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COMO A INFILTRAÇÃO RESINOSA PODE REDUZIR A PERCEPÇÃO DE LESÕES DE MANCHA BRANCA INATIVAS?

HOW CAN RESIN INFILTRATION REDUCE THE PERCEPTIVENESS OF INACTIVE WHITE SPOT LESIONS?

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RESUMO

Embora o infiltrante resinoso tenha sido amplamente usado para tratar lesões de manchas brancas, seu uso tem se concentrado em lesões de cárie inicial ativa. Este tratamento alternativo para tais lesões desmineralizadas foi idealmente proposto para tratá-las especialmente em pacientes não colaboradores. Outra grande vantagem é que também pode penetrar profundamente na lesão, diminuindo sua descoloração branca. No entanto, poucos estudos foram realizados avaliando o efeito dos infiltrantes de resina nas lesões de manchas brancas inativas/mineralizadas, pois as lesões inativas correspondem a uma superfície externa menos porosa e mais resistente, o que poderia dificultar a infiltração da resina. O objetivo deste estudo foi relatar um caso em que um infiltrante de resina foi usado em lesões de mancha branca inativas/mineralizadas para melhorar a estética de dois incisivos centrais superiores e um incisivo lateral superior direito. A superfície foi condicionada com ácido clorídrico 15% (Icon Etch®), seca com etanol (Icon Dry®) e infiltrada com Icon Infiltrant®. Imediatamente após a aplicação do produto, a descoloração desses dentes era imperceptível. Após 24 meses, a lesão da mancha branca ainda era imperceptível e não havia manchamento. Pode-se concluir que a infiltração de resina também pode ser uma alternativa para tratar esteticamente as lesões de manchas brancas após se tornarem inativas, evitando outras opções de tratamento que poderiam levar a um maior desgaste da superfície dentária, como a microabrasão.

Palavras-chave: Cárie Dentária. Estética Dentária. Ortodontia. Remineralização Dentária.

ABSTRACT

While resin infiltrant has been extensively used to treat white spot lesions, its use has been focused on active early caries lesions. This alternative treatment for such demineralized lesions was ideally proposed to treat them especially in non-compliant patients. Other major advantage is that it can also deeply penetrate within the lesion, diminishing its white discoloration. Nonetheless, few studies were conducted evaluating the effect of resin infiltrants on inactive/mineralized white spot lesions, as inactive lesions correspond to less porous and more resistant outer surface, which could hamper the infiltration of the resin.

The aim of this study was to report a case in which a resin infiltrant was used on inactive/mineralized white spot lesions to improve the esthetics of two maxillary central incisors and a right lateral incisor. The surface was conditioned with 15% hydrochloric acid (Icon Etch®), dried with ethanol (Icon Dry®) and infiltrated with Icon Infiltrant®. Immediately after the application of the product, the discoloration of these teeth was imperceptible. After 24 months, the white spot lesion was still imperceptible and no stain could be seen. It can be concluded that resin infiltration can be also an alternative to esthetically treat white spot lesions after they become inactive, avoiding other treatment choices that could lead to more wear of the tooth surface, such as microabrasion.

Key words: Dental caries. Dental esthetics. Orthodontics. Tooth remineralization.

INTRODUCTION

Dental caries is a disease that leads to the dissolution of the tooth's apatite crystals by acids produced by bacteria in a maturated biofilm. The first clinical signal noted by the dentist is a subsuperficial lesion known as white spot lesion. The lesion is composed by an outer pseudo-intact surface with a demineralized subsurface, and its visibility is only possible due to the difference of refractive indexes between apatite crystals, water and air (KIENLE; MICHELS; HIBST, 2006). The presence of water or air in the pores of the demineralized/caries-affected enamel cause light scattering, which result in the appearance of a white discoloration (KIENLE; MICHELS; HIBST, 2006).

