Case Report

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Resin infiltration applications in white spot lesions with caries cavities

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ABSTRACT

White spot lesions (WSLs) describe the initial stage of caries and appear more opaque and white than normal enamel due to changes in the refractive index of light compared to the normal enamel structure. This condition can cause aesthetic concerns for the patient. The primary cause of its formation is poor oral hygiene and excessive plaque accumulation. In the approach to treatment, significant innovations have occurred over time, and the principle of preserving the tooth structure as much as possible has been adopted instead of removing dental tissue and make restoration. The resin infiltration (RI) technique is believed to reduce the amount of dental tissue that needs to be removed in the treatment of WSLs with cavitated carious lesions while meeting the patient's aesthetic expectations. This present case report describes the application and follow-up of the RI technique in pediatric patients with cavitated carious lesions adjacent to WSLs in maxillary anterior teeth. Following RI treatment according to the recommendations of the manufacturer, composite restoration was applied to the teeth deemed necessary for restoration, in two male patients aged 14 and 8, who presented with caries cavities.

Keywords: Caries, resin infiltration technique, white spot lesions

INTRODUCTION

In the initial stage of caries formation, the opaque and white-colored demineralization areas on or beneath the enamel surface are referred to as white spot lesions (WSL).[1,2] In the early stages, WSLs appear more opaque and white than normal due to a porous structure in the lesion body, while the surface initially remains intact, causing a change in the light refractive index. The primary cause of WSL formation is often demineralization resulting from poor oral hygiene. Although commonly observed after orthodontic treatment, WSLs frequently occur in the cervical area adjacent to the gingiva and on the vestibular surface of the tooth in patients with poor oral hygiene. It is noted that WSLs could start to develop within a short period, approximately 1 month, after the placement of brackets in orthodontic treatment, but the formation of cavitation requires a longer period, around 6 months.[3-6] Risk factors may include poor oral hygiene, altered saliva flow, and the presence or absence of fluoride.[6-8]

In the treatment of WSL, the goal should be to stop demineralization while also supporting remineralization. While the conventional treatment approach involves removing demineralized tooth structure and performing restoration, the importance of minimal invasive (MI) treatment procedures has increased to preserve dental structure as much as possible.[7] For these reasons, the use of various fluoride-containing preparations and topical applications, agents supporting remineralization such as casein phosphopeptide-amorphous calcium phosphate (CPP-ACP), xylitol, hydroxyapatite, tricalcium phosphate, the use of resin infiltration (RI) technique, and the application of 18% hydrochloric acid (HCl) with microabrasion are considered as primary treatment preferences in the MI approach for WSL treatment.[7,8]

The RI technique may be considered more advantageous due to the potential disadvantages of many topically applied agents among the mentioned treatment options. These disadvantages include the need for long-term patient cooperation, delayed results, and the risk of the remineralizing powwer being limited to the outer surface of the enamel only.[8] There is limited evidence in the literature regarding the combined application and evaluation of RI and composite restoration in the treatment of WSL with caries cavities. The purpose of this study is to present cases evaluating the effectiveness of RI technique in conjunction with composite restoration material in the treatment of WSLs adjacent to caries cavities in children with poor oral hygiene. In both cases, detailed information was provided to the patient and their family, and signed consent forms were obtained before the treatment.

CASE 1

The 14-year-old male patient and his family, with no significant medical history, complaint aesthetic concerns about the appearance of WSLs on the vestibular surface of the maxillary anterior teeth. Periodontal prophylaxis was administered, and guidance on oral hygiene was provided

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in the first session. After isolation using rubber dam and dental floss, ICON® (DMG, Hamburg, Germany) application was decided for WSLs on teeth 11, 12, 13, 14, 21, 22, 23, and composite restoration was planned for teeth 12 and 23, where cavitation was detected at the beginning of the treatment at the next session. Following the application of ICON-Etch containing 15% HCl acid for 2 minutes and ICON-Dry with 30 seconds of ethanol rinse according to the manufacturer's recommendations. Acid application was repeated three times in total based on this examination. Then, ICON-Infiltrant containing tetraethylene glycol dimethacrylate (TEGDMA) was applied to the vestibular surfaces of the specified teeth, waiting for 3 minutes, and polymerized with Elipar DeepCure-S Light Device (3M Oral Care, St. Paul, USA) for 40 seconds. Another one minute of ICON-Infiltrant application followed by 40 seconds of light curing was performed, and it was noted that the white spot lesions (WSL) disappeared. It was determined that there was no need for composite restoration on tooth 12. To make a better assessment of the need for composite restoration on all teeth, the patient was recalled two days later, and it was decided to perform composite restoration only on tooth 23. G-Premio universal bond (GC Corp., Tokyo, Japan) was used as the adhesive agent, and G-aenial anterior (GC Corp., Tokyo, Japan) A2-colored composite was applied according to the manufacturer's recommendations (Figure 1).

