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Dental hypomineralized enamel resin infiltration. Clinical indications and limits

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Abstract

Enamel hypomineralized lesions are often encountered in clinical practice. Among non-operative treatment options (remineralization with topical fluoride or casein-phosphopeptide amorphous calcium phosphate) resin infiltrative procedure shows predictable results with minimum patient's compliance. Enamel resin infiltration clinical procedure and inclusion criteria for enamel resin infiltration treatment have been reported.

Keywords *enamel hypomineralization; non-operative procedure; resin infiltration.*

Introduction

Caries infiltration is a novel treatment option for hypomineralized enamel lesions and might bridge the gap between non-operative and operative procedures. ICON® technology is the first caries resin infiltration system that aim to fill, reinforce and stabilize demineralized enamel, without drilling and sacrificing healthy tooth structure.

It has also been shown to inhibit caries progression in lesions on smooth surfaces that are too advanced for remineralization therapy [1]. Furthermore, it is virtually painless as it requires no anesthesia and meets the compliance of young patients. ICON® works on the principle of infiltration, pioneering research on operative secondary prevention of white spot lesions progression, developed since the study by Robinson et al, published in 1976 [2].

Enamel Hypomineralization:

Enamel hypomineralization is the common clinical feature of early carious lesion, developmental defects of enamel (DDE), and traumatic hypomineralization. It can present pre-eruptive or post-eruptive etiology. The most common pre-eruptive etiological factors are: fluorosis, malabsorptive syndrome, coeliac disease, traumatic hypomineralization and Molar-Incisal Hypominearlization. Carious White Spots are the most common lesions with post eruptive etiology.

The first stage of carious disease (WSL: white spot lesion) is characterized by enamel hypomineralization without cavitation, corresponding to International Caries Detection and Assessment System (ICDAS-II) 1 and 2 score (1 = first visible sign of non-cavitated lesion seen only when the tooth is dried; 2 = visible non-cavitated lesion seen when wet and dry). The hypomineralized enamel

presents usually a demineralization under an intact 10-30 microns thick surface layer, characterized by higher porosity than sound enamel [3].

EH optical properties and ICON mechanism

The hypomineralized enamel presents a refractive index (RI) of 1.33 [4]. The difference in refractive indices causes light scattering that results in a whitish, chalky and opaque appearance of these lesions, especially when they are desiccated [4]. Sound enamel/apatite has a RI=1.62–1.65, hypomineralized enamel lesion filled with water has a RI= 1.33, or air RI=1.00 (ICDAS-II, score 2) [5]. When the microporosities are filled with infiltrant resin, the refractive indices increase to 1.52.

Treatment options

Non-operative treatment options for enamel hypomineralized areas (DDEs, ICDAS-II score 1-2 lesions, etc.) are remineralization with topical fluoride or casein-phosphopeptide amorphous calcium phosphate. However, remineralizing treatments need to be started early and performed regularly: results are highly dependent on patient's compliance and thus not thoroughly predictable.
When predictability is mandatory (functional, esthetics, planned orthodontic appliances, etc.) resin infiltration may be useful.
According to Denis [6] there are definite inclusion criteria for enamel resin infiltration procedure. WSL and DDE due to malabsorbitive disorders show a similar and comparable lesion structure and resin infiltration is the suggested therapy.

Greater caution should be used on traumatic hypomineralization, since micro-configuration is not completely compatible with the procedure. Moreover, resin infiltration should be discouraged in MIH, since lesions evidence a deeper enamel defect configuration.
Subsequently we can suggest ICON® inclusion criteria: ICDAS-II score 1-2 (**Figure 1**), inactive lesions with smooth, hard, and shiny surface, DDE due to malabsorptive disorders, celiac disease and fluorosis. Exclusion criteria: molar incisal hypomineralization (MIH) (**Figure 2**) and traumatic hypomineralization (**Figure 3**).

Our experience show clinical and esthetic results consistently with Denis M et al [6] inclusion criteria and clinical procedures, with a good color stability and patients' subjective acceptability at 12 month follow-up.

