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Aesthetic Improvement Of White Spot Lesions With Resin Infiltration- An In Vivo Study

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Abstract

Dental fluorosis is a common disorder, characterized by hypomineralization of tooth enamel caused by overexposure to fluoride during enamel formation. This condition affects esthetics of a person and it mostly occurs in the population residing in areas with a considerable amount of fluoride in tap water since the paediatric age. The aim of this study was to clinically assess the effectiveness of masking hypomineralized/ white spot enamel lesions using a resin infiltration technique that was recently developed to arrest incipient caries in a micro-invasive concept.

Keywords: Caries infiltration; White Spot Lesions; Icon; Resin infiltration

Introduction

White Spot Lesions are subsurface enamel porosities caused by a cyclical imbalance between demineralization and remineralization of the enamel, resulting from poor hygiene and associated plaque, bacteria and acids. With time, remineralization at the outer surface of the tooth decreases the access of calcium and other ions to deeper portions of the enamel, eventually arresting the lesion. The lesions look white because there is a scattering of light at the subsurface of the demineralized enamel.

Tooth development could be negatively affected by high doses of fluoride, especially during the mineralization of the enamel tissue; indeed, the increase of fluoride causes a decrease of free calcium ion concentration in mineralizing matrix process with a consequent delay of degradation of matrix proteins. Also, the presence of fluoride provokes a defective crystal growth responsible for typical features of fluorosis.[1]

Features of dental fluorosis are various and the extent of it could be clinically heterogeneous: spotted enamel, brownish or yellowish lesions, pitted surfaces and thin and horizontals striations can appear on all tooth surfaces affecting also dentin.[2] Such lesions could affect self-esteem, especially in younger patients.

Several treatment strategies were proposed for dental fluorosis, depending on the severity and extent of the disease. The most frequently reported are micro-abrasion, bleaching, composite restorations, veneers and crowns.

The introduction of the method of resin infiltration technique indicates the most performing and promising approach. This meets the concept of minimally-invasive restorative dentistry and allows to reach satisfying results avoiding unneeded tissue removal.[3]

The penetration of the resin into the fluorosis lesion is due to etching the enamel surface performed with

15% solution of hydrochloric acid for 120 s. This procedure determines the elimination of surface layer of enamel, making accessible the hypomineralized site. Thus, a low-viscosity resin penetrates the porous enamel. [4]

The principle of resin infiltration is to perfuse the porous enamel with resin by capillary action, thereby arresting lesion progression by occluding the microporosities that provide diffusion pathways for the acids and dissolved materials. This technique aims to create a diffusion barrier inside the lesion and not on the lesion.[5]

This clinical study aimed to present an alternative micro-invasive approach to the treatment of white spot fluorosis lesions through their infiltration with low-viscous light curing resin.

Materials and Methods

A 26 years old patient came to the department of conservative dentistry and endodontics with a chief complaint of white spots on upper front tooth region. On clinical examination, white spots on all teeth indicating dental fluorosis were observed. The patient was informed about the situation and explained the treatment procedure. The patient signed a written informed consent to take part in the study and to undergo treatment of resin infiltration (ICON, DMG, Hamburg, Germany) w.r.t. 13,12,11,21,22,23.

Before treating, oral prophylaxis of teeth was done. The teeth were isolated with gingival barrier, for the purpose of protecting gingiva and soft tissue. In the first step, the surface of the white spot was eroded by application of a 15% hydrochloric acid gel (Icon-Etch) for 2 min with a gentle scrubbing motion. Afterwards, acid was sucked and rinsed for 30 s; then the treated surfaces were dried. The lesion was desiccated by applying ethanol (Icon-Dry) for 30 s followed by air drying. At this point the tooth was observed to determine if an acceptable colour change had occurred. On the basis of the aesthetic outcomes obtained, the etching step was repeated 3 times. In the last step, Icon infiltrate composed of tetraethylene glycol dimethacrylate was applied on the lesion surface using a microbrush and allowed to penetrate for 3 min. The excess was removed using a cotton roll and light cured for 40 sec. Repeated application for another one minute was performed and then the resin was light cured again. The esthetic masking effect of the treatment was evident immediately upon completing the treatment. The excess resin was removed and the surface was polished.

