CASE REPORT

Infiltrating Resins, Noninvasive Treatment of White Spot Lesions: A Case Report

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ABSTRACT

Demineralization of tooth enamel causes milky, opaque white-spot lesions (WSL).

Aim: The aim was to use infiltrating resin as a noninvasive technique on the removal of WSL.

Case description: An 18-year-old female patient presented to a dental consultation complaining about “the spots in her front teeth”; the patient had recently finished her orthodontic treatment. The clinical examination identified WSL on the vestibular surfaces of teeth 11, 21, and 22. A minimally invasive treatment was selected with infiltrating resin (ICON Smooth surface, DGM, Germany). After absolute isolation of the upper anterior sector, the teeth with the WSL were conditioned with 15% hydrochloric acid for 2 minutes and rinsed with abundant profuse water for 30 seconds. Ethanol was applied for 30 seconds and volatilized with oil-free air for 20 seconds. The infiltrating resin was placed and left to act for 3 minutes to allow infiltration in the previously etched area. The excess resin was removed, and light cured for 40 seconds with a LED light-curing lamp (Bluephase N® MC, Ivoclar Vivadent, 800 mW/cm², 430–490 nm).

Conclusion: The WSL were successfully removed, stopping the demineralization process. The use of infiltrating resins is an excellent noninvasive treatment to eliminate WPL timely with excellent clinical results.

Clinical significance: One of the challenges in dental esthetics are visible WSL in the anterior region. Considering the minimally invasive treatments, the use of infiltrating resins is indicated to treat these WSL, as an indication of an initial caries or certain degrees of fluorosis.

Keywords: Case report, Infiltrating resins, Minimal invasive dentistry, White-spot lesions.


BACKGROUND

Dental enamel is a highly mineralized tissue and is considered the hardest in the human body. It has a large amount of hydroxyapatite crystals (96–97%) and a small amount of organic matrix (3–4%). Due to its acellular nature, it is susceptible to irreversible injuries caused by various factors during its formation phase or after it has already been fully formed; these lesions cannot regenerate like those in other tissues in the body. The demineralization on the surface of enamel presents a milky, opaque appearance, due to their appearance they are commonly called a white-spot lesions (WSL).1 The biofilm formed by salivary proteins and bacteria can demineralize enamel, if there is also some irregularity on the surface of the enamel, it will be easier for a white spot to progress toward a cariogenic process.2 This type of lesion is highly prevalent in the orthodontic population, especially in cases where bands are placed or where poor hygiene is present during treatment, producing well-localized WSL.2,3

Although most WSL are because of demineralization, other etiologies may be due to internal/physiological processes and hypocalcemia; environmental factors such as trauma (especially during enamel formation); dental infectious causes by bacteria or viruses; an acid pH (acid) that favors bacteria growth; consumption of high-carbohydrate diet and poor hygiene.1,4 The high intake of fluoride ions during enamel development, which is very common in areas with endemic fluoride, can also produce these white lesions in a generalized way;5,6 therefore, salt and fluoridated water intake should be regulated. Fluorosis, unlike isolated white spots, occurs generally in all teeth and dental organs and appears clinically as white spots or dark-brown spots, depending on its severity.3,8

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Currently, dentistry is favoring on minimal invasion and intervention,5 which is why ultra-low-viscosity resins have been incorporated to treat white lesions noninvasively.9 The mechanism by which these materials work is based on the capillary action of resin in the microscopic spaces produced by demineralization, causing micromechanical retention in the resin, preventing acid attacks in the future.

Infiltrating resins are indicated for initial noncavitated caries lesions that appear as white spots on smooth surfaces or interproximal
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The diagnosis must be supported by X-rays or other means such as the Diagnodent pen, which uses fluorescence technology to detect initial and hidden caries without any invasive intervention. According to the ICDAS classification, grade I and II correspond to noncavitated WSL, but also WSL cases on fluorosis in a very mild stage on the ICMR index, described as enamel surface showing small, opaque, paper-white areas (1–2 mm) scattered irregularly over two or more teeth, could be treated in a noninvasive technique. The most common reasons of patients with WSL are low self-esteem and insecurities caused by WSL, mainly when the anterior region is involved. The objective of this case is to use infiltrating resin as a noninvasive technique on the removal of WSL.