ICON Enamel resin infiltration clinical procedure

ICON Enamel resin infiltration clinical procedure steps are described in Figures 5 and 6.

Figure 4 (A): tooth surface are cleaned with a rubber cup and prophylaxis paste and rubber dam is placed.

Figure 4 (B-E-H): ICON® -Etch (DMG, Hamburg, Germany) 15% hydrochloric acid gel is applied for 120 s. It removes the hypermineralized surface layer and exposes the lesion. Meyer-Lueckel et al. reported that 15% HCl removes approximately 40 µm of the surface layer [7]. The application of ICON® -Etch can be performed up to three times.

Figure 4 (C-F): The etching gel is washed away thoroughly for 30 s using a water spray and dried.

Figure 4 (D-G-I): The lesions are desiccated using ethanol (ICON® -Dry; DMG) for 30 s followed by air drying. The application of ICON® -Dry simulates the visual outcome of resin infiltration , due to the ethanol refractive index is close to the resin index (1.52).
The purpose of using 99% ethanol is also to remove the water that is stored inside the microporosity of the lesion body and to allow the resin to penetrate into the lesion body driven by capillary forces [8].

Figure 4 (L): Infiltrant low viscosity resin (ICON® -Infiltrant; DMG) is applied on the surface and allowed to penetrate for 3 min. The maximum depth of penetration of the resin material is shown to be of 6.06 ± 3.32 µm [1]. During this stage the resin appears slightly yellow, because it contains camphoroquinone.

Figure 4 (M-N): Excessive material is removed using air spray from vestibular surface and using dental floss in the proximal spaces before light curing.

Figure 5 (O): After light curing for 40 s, the application of infiltrant resin was repeated once for 1 min and light cured for 40 s.

Figure 5 (P-Q): Finally, the roughened enamel surface is polished using a polishing rubber point. Proximal finish can be performed with finishing strips.

Figure1. Pre and post ICON® treatment of WSL with optimal clinical outcome.

Figure 2. Questionable ICON® treatment in MIH lesion.

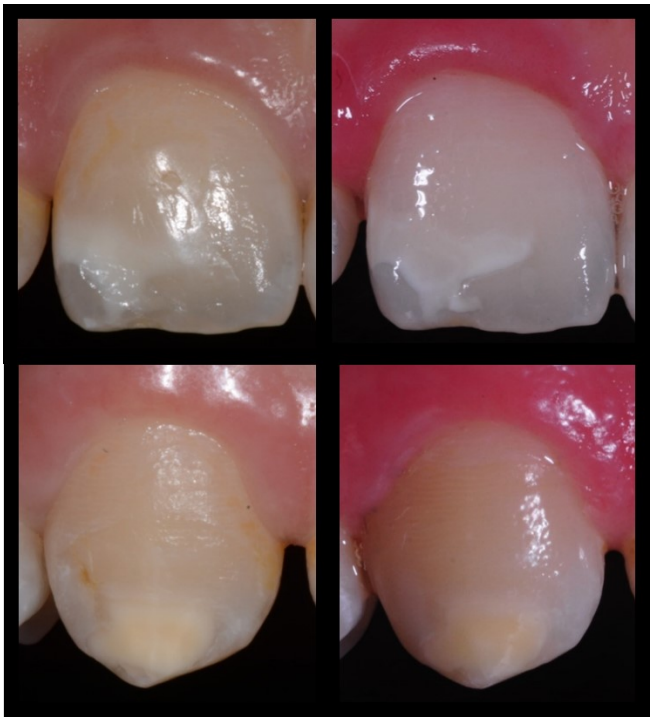

Figure 3. ICON® treatment of Post traumatic lesions.