DMG ICON Resin Infiltration kit

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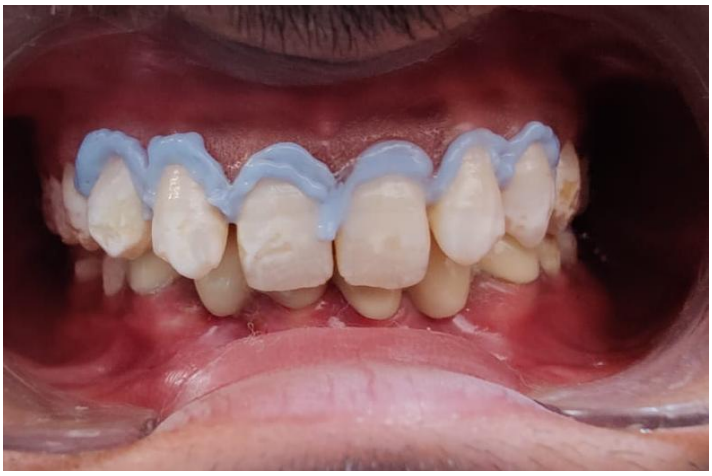
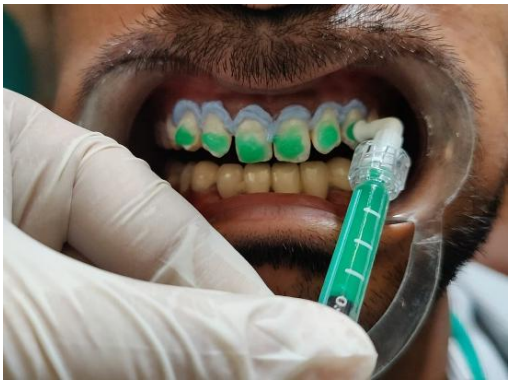
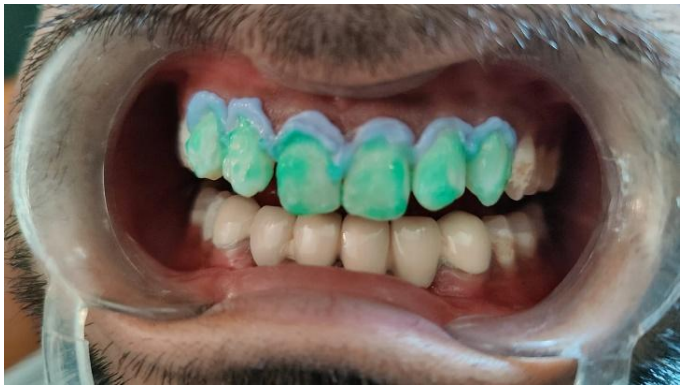
Pre operative:

