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Review Article

Effectiveness of resin infiltration method on white spot lesions post orthodontic treatment - A systematic review

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ABSTRACT

Aim: The aim was to compile information through literature search to systematically review randomized controlled trials done to assess the effectiveness of resin infiltration for white spot lesions post orthodontic treatment.

Materials and Methods: Published articles from various databases such as Cochrane, PubMed, Google Scholar and Embase were assessed for randomized clinical trials related to resin infiltration. Young adults and adolescents aged less than 30 years with presence of white spot lesions within 3-4 months after orthodontic treatment were considered for the study. Studies related to the effectiveness of the resin used and esthetics in terms of color masking were a part of this study.

Results: A total of 4 studies complying with the inclusion and exclusion criteria were selected for the systematic review. Most studies showed that there was a significant improvement in the clinical appearance of the lesions and a reduction in their size after resin infiltration. The method of resin infiltration can be followed for achieving an aesthetic improvement of post-orthodontic white spot lesions.

Conclusion: The ICON (Infiltration CONcept) is a technique which can be used as a form of a minimally invasive procedure for the treatment of early caries in patients of all ages. The advantage of this procedure includes minimum damage to the tooth structure due to the low viscosity of the resin.

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1. Introduction

Orthodontic treatment aims to improve both facial and functional aesthetics that benefits oral and overall health of a person. However, any treatment could be related to few complications but can be avoided by altering the usual lifestyle. The most known risk that can be developed during or after orthodontic treatment is the demineralization of enamel surface also known as White Spot Lesions which are known to occur despite of having many treatment alternatives.¹

The term "white spot lesion" (WSL) as defined by Fejerskov et al. is "the first sign of caries lesion on enamel

that can be detected with the naked eye" and is used along with the terms "initial" or "incipient" lesions.² They are usually seen around the periphery of the brackets as small lines but may also be seen as large areas of decalcifications in few cases.³

White spot lesions usually occur as a sign of initial decay showing a disproportion between demineralization and remineralization of the enamel surface. WSLs can be caused due to bacterial invasion due to their acid production since it is said to contain sugars which leads to destruction of the surface.⁴

Usually WSLs have an opaque, white and a chalky appearance which is due to an optical phenomenon which is caused due to loss of minerals in the surface and subsurface

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areas of the enamel.⁵

Many studies have stated that the overall prevalence of the damage to the enamel surface after orthodontic treatment ranges between 2-96% as compared to controls and the most affected teeth are said to be molars, mandibular canines, premolars, and maxillary lateral incisors.⁶

Considering the development of these lesions, orthodontists face many challenges owing to the early diagnosis and treatment of WSLs, and this requires complete knowledge about the disease and factors causing it which are unique with every patient. These problems should be brought into evaluation at a very early stage to minimize the risk of persistent tooth decay and its effects.¹

Therefore, it would be very useful for the orthodontist to take up methods for prevention and control the formation of WSLs if they are detected in their early stages during orthodontic treatment.⁷

Many studies have been carried out in relation to the effectiveness of resin infiltration for cavitated enamel lesions but not many studies signify its effect after orthodontic debonding. Therefore, the aim of this systematic review was to evaluate the effectiveness of resin infiltration method on white spot lesions post orthodontic treatment.

2. Materials and Methods

2.1. Protocol

This systematic review was performed based on the given PRISMA statement guidelines.⁸

2.2. Focus question

Effectiveness of resin infiltration method on white spot lesions post orthodontic treatment.

2.3. Study design

Randomized Clinical Trials (RCTs) or Controlled Clinical Trials (CCTs) and In-Vivo studies.

2.4. Search strategy

Four electronic databases (PubMed, Google Scholar, Embase and Cochrane Library Database) were searched from 2009 to 31st October 2019 for original studies of the required criteria. Only articles in English were reviewed.

The search terms under MeSH heading were “White Spot Lesions” AND “Resin Infiltration” AND “Orthodontic Debonding”. Papers with ‘in-vitro’ and ‘in- situ’ studies with artificial White Spot Lesions were not taken into consideration. The reference lists of the accepted papers were hand-searched for additional literature. Key data of the accepted studies were independently reviewed by two reviewers.

