Treating White Spots: New Caries Infiltration Technique

Written by Howard S. Glazer, DDS Thursday, 01 October 2009 00:00

White spots: We all see them, and often wonder what we can do about them. It is reasonable to say that every clinical dentist will see a fair number of patients who have white spot lesions on their anterior teeth. The dilemma is *how to treat* these spots. Certainly, there are invasive methods such as “prepping” the white spot and then restoring the area with a composite filling material. Or, perhaps you may provide the patient with a direct or indirect laminate veneer. Or even more dramatic, some may consider preparing the tooth for a full coverage restoration.

In today’s dental world, we are conscious of providing minimally invasive treatments that maintain a conservative approach to patients. Until now, our choices have been limited to invasive methods of varying degree to treat white spots, a fairly common decalcification phenomenon, especially in post-orthodontic cases. If the lesions are not starkly obvious, they may not bother every patient, but others often want to eliminate them by some means.

ETIOLOGY OF WHITE SPOT

White spot lesions are early signs of demineralization under intact enamel, which may or may not lead to the development of caries. The reason for the white spots is that the pathogenic bacteria have breached the enamel layer, and organic acids produced by the bacteria have leeched out a certain amount of calcium and phosphate ions. Unfortunately, they are not being replaced naturally by the remineralization process. This loss of the mineralized layer creates porosities that change the refractive index of the normally translucent enamel.[1] Typically characterized by white or opaque areas on smooth enamel surfaces, white spot lesions can be present in both primary and secondary teeth and, depending on their cause or severity, can be treated noninvasively, in either case.

While white spot lesions are often seen when orthodontic bands and brackets are removed, they can also be caused by incipient caries that stopped progressing and remineralized. Other potential causes include fluorosis, hypoplasia, hypocalcification, erosion, tetracycline staining, xerostomia, and trauma. Adjunct causes of white spot lesions may include heavy plaque accumulation, inadequate oral home care routines, and a high sugar or acid content diet (especially in people who drink a lot of soda pop, high-energy drinks, or eat a lot of citrus fruit).

DIAGNOSING WHITE SPOTS

Table. Clinical Characteristics of Enamel[4]

	Hydrated	Desiccated	Surface Texture	Surface Hardness
Normal enamel	Translucent	Translucent	Smooth	Hard
Hypocalcified enamel	Opaque	Opaque	Smooth	Hard
Incipient caries	Translucent	Opaque	Smooth	Softened
Active caries	Opaque	Opaque	Cavitated	Very Soft
Arrested caries	Opaque, dark	Opaque, dark	Roughened	Hard

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Evaluation of the patient should include causation, and the treatment choices available, in order to determine a proper diagnosis and treatment plan. While it is difficult to do, we must be able to distinguish between incipient caries and developmental hypocalcifications (Table). Treatment approaches are dictated by the type and status of the lesion; whether it is an active lesion (progressing toward cavitation), or an inactive lesion (not progressing, but also not healing).[2] These stages represent cycles of demineralization (active) and remineralization (stable).

Proper diagnosis may be difficult, requiring a 2-fold clinical-diagnostic approach since smooth surface white spot lesions will not show up with any current caries detection tools or on diagnostic radiographs.[3]

Consequently, the best way to analyze them is to dry the tooth surface and to examine them under magnification with good lighting. Incipient caries are visible when the enamel is dry, but will virtually disappear when the enamel is wet. Hypocalcification remains visible wet or dry.[4]

Tactile analysis is the next step in diagnosis. If the surface feels smooth and looks shiny, the lesion is probably inactive. If it feels rough, appears to be spongy or chalky, and has a dull or matte surface, the lesion has a porous surface that may lead to caries with cavitation and/or dental hypersensitivity.[2] These lesions also may discolor with time, turning a brownish tint.[1]