with application of gingival barrier

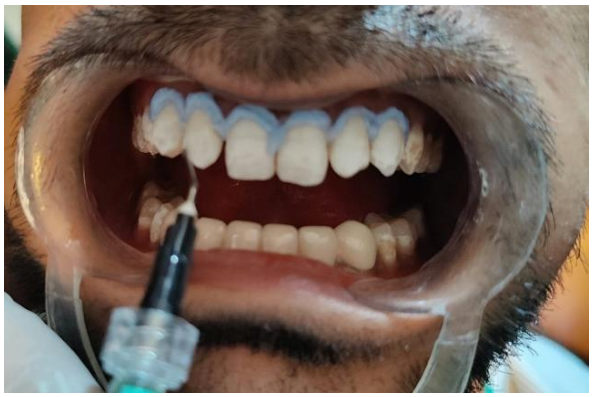


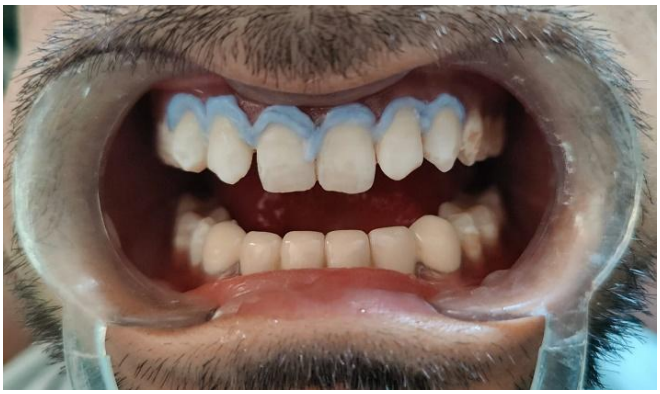
Application of **ICON ETCH** for 2 min





Application of **ICON DRY** for 30 seconds





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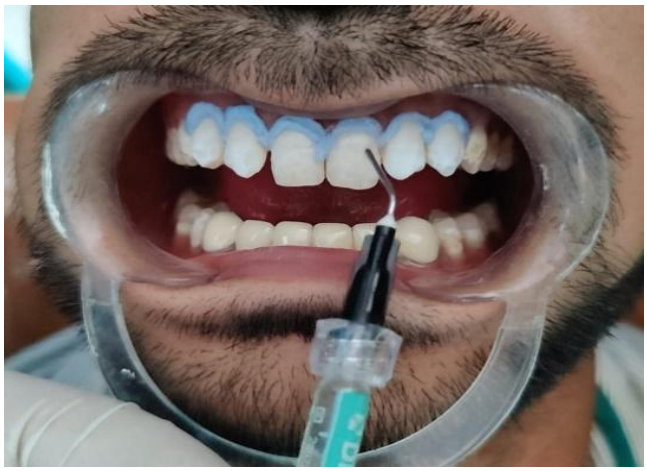
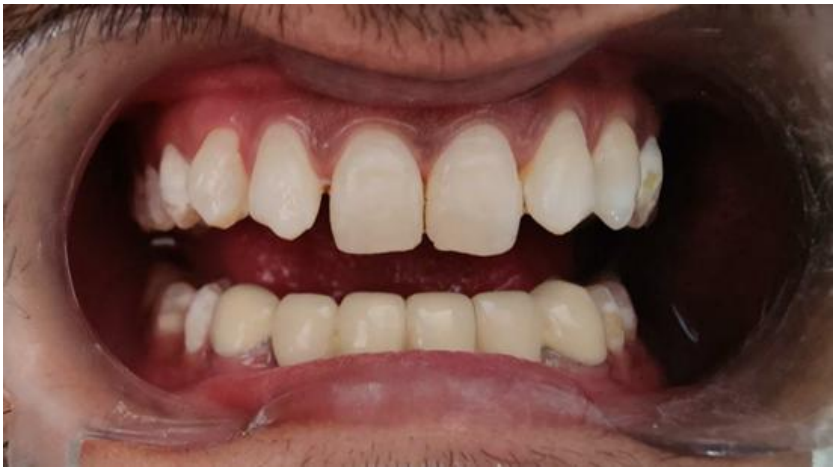
Application of **ICON INFILTRANT** for 3 min



Light cure each tooth for 40 seconds

Post operative



Discussion

Cosmetics and esthetics are current trends of dental industry. As more and more patients are demanding for minimally invasive cosmetic enhancement without anesthesia and drilling, the technique of resin infiltration may be considered as a microinvasive treatment of smooth-surface white spot lesions and also one that allows for the recovery of natural tooth appearance.

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The porosity created by the initial demineralization of a caries process changes the refractive index of enamel, resulting in a white coloration in the incipient lesion. The resin infiltration technique has an additional positive effect on esthetics in which the penetration and polymerization of the low viscous resin inside the lesion body allows a change of the lesion's whitish appearance to the natural enamel appearance.

Since the surface layer of enamel lesions has a lower pore volume compared to that of the lesion body underneath, it forms a barrier that might hamper the infiltration of resin into the lesion body. Therefore, a preparation phase is required where the surface of the teeth is cleaned and prepared with 15% hydrochloric acid (icon etch). 15% HCL produces a penetration depth of 58 µm, which is more than twice that of phosphoric acid (25 µm), enabling penetration into the deepest part of the lesion, thus eliminating the decalcified areas, preventing further attacks.[6]

Ethanol wet bonding technique is used to desiccate the surface by applying 99% ethanol (Icon Dry). It is based on the mechanism that it will coax hydrophobic monomers to infiltrate into demineralized wet enamel or dentin, and improve the efficacy of penetration of the hydrophobic infiltrate (TEGDMA) to get a well-defined, resin-infiltrated layer. This technique involves slowly replacing water within the demineralized collagen matrix with ascending concentrations of ethanol, allowing the latter to penetrate the collagen matrix without causing additional shrinkage of the interfibrillar spaces, thus preventing the phase separation of hydrophobic resin monomers.[7,8]

The principle of masking enamel lesions by resin infiltration is based on changes in light scattering within the lesions. The improvement of aesthetics using resin infiltration is due to modification of refracting index (RI) from porous lesion composed by air (RI = 1) and water (RI = 1.33) to the surface infiltrated by resin (RI = 1.42–1.44) closer than healthy enamel (RI = 1.62–1.63), therefore a restoration with enamel-like optical characteristics is obtained [9].

The resin is applied twice because of the shrinkage of the material after the first application, resulting in the generation of space that can be then occluded by a second application.[10]

Kim S et al. in his clinical study on assessing the effectiveness of masking white spot enamel lesions using resin infiltration found that among the 20 teeth with the developmental defect of enamel, 5 teeth (25%) were classified as completely masked, whereas 7 (35%) and 8 teeth (40%) were partially masked and unchanged, respectively.[11]

Another in vitro study showed how the Icon resin significantly increased the micro hardness of the enamel, as the penetration power in structures was 67.14% compared, for example, to other materials, such as colloidal silica, whose percentage was 54.53%. [12]

Conclusion

Resin infiltration represents a new concept in dentistry and therefore needs to be better investigated. Based on the available laboratory and clinical studies, it seems convincing that the resin infiltration of enamel lesions should reduce (or even stop) the progress of white spot lesions. This technique is considered to be microinvasive and might bridge the gap between non-invasive and minimally invasive treatment of initial dental caries, postponing, as long as possible, the need for restoration.

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