**Case Description**

An 18-year-old female patient presented to dental appointment complaining about “the spots in her front teeth”. The patient has finished her orthodontic treatment; the photographs prior to the orthodontic treatment revealed that the WSL on the vestibular surface were already present on teeth #21 and #22 (Fig. 1). In the current assessment, an increase of the lesions on #21 and #22 was observed, and as well as the presence of two incipient lesions in tooth #11 (Fig. 2). The tip of the previously calibrated sapphire fissure probe from the Diagnodent pen (Diagnodent pen, Kavo dental, Warthausen, Germany) was
used as a diagnostic method. White-spot lesion readings were between 18 and 20. According to Diagnodent, pen readings in the range of 13–14 on flat surfaces indicate that the recommended treatment is a noninvasive method. Therefore, the treatment proposed was a minimally invasive treatment with infiltrating resins. The patient agreed to the treatment. The case was treated with smooth surface-infiltrating ICON (ICON Smooth surface, DGM, Germany).

Absolute isolation of the upper anterior area without anesthesia was achieved by lacing the dam with thread and wedges in the most distal area to protect the soft tissues from hydrochloric acid (Fig. 3A). The manufacturer’s instructions were followed, so the teeth with the WSL were conditioned with 15% hydrochloric acid “HCl” (ICON Etch, DGM, Germany) for 2 minutes (Fig. 3B); the gel’s consistency avoids placing it in areas where there are no WSL. The 15% hydrochloric acid was removed with abundant water for 30 seconds.

Subsequently, ethanol (ICON Dry, DGM, Germany) was applied for 30 seconds and volatilized with oil-free air for 20 seconds (Fig. 3C). If a WSL does not disappear with the addition of ethanol, the application of 15% hydrochloric acid and ethanol can be repeated until the lesion is no longer visible. These two steps were therefore repeated twice more, for a total of three applications for this patient. The infiltrating resin (ICON Infiltrant, DGM, Germany) was placed with the help of its applicator and left to act for 3 minutes to allow infiltration in the previously etched area (Fig. 3D). The excess resin was removed with oil-free air for 30 seconds; the excess on the proximal surfaces was removed with the help of dental floss. It was light-cured for 40 seconds (Fig. 3E) with a LED light-curing lamp (Bluephase N MC, Ivoclar Vivadent, 800 mW/cm², 430–490 nm). The final step involved applying a second layer of ICON Infiltrant for 1 minute and polymerizing it again for 40 seconds. Finally, polishing was performed on the surface of the teeth treated with a polishing brush (Jiff Polishing Brushes, Ultradent, EU) and 0.5-µm diamond paste (Ultradent Diamond Polish Mint, Ultradent, EU) (Fig. 3F). Figure 4 shows the initial situation of the WSL, the immediate result after the infiltrating resins, and the 6-month control.

**Discussion**

The current trend in dentistry of minimal invasion and intervention, advises that “Carious tissues should only be removed when there is no feasible alternative management such as cleaning cavities regularly with brush and fluoride toothpaste”. Visible white spots in the anterior region are one of the most challenging aspects of dental esthetics. According to the Delphi Consensus, there is an imperious need to change the management of dental caries, to one that avoids pain during treatments, loss of dental structure and loss of teeth, and maintains esthetics. Considering the amount
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of tissue removed, this consensus manages three levels of caries care, the first one includes noninvasive techniques such as fluoride applications or dietary and biofilm control, thus maintaining the mineral ionic balance. The second level, known as microinvasive techniques, removes only the surface of the tissue; infiltrating resins and sealants are comprised in this level, since both make use of 15% hydrochloric acid and 37% phosphoric acid, respectively, this results in a micrometric loss of enamel to favor adhesive processes. And finally, the third level is marked as invasive techniques, where a substantial part of the dental tissue is removed, and therefore direct restorations are required to recover function and shape.\textsuperscript{13}