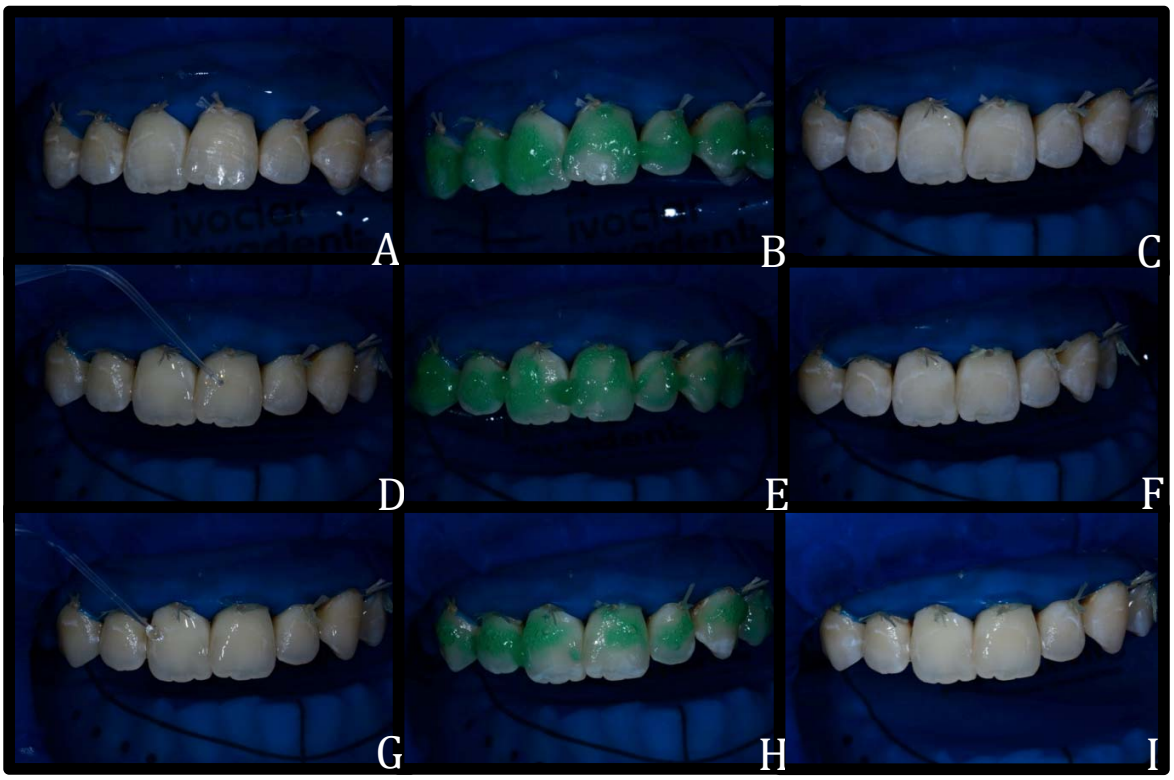

Figure 4

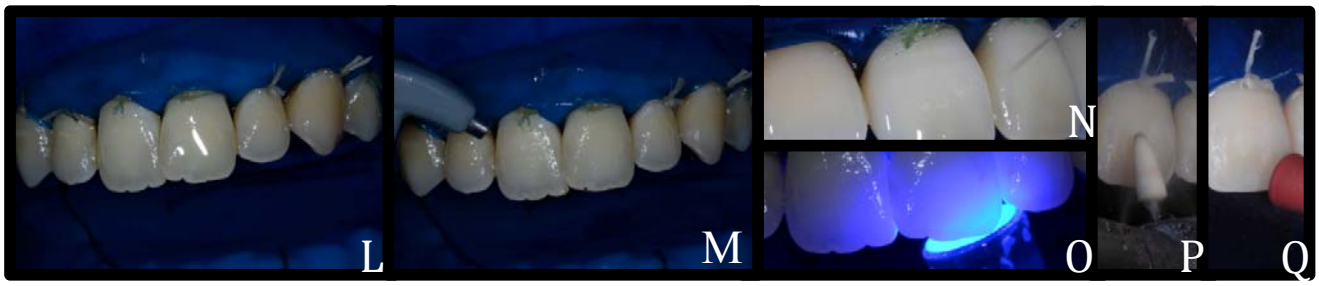

Figure 5

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