB groups showed no significant differences in ΔV values. Subsequently, the total change in color perception for each patient was calculated. The data were statistically analyzed using one-way ANOVA and Tukey's test at a significance level of 0.05.

3. Results

The application of one way ANOVA revealed significant differences among the groups when evaluating the V parameter. The Tukey test indicated that the NB group displayed the lowest color alteration, significantly lower than the B group.

This study is significant as it provides insights into the aesthetic management of white spot lesions, a common dental issue, using minimally invasive techniques, thereby informing clinical practice on effective treatment modalities.

4. Discussion

While the primary objective of resin infiltration for white spot lesions is to halt the progression of caries, an additional benefit of this technique is the immediate improvement in aesthetics, especially when applied to specific white spot lesions. This method is less invasive than microabrasion using hydrochloric acid and pumice stone, which is often employed to enhance the appearance of white spot lesions. It can also be combined with conventional aesthetic restorations for more severe cases.^{7, 8} The effectiveness of caries infiltration in masking white spot lesions and restoring the natural appearance of demineralized tooth enamel has been documented in previous studies.^{7, 8, 27}

Although the aesthetic results can be unpredictable, there is typically a notable enhancement in tooth appearance following resin infiltration, even if the entire white spot lesion is not completely concealed. The success of the treatment may depend on the depth and activity of the lesion, with better outcomes often observed in more active and younger lesions where the surface layer is thinner and the lesion is shallower.²⁸

Once these white spot lesions are concealed, some patients may notice a 'darkening' of their teeth, as the removal of the white appearance exposes the natural tooth color. This could lead patients to seek bleaching treatments following caries infiltration. In such cases, the presence of resin within the tooth structure may affect the whitening gel's effectiveness. While this study artificially created caries on enamel to replicate active white spot lesions on the labial surface, the specimens consisted of both enamel and dentin to accurately simulate the tooth's optical properties. The perceived color is influenced by the diffuse reflectance of light from the dentin through the enamel layer.²⁹

The findings of this study align with those of Gugnani et al., who assessed the impact of resin infiltration, bleaching, and their combination on non-pitted fluorosis stains. They found the most favorable results in the group treated with a double application of the resin infiltrate, followed by the resin infiltrated group, then the bleached and resin infiltrated group, with the least improvement in the bleached group.²⁵ Similarly, Schoppmeier et al. reported a greater reduction in color difference from baseline following resin infiltration compared to light-activated office bleaching for treating enamel fluorosis, although a direct statistical comparison was not made.²⁶ Conversely, Torres et al. showed that resin infiltration increased enamel fluorescence immediately, whereas bleaching reduced the fluorescence to baseline levels.²⁹ Araujo et al. found a higher L* value upon bleaching of stained white spot lesions compared to non-stained lesions treated with resin infiltration, although no direct statistical comparison was made.²⁷

Despite this, it can be argued that fluorescence changes do not directly correlate with color changes. Conversely, Horuzetepe et al. found no statistically significant difference between resin infiltration and office bleaching when comparing the color change from baseline.²⁸ It can be suggested that a single bleaching application may not suffice to camouflage the color of white spot lesions. However, the goal of this study was not

to evaluate the efficacy of bleaching in masking white spot lesions per se.²⁹

5. Conclusion

This study highlights the aesthetic benefits of using resin infiltration to treat white spot lesions, showing it as a viable option for improving tooth appearance. While combining resin infiltration with bleaching does not significantly enhance color changes beyond individual treatments, it may still be considered for specific cases. Further research is needed to explore the long term effects and color stability of these treatments.

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