In the dental caries management, it is mandatory to promote the removal and control of cariogenic biofilm by toothbrushing, yet its effectiveness depends on patient compliance (DOMÉJEAN; BANERJEE; FEATHERSTONE, 2017; ISMAIL et al., 2015). Additionally, in order to control the caries activity of the patient and preserve tooth structure by preventing the formation of a cavity, based on the caries-risk approach, the dentist can use remineralizing agents, such as highly concentrated fluoride varnishes and gels (MARINHO et al., 2003; MARINHO et al., 2004). Many studies have evidence the remineralizing potential of different fluoridated vehicles in respect to dental caries (DE AMOÊDO CAMPOS VELO et al., 2020; MARINHO et al., 2003; MARINHO et al., 2004; SALOMÃO et al., 2017).

However, despite highly concentration fluoride vehicles promoting a reduction of the permeability of the outer surface of enamel, they also prevent the diffusion of minerals within the lesion (GOORHUIS; PURDELL-LEWIS, 1986; LAGERWEIJ; TEN CATE, 2002; ØGAARD, 2001; TEN CATE; JONGEBLOED; ARENDS, 1981), hampering the remineralization to occur deeply within the lesion. Consequently, when remineralized, the white spot lesion seems to diminish and to be more lustrous, but may not disappear completely, which may compromise the esthetics of patients.

One alternative to treat them is resin infiltration. These infiltrants are light curable resins mainly composed by triethylene glycol dimethacrylate (TEGDMA) that were developed to penetrate into the pores of a white spot lesion and hamper the diffusion of acids, arresting the progression of dental caries (FREITAS et al., 2018; PARIS; MEYER-LUECKEL, 2010; PARIS; MEYER-LUECKEL; KIELBASSA, 2007; WANG et al., 2021). So, for that to be possible, the outer surface of the enamel needs to be etched with an acid to allow the penetration of the resin (MEYER-LUECKEL; PARIS; KIELBASSA, 2007).

The main advantage of this treatment is that it does not depend on patient compliance to be successful and resin infiltrants own a refractive index similar to the apatite crystals, so the discoloration can be less perceived. Many studies have been conducted comparing the improvement in esthetics after infiltration of active white spot lesions (GENÇER; KIRZIOĞLU, 2019; MUÑOZ et al., 2013; PARIS; MEYER-LUECKEL, 2009; THEODORY et al., 2019; TORRES; BORGES, 2015).

Nonetheless, in inactive (remineralized) white spot lesions, the outer surface becomes less porous and more resistant (LAGERWEIJ; TEN CATE, 2002), which may hamper the infiltration of the resin. So, in cases of persistent lesions, micro-abrasion is not an uncommon elective treatment (JAHANBIN et al., 2015; RODRIGUES et al., 2013; SOUZA DE BARROS VASCONCELOS et al., 2014). Though, when this procedure is elected, some level of tooth wear is promoted (RODRIGUES et al., 2013).

Since there are few studies using resin infiltrants in inactive white spot lesions (SENESTRARO et al., 2013), this case report aimed to contribute to the scientific literature by evidencing the use of a resin infiltrant (Icon®, DMG, Germany) in an inactive white spot lesion in respect to reducing its perceptiveness while preserving tooth structure.

CASE REPORT

A 33-year-old male patient sought the local clinic complaining about the white spots present in the buccal surface of his maxillary central incisors and right maxillary lateral incisor and wear of the incisal edges of his front teeth (Figure 1).

Figure 1: Initial aspect of the patient's maxillary front teeth. White spot lesions can be seen on the central incisors and right lateral incisor, as well as their chipped incisal edges.

Source: The authors.

During the anamnesis, the patient informed that he used to intake soft drinks many times per day and informed that he had undergone orthodontic treatment. Upon clinical examination, the patient presented previous history of dental caries, suggested by posterior teeth, which were properly restored. He also presented current good oral hygiene habits, and was aware of his sleep bruxism before orthodontic treatment. However, after this treatment, sleep bruxism was not noticed by the patient anymore.