Other causes to consider for generalized enamel hypoplasia include heredity, nutrition deficiencies, severe childhood infections, fever-producing disorders, and ingestion of fluoride in excess of 1.8% ppm per day during tooth development.[5] Local infection and trauma can also cause hypoplasia to individual teeth.[5] Enamel hypocalcification is linked to faulty mineralization during enamel formation, as well as the factors listed for hypoplasia and overexposure to citric acid. Hypocalcified enamel is not a problem clinically unless cavitation occurs, or the patient finds it unacceptable aesthetically.[4]

CONVENTIONAL TREATMENTS AVAILABLE

Often, the first approach to eliminating white spot lesions is remineralization. There are several creams, pastes, and topical remineralization treatments on the market (eg, fluoride therapy, casein phosphopeptide-amorphous calcium phosphate pastes), with lots of evidence for varying degrees of success to be found in the dental literature. If these treatment options do not resolve the problem, tooth whitening may suffice, but will require retreatment in time. More invasive approaches to eliminating white spot lesions in the aesthetic zone include microabrasion, conventional bonding, and the various types of veneers available today.

A NEW MINIMALLY INVASIVE APPROACH

Recently, I have been using a new minimally invasive technique on smooth surface white spot lesions in my practice called caries infiltration. This technique and product, Icon (which is short for “infiltration concept”) (DMG America), was designed to bridge the gap between prevention and restoration, by filling and reinforcing the pore system of a noncavitated white spot, or incipient proximal lesions, with a light-curable resin. The infiltrating resin has a high refractive index and produces a chameleon effect, and requires no shade matching. Remarkably, I have found that after infiltration, lesions lose their whitish opaque color and blend reasonably well with surrounding natural tooth structure.

Only recently introduced in the United States, caries infiltration is truly a novel technology for arresting dental caries. A simple one-visit procedure can arrest the progression of early enamel lesions and remove white spot lesions with no drilling or anesthesia, while protecting and preserving healthy tooth structure. This technique hold a real advantage over other procedures that may involve drilling, anesthesia, repeat visits, additional bleaching, reapplication of sealants, bonding touch-ups, or recementing veneers. Icon’s microinvasive infiltration technology is designed to treat both smooth-surface lesions as well and proximal carious lesions up to the first third of dentin (D-1 level).

CASE SELECTION

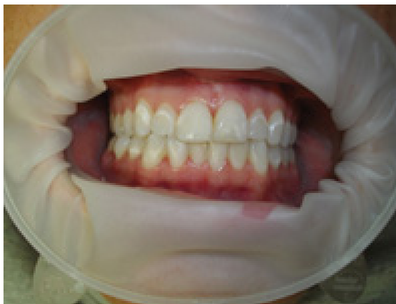

Figure 1. Decalcification after orthodontic therapy.

Many of us assume that incipient lesions, including white spots, have an intact surface layer. However, it was reported in a recent study that enamel surfaces were less intact than previously thought,[6] and therefore are more likely subject to cavitation. This, combined with the difficulty of accurately diagnosing carious activity in smooth surface lesions, means that a complete patient history with an emphasis on the possible causes of existing white spot lesions is necessary to determine whether caries infiltration is appropriate in an

individual case.

If the patient has a history of orthodontic therapy with bands or brackets, poor oral hygiene, or high acid exposure, caries infiltration is a very good choice (Figure 1). However, caries infiltration is not indicated if the patient has fluorosis, hypoplasia, hypocalcification (as can be noted on both incisors in Figure 1), visible erosion, tetracycline staining, or suffered some sort of trauma to the teeth. Infiltration is also not appropriate in cavitated enamel or in cervical regions with thin enamel or exposed dentin. These scenarios will require more traditional, invasive treatment.

HOW DOES CARIES INFILTRATION WORK?

Caries infiltration works by capillary action, whereas sealants only cover incipient caries lesions at the surface of the tooth (and eventually wear off). With this technique, the unique low viscosity resin is drawn deep into the pore system of a lesion like a sponge draws up liquid. The resin completely fills the pores within the tooth, replacing lost tooth structure and stopping caries progression by blocking further introduction of any nutrients into the pore system. With infiltration, carious lesions are stabilized while the anatomical shape and color of the tooth are not altered at all.