2.5. Inclusion criteria

The PICO was constructed as follows:

P- Young adults and adolescents aged less than 30 years with white spot lesions seen within 3-4 months post orthodontic treatment.

I- Any intervention except for laminates or veneers to converse post-orthodontic lesions or improving esthetics.

C- No treatment or Placebo.

O- Effectiveness of the resin used and esthetics in terms of color masking.

2.6. Exclusion criteria

1. Studies comparing the effectiveness of resin infiltration with other treatment modalities.
2. Studies performed without using resin infiltration technique.
3. Studies other than RCT's or In- Vivo.

2.7. Risk assessment

Two review authors (VS and SB) independently assessed the risk of bias for the selected trials using Cochrane's tool for assessing risk of bias, as described in section 8.5 of the Cochrane Handbook for Systematic Reviews of Interventions.⁹

We assessed the following domains as being at low, high or unclear risk of bias:

1. Random sequence generation (selection bias)
2. Allocation concealment (selection bias)
3. Blinding of participants and personnel (performance bias)
4. Blinding of outcome assessors (detection bias)
5. Incomplete outcome data addressed (attrition bias)
6. Selective outcome reporting (reporting bias)
7. Other bias.

2.8. Overall risk of bias

The overall risk of bias for all the studies in the systematic review is unclear.

3. Results

A total of 111 records were found through all the databases out of which, a total of 12 articles were literature reviews relevant to the study and only 4 articles¹⁰⁻¹³ were RCTs which met the inclusion criteria (Figure 1).

Two authors independently extracted information regarding methods, participants, interventions, outcome measures and results and the risk of bias for each study was evaluated (Table 1).