White-spot lesions can appear as a result of various internal or physiological processes, environmental factors, infectious factors, decreased salivary pH, excessive carbohydrate consumption, and poor hygiene.\textsuperscript{23,24} About 43% of patients with orthodontic treatment develop WSL, predominately on the lateral incisors, followed by the canines and upper central teeth.\textsuperscript{6} A prior approach to treating this type of WSL required invasive measures, such as removing the lesion and covering healthy tissue with veneers or resin to achieve good adhesion\textsuperscript{14} eliminating the opaque white area and achieving a good cover-up of the restoration.

Currently, noninvasive methods have been developed to treat WSL, such as enamel remineralization with fluoride application,\textsuperscript{5,15,16} these topical applications are not always recommended, such as when treating fluorosis lesions. Calcium phosphate–casein phosphopeptide (CPP–ACP) toothpaste that favors the calcium apoposition has been recommended for decalcification\textsuperscript{6–19} although patients who are intolerant to milk protein cannot use this CPP–ACP paste due to their sensitivity to casein. The use of 1.1% sodium fluoride and fluoride-doped CPP–ACP has been found to be more effective than topical application of CPP–ACP pastes;\textsuperscript{18,20} these methods require long-term application to achieve a decrease in WSL.

Another treatment option for these conditions is microabrasion, it consists in putting an abrasive paste based on hydrochloric acid and rubbing it on the surface where the lesions occur,\textsuperscript{21} by eliminating extrinsic coloration and texture changes caused by hypoplasia, amelogenesis imperfecta, or mild–moderate fluorosis. It is important to correctly identify the etiology and the surface where the WSL are, otherwise, the elimination of these may not be successful; a thorough anamnesis, identification of the etiology, because only surface noncavitated lesions can be treated noninvasively. Microabrasion produces an increase in roughness on the enamel surface that varies between 35.95 µm with a single application of 2 minutes and up to 79.22 µm with 4 2-minute applications.\textsuperscript{22} This technique can increase the retention of dental plaque, but it is more effective in the case of lesions with brown pigmentation.

Infiltrating resins allow the treatment of white lesions caused by the demineralization of dental tissues, which may be a clinical presentation of initial caries. The WSL that will be treated with infiltrating resins must have certain characteristics to achieve the desired expectations; within the ICDAS classification, it can be used for a code-2 classification, but also lesion cases of fluorosis may be treated if they are in a very mild stage on the ICMR index,\textsuperscript{12} described as enamel surface showing small, opaque, paper-white areas (1–2 mm) scattered irregularly over two or more teeth.

The anatomy of the tooth will not be modified since a high-speed handpiece is not used, complying with the principles of minimal invasion. In order to infiltrate the resin into the enamel, it is necessary to create porosities on the enamel surface with the help of 15% hydrochloric acid,\textsuperscript{22} this being one of the basic compounds of the infiltrating resins to achieve the correct conditioning of the dental organ and elimination of the WSL; ethanol eliminates the excess humidity inside the treated enamel and then the ultra-low-viscosity light-curing resin based on TEGDMA\textsuperscript{23} will penetrate into the WSL. The mechanism of action of the infiltrating resins to stop the progression of demineralization consists in blocking the diffusion channels, denying the passage of hydrogen ions in the enamel, thus preventing the passage of acids into the interior,\textsuperscript{23,24} which allows us to obtain good results immediately and with a noninvasive procedure.

**Clinical Significance**

One of the most important challenges in dental esthetics are visible lesions in the anterior region and considering the current trend in dentistry that is minimally invasive. It is important to make a good diagnosis to discern when the use of infiltrative resins can be performed to achieve the expected results and to be successful in the treatment. The use of infiltrating resins is indicated to treat WSL due to demineralization, this being an initial caries or certain degrees of fluorosis.

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