The treatment plan included dietary orientation, removal of the white spot lesions and restorative treatment of the incisal edges of his maxillary incisors with composite resin.

To treat the discoloration of the mentioned incisors, microabrasion or even the placement of a composite resin restoration could be elected. However, by following the principles of minimal intervention dentistry, resin infiltration was considered due to its advantage and capacity to preserve dental structure, and, if it was ineffective, invasive treatments could be carried out later.

After the patient's consent, the shade of his maxillary incisors was selected under natural light and then a rubber dam was placed. Considering the etiology of caries lesions, resin infiltration using Icon® (DMG, Germany) was elected as a microinvasive treatment, since the placement of a direct restoration would result in more tooth loss.

For that, the teeth were cleaned with pumice powder and then Icon Etch® (15% hydrochloric acid) was applied for 2 minutes, following the manufacturer's instructions (Figure 2). After that time, the acid was rinsed and the enamel surface was dried using Icon Dry® (99% ethanol) for 30 seconds. At this stage, as stated by the manufacturer, the white discoloration is supposed to diminish or even disappear.

As inactive white spot lesions are known to have a mineralized surficial layer, after application of Icon Dry®, the discoloration did not diminish, so other two one-minute applications of Icon Etch® were conducted, followed by water rinsing and application of Icon Dry® (Figure 3). Thereafter, Icon Infiltrant® was applied for 3 minutes using the smooth surface nozzle (Figure 4). The excesses were removed using dental floss and the tooth was light cured for 40 seconds with Radii-Cal (1,200mW/cm^2, SDI, Victoria, Bayswater, Australia). Then a second application of the Icon Infiltrant® was conducted for 1 minute and light cured for another 40 seconds.

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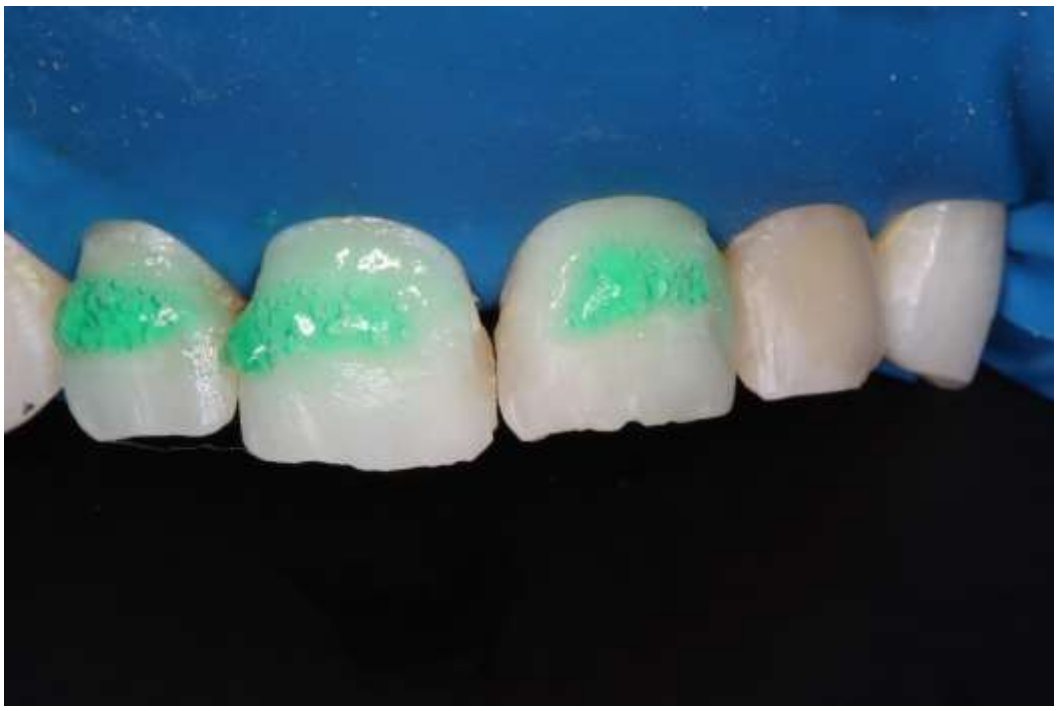
Figure 2: Etching of the teeth enamel with 15% hydrochloric acid (Icon Etch®) in order to remove the superficial mineralized layer to allow resin infiltration within the enamel.