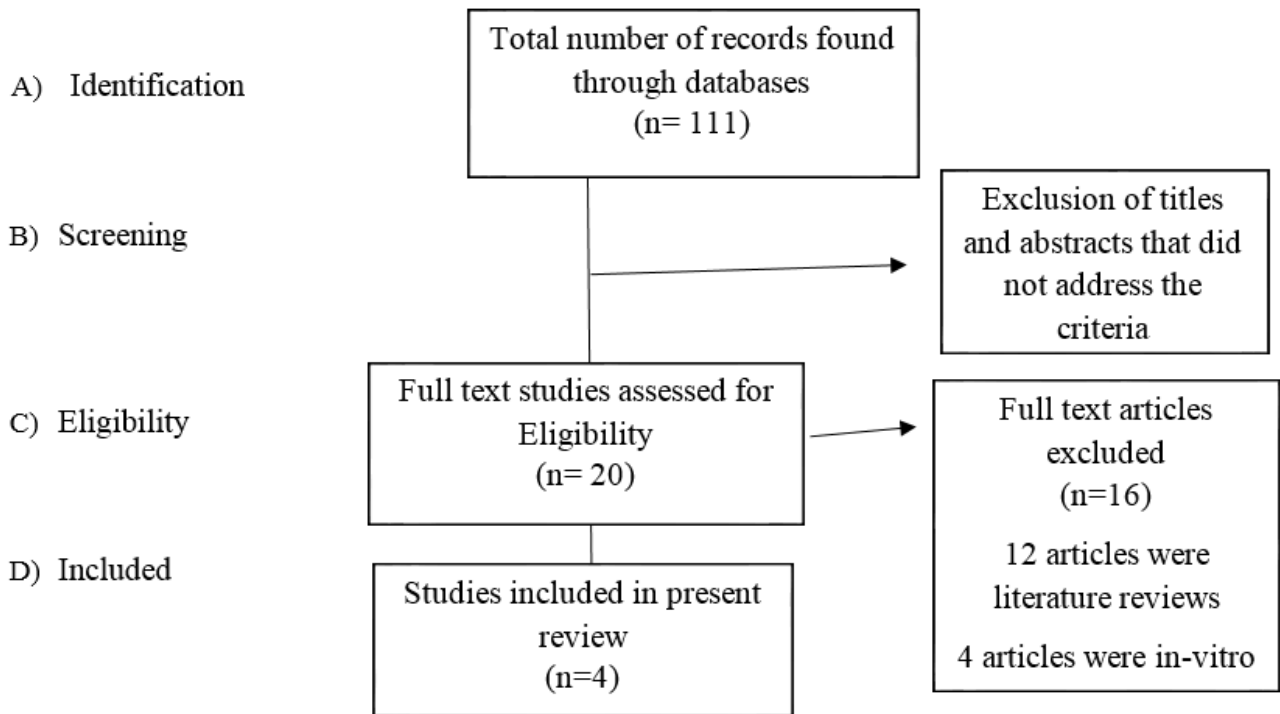


Fig. 1: Flowchart of included studies

Table 1: Risk of Bias for every study

Study	Random Sequence Generation	Allocation Concealment	Blinding of participants and Personnel	Blinding of outcome assessment	Incomplete Outcome Data	Selective Reporting	Other Bias
Michael Knosel et al. ¹⁰	?	+	?	?	?	?	?
Eckstein et al. ¹¹	?	+	?	?	?	?	?
Senestraro et al. ¹²	-	-	?	?	?	?	?
Knosel et al. ¹³	?	-		?	?	?	?

4. Discussion

The development of WSLs is seen to be a most common secondary response to orthodontic treatment and many treatment options are available in the market today.¹⁴

The treatment of WSLs using resin infiltration technique has been shown to have positive results in its effectiveness to be able to camouflage with the adjacent enamel based on the researched studies. But the long-term persistence of the technique remains questionable to both patients as well as clinicians.^{3,15}

This systematic review is unable to provide adequate scientific support because it includes only in-vivo and Randomized Clinical Trials (RCTs) of resin infiltration on white spot lesions (WSL) developed post-debonding compared to sound enamel from the available literature.

The first study included the re-assessment of long-term camouflage effects of resin infiltration (ICON) on white

spot lesions (WSL) compared to sound enamel which was achieved in a previous trial. The subjects who had received resin infiltration in the previous trial after fixed orthodontic treatment were reassessed for the effectiveness of the resin. The results achieved by this technique were shown to be effective in the hue and chroma, and no changes were observed over the last 24 months.

The second study was an in-vivo study assessing the camouflage effects by concealment of post-orthodontic white-spot lesions to sound adjacent enamel achieved over 12 months with resin infiltration (ICON). Out of 20 subjects selected, only 9 subjects were available at the end of 12 months for assessment. The results after a 12-month analysis stated that there was a decrease in the color and lightness of WSLs when compared to adjacent sound enamel which indicated its assimilation.

The 3rd and 4th studies were Randomized Clinical Trials (RCTs) where the subjects selected were participants who

had completed orthodontic treatment to assess changes in the appearance of white-spot lesions (WSLs) that were treated with resin infiltration. The teeth under the treatment group were evaluated for changes using photographs and a visual analog scale.

There was a significant improvement in the clinical appearance of white spot lesions which had developed during orthodontic treatment seen in 8 months and 12 months respectively.

5. Conclusion

Based on currently available literature and after viewing them systematically, the following can be concluded:

1. Long term improvement in the aesthetic appearance of WSLs after orthodontic treatment can be considered suitable when compared to the color of adjacent enamel surface.
2. ICON technique is said to have an improvement on the optical appearance of WSLs.
3. There are no alterations observed with respect to the colour and lightness of the adjacent sound enamel.
4. Consistent stability over a period of 12 months as seen in all 4 studies can be achieved using the ICON for masking WSLs with adjacent sound enamel.
5. Finally, the recent advancement of resin infiltration method for masking White Spot Lesions has been proved successful and better as compared to other traditional techniques.

However, due to a limited number of studies performed and risk of bias, more studies should be undertaken to assess the effectiveness of resin infiltration method on white spot lesions post orthodontic treatment.

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7. Conflict of Interest


None declared.


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