



AN IN VIVO STUDY ON THE CLINICAL EFFICACY OF RESIN INFILTRATION TECHNIQUE ON TREATMENT OF WHITE SPOT LESIONS

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ABSTRACT

The caries infiltration technique was introduced with the aim of filling the intercrystalline spaces with a low-viscosity resin, to arrest lesions and treat the esthetic problem of white spot lesions. This study was designed to evaluate the effect and clinical efficacy of resin infiltration technique on masking of enamel white spot lesions compared to an ordinary adhesive system. **Methods:** A total number of 20 patients having 120 not cavitated anterior teeth with white spot lesions were subjected to this study. After scaling, polishing and oral hygiene measures, the six maxillary anterior teeth were isolated with rubber dam. The teeth were divided into two groups, the first group (central incisor, lateral incisor and canine on right side of patient) was treated with hydrochloric acid (Icon-Etch) then ethanol (Icon-Dry) followed with application of resin (Icon-Infiltrant), while the second group: (central incisor, lateral incisor and canine on left side of the same patient) was treated with phosphoric acid (N-Etch) and adhesive (Excite F). Durability of used resins were clinically assessed by six of the FDI World Dental Federation criteria which were selected to be suitable for the current study (Surface luster, Surface Staining, Postoperative hyper-sensitivity, Recurrence of caries, Adjacent mucosa, and Patient's view), Each property has five grades from excellent to poor. **Results:** Both of treated groups showed improved surface luster, decreased postoperative hypersensitivity, diminished recurrent caries and increased patient satisfaction. Icon resin infiltration was more durable than Excite F adhesive after one year follow up. Both groups showed no initial surface staining, but with time surface staining being more with icon infiltrated group. Both materials have no effect on adjacent mucosa at different aging times. **Conclusions:** Icon resin infiltration is an effective treatment for demineralized white spot lesions but with frequent repolishing to overcome surface staining for long lasting esthetic outcome. Excite F adhesive can be used only for short time sealing of enamel surface to improve the esthetics of white spot lesions and control of caries progression.

INTRODUCTION

Opaque white spots on the facial surfaces of the teeth can be an unsightly appearance. The whitish appearance is due to the presence of internal porosities beneath an apparently intact surface layer that alters the refractive index of usually translucent enamel⁽¹⁾.

The caries infiltration technique was introduced with the aim of filling the intercrystalline spaces with a low-viscosity resin, to arrest lesions^(2,3). The caries infiltration technique is a promising therapeutic method as its approach is between preventive and restorative actions in the treatment of noncavitated carious lesions⁽⁴⁾. The infiltration technique has

gained a lot of interest in the past few years. It is less invasive than microabrasion and restorative treatments⁽⁵⁾.

The application of adhesive for sealing the susceptible enamel surface in order to form a caries-protective shield (specially prior to bracket bonding) has been the focus of interest in previous studies^(6,7).

The aim of this study was to compare the effect of resin infiltrate versus dental adhesive on color masking of white spot lesions, and to extend available knowledge on the longevity of achieved color and lightness improvement as well as to evaluate the clinical behavior of both materials for twelve months' period.

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Ethical considerations:

Full ethical approval was obtained from Faculty of Dental Medicine, Al-Azhar University Ethics Committee, and all patients gave informed consent before the start of the study.

Materials and Methods

Two resin based materials were utilized in this study:

1. Icon resin infiltration: It comprised 3 steps for resin infiltration; icon etch, icon dry and icon infiltrant.(DMG America, Englewood USA)
2. Excite F dental adhesive: It was a two-step etch and rinse adhesive. It comprised 2 steps N-Etch and Excite F adhesive. (Ivoclar Vivadent)

Methods:

This study was a follow-up of patients with White spot lesions treated by two resin infiltration techniques during a single-center, split-mouth trial.

Patients selection:

A total of 20 adult Egyptian patients agreed to participate in the study, which are selected from the outpatient clinics, Department of Operative Dentistry, Faculty of Dental Medicine, Assuit, Al-Azhar University

Inclusion criteria:

1. Obvious area of white spot lesions on labial surface of maxillary anterior teeth.
2. Non-cavitated enamel surface.
3. Maxillary anterior teeth were free of any restorations.
4. No history of tooth sensitivity or previous whitening procedures.

Exclusion criteria:

1. Cavitated enamel surface that requiring restoration.

2. Presence of any restorations including the labial surface of the maxillary anterior teeth.
3. Presence of any environmental or developmental enamel defect.
4. Smoking, para-functional habits or gingivitis.

A signed informed consent was obtained from every participant.