Source: The authors.

Figure 3: Drying the enamel by inserting ethanol (Icon Dry®) inside the pores of the white spot lesion in order to remove water. Discoloration diminished after applying Icon Dry®.

Source: The authors.

Figure 4: Infiltration of resin (Icon Infiltrant®) within the white spot lesion.

Source: The authors.

The disappearance of the white discolorations was noticed immediately after the second application of the infiltrant (Figure 5). Thenceforth, the restorative treatment of the incisal edges was initiated by beveling the enamel with a low-speed 3118 diamond bur. Etching with 37% phosphoric acid was conducted for 30 seconds, followed by application of the bonding agent of a self-etching adhesive system (FL Bond II, Shofu, Japan). The incisal edges were restored with nanohybrid composite resin (Spectra Smart A1, Dentsply Sirona, York, PA, USA), followed by the usage of a finishing carbide burs (KG Sorensen Ind. e Com. Ltda., Barueri, SP, Brazil) and Super Snap polishing discs (Shofu, Japan) and a silicon carbide brush. The final aspect of the restorations can be seen in Figure 6.

Figure 5: Final aspect of the front teeth after resin infiltration. Due to similarity of refractive index between hydroxyapatite and Icon Infiltrant®, the white spot lesion diminishes.

Source: The authors.

Figure 6: Final aspect of the teeth after composite resin restoration. The white spot lesions and the chipped incisal edges were properly treated.

Source: The authors.

The patient informed that after the orthodontic treatment, he no longer felt any facial discomfort and no longer clenched his jaw during sleep. Hence, he was oriented regarding the issues of not wearing an oral appliance during sleep to protect his teeth and the restorations on the incisal edges of the incisors. Yet, as wished by the patient and since he reported no symptoms of sleep bruxism, no oral appliance was installed.

After two years, the patient was reassessed and no tooth discoloration or chipping of the restoration was noticed. Therefore, polishing of the restoration was conducted (Figure 7). The patient also reinforced that he no longer felt any facial discomfort due to sleep bruxism.

Figure 7: Follow-up after 2 years. Proper aesthetics provided by the masking ability of the resin infiltrants and the composite resin on the incisal edges of the central incisors and right lateral incisor.

Source: The authors.

DISCUSSION

Without the advent of resin infiltration, the treatment for carious white spot lesions relied solely by remineralizing agents, mainly represented by high-concentrated fluoride vehicles or other remineralizing products, such as casein phosphopeptides amorphous calcium and phosphate (CPP-ACP) (DE AMOÊDO CAMPOS VELO et al., 2020; MARINHO et al., 2003; MARINHO et al., 2004).

White spot lesions are constituted by a pseudo-intact mineralized surface on top of a subsurface with lower concentration of minerals. Due to the porosity of the outer surface, the dissolution of the subsuperficial apatite crystals can occur. So, in order to achieve deep mineralization, frequent applications of low-concentrated fluoridated vehicles are desirable. However, professional fluoridated products are commonly high-concentrated, such as gels and varnishes. These vehicles increase the amount of CaF_2 on the tooth surface, which works as a slow-release depot (LAGERWEIJ; TEN CATE, 2002; RØLLA; SAXEGAARD, 1990).

Nonetheless, higher concentrations lead to an occlusion of the outer surface pores, so these pores become less permeable and prevent the diffusion of minerals within the lesion (GOORHUIS; PURDELL-LEWIS, 1986; LAGERWEIJ; TEN CATE, 2002; ØGAARD, 2001; TEN CATE; JONGEBLOED; ARENDS, 1981). Therefore, these high-concentrated products' mineralizing mechanism consist solely on reinforcing the superficial layer by enhancing its mechanical properties in order to prevent further cavitation. Consequently, in such cases, after remineralized, the white spot lesion seems to diminish and to be more lustrous, but does not disappear completely.