Figure 1. Treatment pictures for Case 1. (a) Initial intraoral view, (b) Intraoral view after applying rubber dam, (c) ICON-Etch application, (d) View after applying ICON-Infiltrant, (e) Intraoral view after removing rubber dam, (f) Intraoral view after composite restoration on the vestibulocervical of tooth 23

CASE 2

An 8-year-old male patient without any medical conditions and his family visited our clinic due to general dental examination and concern about the appearance of his maxillary anterior teeth. It was decided to apply ICON® to teeth 11, 12, 21, 22, and to restore the interproximal caries lesions of teeth 11 and 21 with composite. The teeth were isolated using rubber dam and dental floss. ICON-Etch was applied to the WSLs on the isolated teeth for 2 minutes, and after rinsing with water, visual assessment of the lesions was performed using ICON-Dry after 30 seconds of its application. Based on these assessment results, ICON-Etch was applied three times in total, and treatment procedures were completed in the first appointment, similar to Case 1. One week after the ICON® application, the caries in the interproximal surfaces of teeth 11 and 21 were carefully removed with high speed handpiece, and the teeth were restored using the same materials as in Case 1 (Figure 2).

Figure 2. Treatment pictures of Case 2. (a) Initial intra-oral view, (b) Intra-oral view after rubber dam placement, (c) ICON-Etch application, (d) Appearance after ICON-Infiltrant application, (e) Intra-oral view after rubber dam removal, (d) Intra-oral view after removal of carious tissue and composite placement on the interproximal surfaces of teeth 11 and 21

The fluoride toothpaste using was recommended to both patients to support the remineralization process. In the 3-month follow-ups of both cases, visual comparisons based on end-of-treatment photographs clinically recorded no discoloration, indicating the success of the treatment (Figure 3).

Figure 3. (a) 3-month follow-up picture for Case 1, (b) 3-month follow-up picture for Case 2

DISCUSSION

In the treatment of WSL, known as initial carious lesions, there are numerous different invasive and non-invasive treatment procedures available.[9] In today's context, where the importance of preserving tooth structure has increased, RI technique is a highly successful method that can be employed. For this purpose, ICON®, commercially developed and available in the market, is frequently used, and it constitutes a kit consisting of three syringes with different contents. It includes ICON-Etch containing 15% HCl, ICON-Dry containing ethanol, and ICON-Infiltrant containing TEGDMA.[1] ICON-Etch exhibits a caryostatic effect on bacteria present in the lesion, while ICON-Infiltrant facilitates better penetration into the lesion. ICON-Dry is used to remove excess water from the lesion and to allow for a more accurate visual assessment. ICON-Infiltrant fills the porous structure of the lesion, preventing bacterial growth and ensuring that the refractive index of the lesion is close to that of enamel.[5] These case reports aim to describe the treatment of WSLs with caries cavities, with minimal tissue removal from the tooth structure, using combinated different treatment methods.

Simon and colleagues[10] evaluated the effectiveness of RI and CPP-ACP application in the treatment of post-orthodontic WSLs. They noted that both methods could achieve permanent and desired aesthetic improvement, suggesting that the use of both could be recommended. Torres et al.[11] in 2011 reported that RI technique was more effective than fluoride application in the treatment of WSLs. In this case report, considering the high aesthetic expectations of the patients, the treatment duration, and cooperation, the RI technique has been preferred.

Omota and colleagues[1] stated that the RI technique is an effective and successful MI method in stopping the progression of caries in the patient's anterior teeth in their case report. Cazzolla et al.[8] used the RI technique in the treatment of cavity-free WSLs observed after orthodontic treatment in their case report. They mentioned that, there was no clinically observed recurrence of caries or significant discoloration on the teeth where the application was performed after 4-year long-term follow-up. In Sadıkoğlu's[9] case report, combined approach of RI technique and composite restoration was applied in the treatment of teeth with both WSLs and cavitated caries. It was mentioned that the visibility of white opaque lesions disappeared, composite could be applied without the need for invasive removal of tooth structure, and there were no issues reported during the 1-year long-term follow-up.[9] In contrast to this case report, in the case 2, the use of a high-speed handpiece was required to remove carious tissues on the interproximal surfaces. However, it is considered that the RI application still reduced the amount of tissue that would need to be removed compared to if it had not been applied. The shorter follow-up duration in this study is another limitation.

Torres et al.,[12] treated a tooth with molar incisor hypomineralization using a combination of macroabrasion, RI technique, and composite restoration, stated that after applying ICON-Infiltrant in the same session, composite restoration could be performed without the need for reapplication of an adhesive agent. In these case reports, since the restoration material could not be applied on the same day in both cases, it was deemed necessary to perform etching and subsequent adhesive agent application on the restored teeth. However, there is a need for studies comparing the long-term outcomes, including discoloration and bond strength, of restorative procedures performed with or without the application of adhesive agent at the same day.

CONCLUSION

The RI technique is minimally invasive and non-traumatic method that can be used in the treatment of WSLs, proving to be highly effective and successful in remineralizing the lesion and filling sub-surface porosities. Additionally, the advantage of having a treatment duration of no more than a few sessions is significant compared to other treatment options.

ETHICAL DECLARATIONS

Informed Consent

The patient signed and free and informed consent form.

Reviewer Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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