Study design

A total number of twenty patients having a total number one hundred and twenty anterior teeth with white spot lesions (not cavitated) were subjected to this study. Teeth were divided according to type of infiltrating materials into two main groups A1 and A2 (60 teeth each). The infiltrated teeth of each group were evaluated at different durations; B0, B1, B2, B3, B4, and B5. For each follow up period both six clinical criteria C1, C2, C3, C4, C5 and C6 were evaluated.

Intervention:

All teeth were scaled and polished with fluoride-free polishing paste using polishing brush.

After rubber dam isolation of the maxillary anterior teeth with premolar clamps on first premolar teeth. A 15% HCl gel (Icon-Etch) was applied on the labial surface of first group (A1) for 120 seconds, the etchant was rinsed off with water spray for at least 30 seconds, a 99% ethanol (Icon-Dry) was applied onto the etched area for 30 seconds, after which it was air dried. Then the resin infiltrant was applied onto the etched lesion surface and left for 180 seconds to infiltrate and spread into the micro-porosities and then light-cured (output of 450 nm wavelength and a light intensity of 800 mW/cm² for 40 seconds). A second layer of Icon-Infiltrant was applied, for 60 seconds, and light-cured again for 40 seconds.

Phosphoric acid gel (N-Etch) was applied for 20 seconds on labial surface of teeth of second group

(A2); then rinsed off with water for 10 seconds then it was air dried for 10 seconds using air syringe.

Excite F adhesive was then applied and rubbed in for 20 seconds with a micro-brush and light cured for 20 seconds, a second layer of adhesive was applied as the first one.

Post-operative aging and follow up:

At every follow up visit, anterior teeth were polished with fluoride-free polishing paste using a rubber cup. The durability of resin infiltration on masking of white spot lesions was clinically evaluated by the FDI World Dental Federation criteria ⁽⁵⁸⁾. Six of these criteria were selected to be suitable for the current study. Each property has five grades from excellent to poor.

Data management and statistical analysis:

The mean and standard deviation values were calculated for each group in each test. Data

Effect of time and infiltrating material and on surface luster:

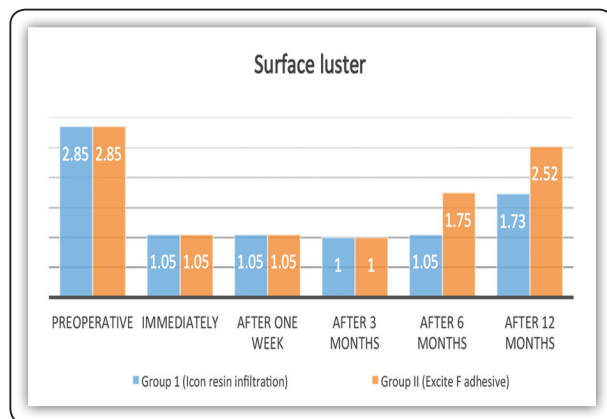


FIG (1) Bar chart representing the effect of time and infiltrating material on surface luster.

were explored for normality using Kolmogorov-Smirnov and Shapiro-Wilk tests. Data showed non-parametric (not-normal) distribution. Friedman test was used to compare between more than two related samples. While Mann Whitney test was used to compare between two non-related samples. Wilcoxon test was used to compare between two related samples.

The significance level was set at $P \leq 0.05$. Statistical analysis was performed with IBM® SPSS® Statistics Version 20 for Windows.

RESULTS

Clinical evaluation has done using the FDI criteria, six of these criteria which have a five grades from excellent to poor were selected to be suitable for this study (excellent =1, good =2, satisfactory =3, unsatisfactory =4 and poor =5). The mean and standard deviation values were calculated for each clinical property in each test group.

Effect of time and infiltrating materials on surface staining:

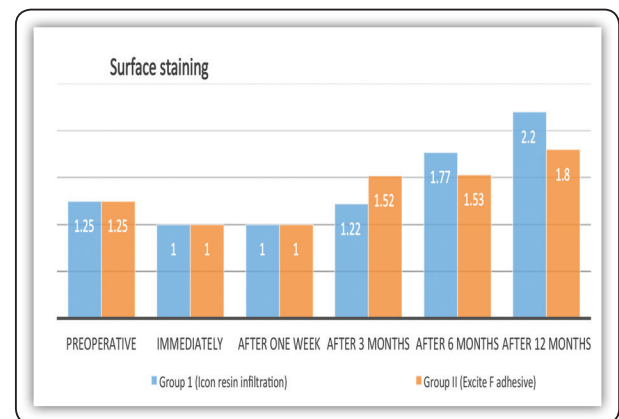


Fig. (2): Bar chart representing the effect of time and infiltrating material on

Effect of time and infiltrating materials on postoperative hypersensitivity:

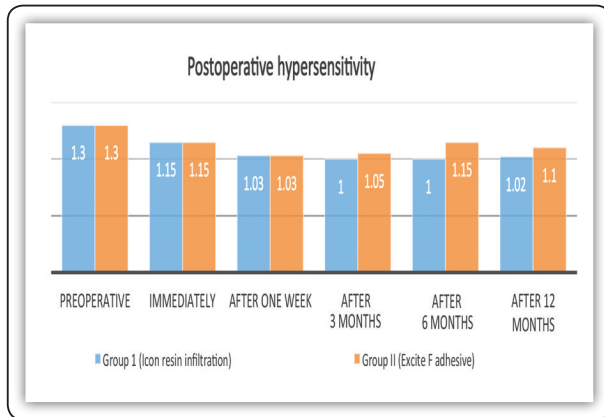


Fig. (3): Bar chart representing the effect of time and infiltrating material on postoperative hypersensitivity.

Effect of time and infiltrating materials on recurrence of caries:

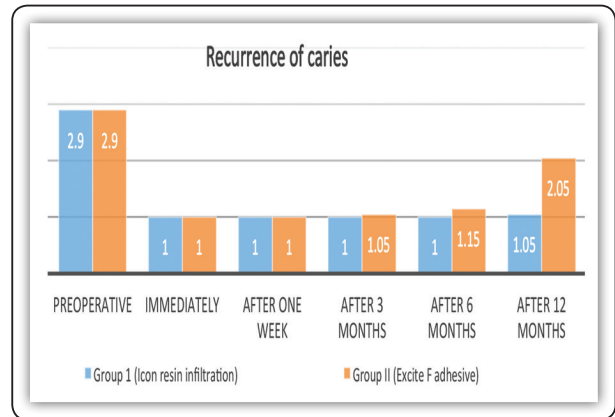


Fig. (4): Bar chart representing the effect of time and infiltrating material on recurrence of caries.

Effect of time and infiltrating materials on adjacent mucosa:

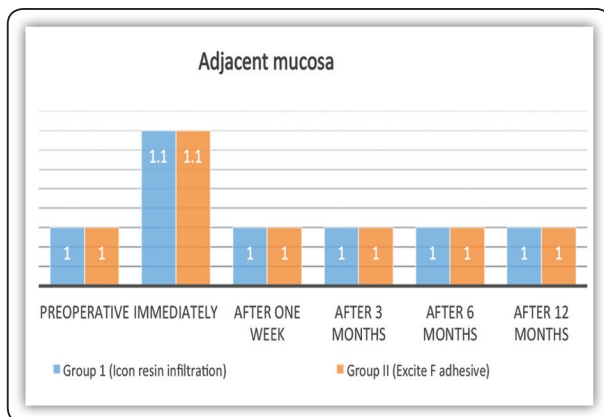


Fig. (5): Bar chart representing the effect of time and infiltrating material on adjacent mucosa.

Effect of time and infiltrating materials on patients' view:

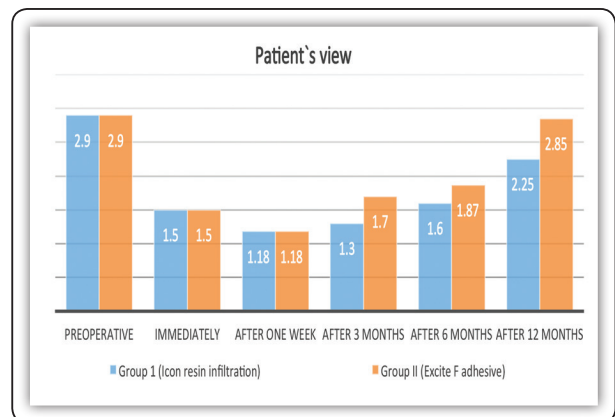


Fig. (6): Bar chart representing the effect of time and infiltrating material on patient's view.

DISCUSSION

White spot lesions disturb the esthetic appearance of the enamel of the front⁽⁸⁾, teeth and also they are an initial stage of enamel caries that can progress to a stage at which restoration will be needed if the patient has inadequate oral hygiene⁽⁹⁾. So there are two aspects of treating white spot lesions considering: arresting lesion progression, and addressing the esthetic disturbance⁽⁸⁾.