This diminishing occurs due to the differences between the refractive index of hydroxyapatite (HAp) crystals (1.62), water (1.33) and air (1.0) (KIENLE; MICHELS; HIBST, 2006). When the pores of enamel are wide and filled with water or air, the differences in these two substrates' indexes produce light scattering, resulting in the appearance of a white spot. When mineralization occurs, the precipitation of mineral content seems to produce some HAp crystals, diminishing the white aspect, yet, when the white lesion is too deep, it cannot be completely remineralized and the white aspect still remains.

The resin infiltrant owns a similar refractive index to the one of HAp (1.51) (WANG et al., 2021), hampering light scattering and allowing the disappearance of the discoloration if properly penetrated within the lesion. In order for that to be possible, an acid etching step is conducted to promote some level of dissolution of the hypermineralized superficial layer. In inactive white spot lesions, the acid step is more likely to be repeated because the superficial layer is more mineralized than in active lesions. A previous study comparing the use of 37% phosphoric acid and 15% hydrochloric acid has evidenced that the latter resulted in better dissolution of such layer and deeper

infiltration was achieved (MEYER-LUECKEL; PARIS; KIELBASSA, 2007). Also, a recent in vitro study reported that the inclusion of a phosphoric acid ester in the composition of the infiltrant resulted in deeper penetration within the white spot lesion without requiring previous etching with hydrochloric acid (WANG et al., 2021). Nonetheless, it is important to highlight that etching with hydrochloric acid still promotes less wear on the tooth surface (15μm) (PARIS; DÖRFER; MEYER-LUECKEL, 2010; TEREZA et al., 2016) than wear promoted by micro-abrasion (33-38μm) (RODRIGUES et al., 2013), a common procedure conducted on white lesions on enamel.

Several published studies addressed the disappearance of white lesions after resin infiltration (GENÇER; KIRZIOĞLU, 2019; MUÑOZ et al., 2013; PARIS; MEYER-LUECKEL, 2009; THEODORY et al., 2019; TORRES; BORGES, 2015), yet only one clinical trial applied this product on arrested white spot lesions and has proven to be effective to diminish its discoloration (SENESTRARO et al., 2013).

Other concern with this patient is his dietary habits regarding dental erosion. As well stablished in literature, dental erosion occurs due to the contact of an acid of non-bacteria origin (LUSSI, 2006; LUSSI et al., 2011; MAGALHÃES; WIEGAND; BUZALAF, 2014). This allows the softening of the tooth mineralized tissues and makes to tooth more prone to wear upon mechanical challenges, such as brushing and chewing (LUSSI et al., 2011; MOSQUIM et al., 2017; VERTUAN et al., 2020).

Some recent studies addressed the effectiveness of fluoride-based varnishes and solutions in remineralizing eroded enamel and dentin (MOSQUIM et al., 2019; VERTUAN et al., 2021). But after resin infiltration, some studies have also evidenced that the presence of the infiltrant on the tooth surface is able to prevent the progression of further erosion lesions (OLIVEIRA e al., 2015; RIOS et al., 2019; TEREZA et al., 2016). This happens because the presence of the resin-based material works as a protective barrier, hindering the contact of the acid with the tooth surface, preventing the dissolution of HAp crystals. This technique presents some advantages because it does not depend on the patient's compliance to be affective, unlike the use of fluoridated vehicles.

The patient was also oriented regarding his intake of soft drinks in order to hamper the progression of erosive tooth wear, once the erosive challenge promoted by soft drinks play an import role at softening the tooth structure.

CONCLUSION

Resin infiltration of inactive/remineralized carious white spot lesions seem to be an effective treatment to diminish the discoloration of such lesions while preserving the tooth tissue, as proposed by minimal intervention dentistry.

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