SMOOTH SURFACE CARIES INFILTRATION TECHNIQUE

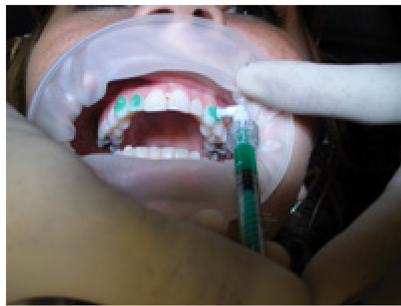

Figure 2. Application of Icon-Etch (DMG America).

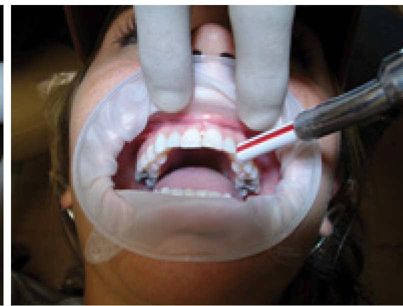

Figure 3. Evacuation of etch.

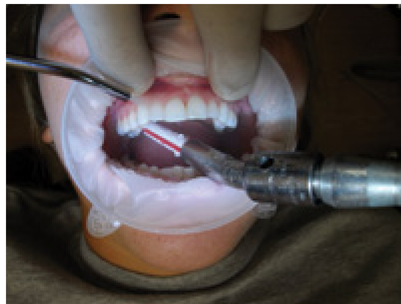

Figure 4. Rinse remaining etchant.

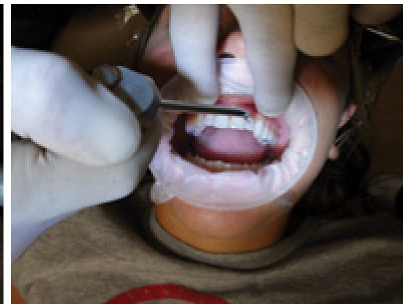

Figure 5. Dry with air.

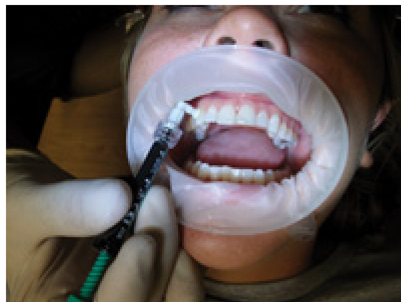

Figure 6. Applying Icon-Infiltrant.

Figure 7. Light cure.

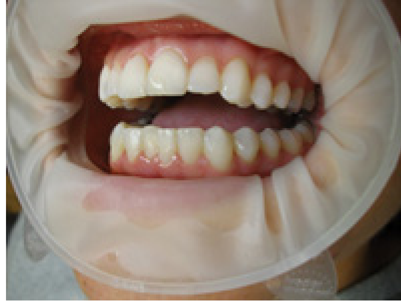

Figure 8. After Icon treatment, left view.

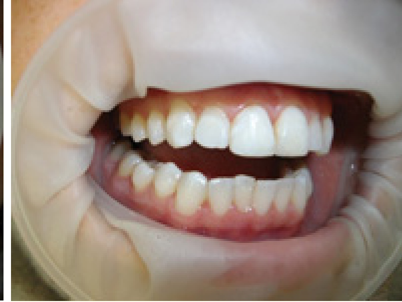

Figure 9. After Icon treatment, right view.