White spot lesions show irregular mineralization patterns and are histologically characterized by highly porous hypomineralized subsurface enamel⁽¹⁰⁾. The removal of the surface layer may enable access to the volume of porous enamel, which could be penetrated by a resin with a refractive index (RI) similar to sound enamel afterwards. Adapting the RI of the lesion to the RI of enamel would allow masking of the subsurface enamel alteration. The objective of infiltration in

esthetic areas is thus to fill up the microporosities of hypomineralized enamel with a resin whose RI is close to that of healthy enamel, in order to mask the enamel defect⁽²⁾

Icon resin infiltration (DMG) is an innovative product for the micro-invasive treatment of cervical and proximal dental lesions. Driven by capillary forces, the infiltrant, a highly fluid resin, penetrates into the enamel caries and blocks the diffusion paths for cariogenic acids, thus promoting the early arrest of caries. Icon closes the gap between preventive therapies and corrective restorations.

Excite F dental adhesive is one of the commonly used etch and rinse dental adhesives, it is a fluoride releasing, Acetone free, high monomer content, light-curing single-component dentin enamel adhesive.

The durability of both resin infiltration techniques on treatment of white spot lesions evaluated by the FDI World Dental Federation criteria⁽¹¹⁾. Only six of the FDI criteria were selected to be suitable for the current study namely; Surface luster, Surface Staining, Postoperative hyper-sensitivity, Recurrence of caries, Adjacent mucosa, and Patient's view. Each property has five grades from excellent to poor.

As regard to surface luster, there was a statistical significant difference between preoperative and immediate post-operative for both icon resin infiltration group and Excite F adhesive group with no statistically significant difference between the two material groups. Both groups still serve well till three months but at six-month interval the surface luster begin to deteriorate with the peak in the Excite F adhesive group at 12 month interval.

This result is supported by others showed that infiltrated or sealed enamel surfaces become lustrous and less roughness than carious or demineralized enamel but not as sound enamel; Gurdogan et al (2017)⁽¹²⁾ evaluated the surface roughness via

atomic force microscopy and observed that the infiltrant material creates a significantly rougher surface compared to healthy, untreated enamel.

Through evaluation of surface staining both groups showed no surface staining, at the immediate and one week post-operative but staining begin to increase to the highest mean at twelve months, indicating minor to moderate surface staining.

This result is in consistent with other studies^(13,14). Their results showed enamel treated with icon resin infiltration showed significantly higher staining than non infiltrated enamel however, the repolishing of the specimens minimized the staining effect. Nicolas REY et al⁽¹⁵⁾ showed that Icon resin may become more discolored than other adhesives (Clearfil SE Bond, Heliobond, OptiBond FL, Scotchbond Universal Adhesive) over time especially when the patient habitually consumes teeth-staining food and beverages.

This surface discoloration may be influenced by the rate of water absorption of the material (unfilled resin), degree of polymer conversion of the monomers, technique used for surface polishing in addition to plaque accumulation with consequent superficial pigmentation^(16,17). Immediate decrease of hypersensitivity, this improvement increases at the one week follow up. With time there is a low hypersensitivity for a limited period of time in some cases with the highest mean score was found in Excite F adhesive group at the six months recall. Both resin infiltration with Icon or sealing with Excite F adhesive results in closing the open demineralized enamel pathways and stop caries progression that allow less sensitivity.

Both Icon resin infiltration and Excite F adhesive serve in a good manner preventing recurrent caries till the three months' recall with no statistically significant difference between the two groups. This result is in consistent with studies of other researchers⁽¹⁸⁻²⁰⁾ who showed that filling of the pores

in initial enamel lesions with adhesives can inhibit further demineralization.

The icon resin infiltration group still protected from recurrent caries after one year follow up because the enamel is sealed off and filled from within, without requiring a protective surface layer of resin thickness, which is the primary mechanism by which sealants or adhesives function, the resin also serves as a barrier to stop the future progression of incipient lesions by physically blocking further mechanical, bacterial, and acid attack⁽²¹⁾.

Both icon resin infiltration group and excite F adhesive group have a very good result as regard to the effect on adjacent mucosa.

Immediate patient satisfaction increases after week post-operative due to aesthetic improvement, disappearance of immediate mucosal affection. Patient satisfaction decreases with increased follow up period with the highest mean score was found in group (II) at one year recall which was attributed to increased recurrent caries, increased postoperative hypersensitivity, surface staining and instability of color improvement.

CONCLUSIONS

Icon resin infiltration is an effective treatment for demineralized white spot lesions but with frequent repolishing to overcome surface staining for long lasting esthetic outcome. Excite F adhesive can be used only for short time sealing of enamel surface to improve the esthetics of white spot lesions and control of caries progression.

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