First, place a rubber dam to provide a dry working field to ensure the best treatment result possible. In the illustrated case, a liquid light-cured dam was used to protect the gingival, as well as the OptraGate Lip and Cheek Retractor (Ivoclar Vivadent). (*Note: Do not use rubber dams made with thermoplastic elastomers*.) Then, perform prophylaxis on the tooth or teeth to be treated, as well as immediately adjacent teeth, and rinse them clean with water. Next, attach the Smooth Surface Tip (which looks like a mini-brush head) to the Icon-Etch syringe and carefully apply (by twisting the syringe top) an ample amount of the 15% hydrochloric acid (Icon-Etch) to the lesion surface area, extending 2 mm beyond the edges of the lesion, letting it set for 2 minutes. As with any etching procedure, be sure to avoid contact of the etching gel with the gingiva or adjacent teeth (Figure 2). Evacuate the etch (Figure 3), then rinse the remaining etchant away with water for at least 30 seconds (Figure 4), and dry with oil- and water-free air (Figure 5). (*Note: If after and drying, the etched enamel does not have a chalky white appearance, the process must be repeated. The etched surface must be kept free of saliva and other contaminates [such as rubber glove residue]. If contamination occurs, re-etch for 10 seconds*.)

Next, screw the application cannula onto the Icon-Dry syringe (99% ethanol) and apply roughly half the Icon-Dry syringe content onto the lesion site, and let it set for 30 seconds, and then dry with air. Then, attach a clean Smooth Surface Tip onto the Icon-Infiltrant syringe, and apply an ample amount of the Icon-Infiltrant onto the etched lesion surface and let the infiltrant set for 3 minutes (Figure 6). Remove any excess material with dental floss and light cure it for 40 seconds (Figure 7). Apply a second layer of Icon-Infiltrant , let it set for an additional minute, and then remove excess material and light cure again for 40 seconds. Finally, after removing the rubber dam, use polishing cups to finish the surface to a smooth luster (Figures 8 and 9). (*Note: Icon-Infiltrant should not be applied to anterior tooth surfaces under direct operating light. In addition, because the infiltrant is not radiopaque, record the location of infiltration treatments in the patient's chart*.)

It is important that light-curing units used for this procedure have an output of 450 nm and a light intensity of at least 800 mW/cm^2. During curing, the light should be placed as close to the material as possible, but should not touch the material. The total treatment time per tooth is about 15 minutes.

Treated teeth may become desiccated during treatment and may appear lighter than adjacent teeth immediately after the procedure. There is no discomfort associated with this potential outcome and patients should be counseled to rinse and hydrate the tooth (or teeth) for several hours after the procedure. The final shade result will be harmonious with adjacent teeth.

The treatment kits include everything needed for the procedure (except the rubber dam) and the syringes contain enough material to treat 2 or 3 smooth surface lesions. The specially designed screw-type syringes with luer-lock tips ensure gentle and slow extrusion of the materials, and they can be operated with one hand. Conveniently, adjacent surfaces can be treated at the same time.

DISCUSSION

Until recently, as previously mentioned, dentists and hygienists had only 2 principal options for treating incipient decay: fluoride or remineralization therapies. White spot lesions were also subject to invasive procedures in order to meet patients' aesthetic demands. Caries infiltration is a major breakthrough in microinvasive technology that will fill, reinforce and stabilize demineralized enamel, without drilling or sacrificing healthy tooth structure. Caries infiltration is a simple, painless, ultraconservative technique that allows immediate treatment of lesions not advanced enough for restorative therapy. Furthermore, it has been shown to stop caries progression in lesions that are too advanced for fluoride therapy.[7] With caries infiltration, we can restore white spot lesions without having to "wait" until caries have cavitated enough to warrant more invasive restoration. This can eliminate the "wait and see" approach which inevitably leads to "drill and fill."

Infiltration is indicated for noncavitated lesions in any age patient. This technology has enabled me to treat

demineralized enamel while preserving healthy tooth structure in patients ranging in age from 15 to 23 years.

SUMMARY

My patients have appreciated receiving minimally invasive cosmetic enhancement without anesthesia, drilling, or more expensive restorations. Because caries infiltration prevents lesion progression, it prolongs the life of the tooth and provides a "simple" solution for patients who are known for poor compliance. Undoubtedly, this innovative material and technique will help many patients avoid many more rigorous and invasive restorative procedures. (*Note: more information and instructive videos can be found at: drilling-no-thanks.com*.)

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