

## EVALUATION OF POSTOPERATIVE SENSITIVITY IN AMALGAM RESTORATIONS: COMPARISON BETWEEN TWO CAVITY LINERS

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### Abstract

**Objective:** To determine the comparative effect of two cavity liners on postoperative sensitivity in amalgam restoration.

**Materials & Methods:** A randomized clinical trial (RCT) study included one hundred patients (both genders) having class 1 cavity divided into two equal groups by blocked randomization. Visual Analogue Scale was used to record pain intensity in patients before restoration, 24 hours and seven days after restoration. In a group, A dentin adhesive and in group B Copal varnish was used as a cavity liner under Amalgam restoration. All the findings were recorded in proforma and data was analyzed using SPSS 20.

**Results:** The age ranges of 18-45 years and in both groups, male were more in number. There was no statistically significant difference between the ages and gender distribution of the treatment groups { $p=0.223$  and  $p=0.538$ } respectively. Values of sensitivities to the cold application before the treatment for group A and B were recorded to be  $2.08\pm 0.518$  and  $2.12\pm 0.627$  respectively. After 24 hours of the procedure, these values were  $3.22\pm 0.974$  (group A) and  $3.60\pm 0.903$  (Group B). On the 7th day, these values were recorded as  $2.88\pm 0.961$  (Group A) and  $3.30\pm 0.994$  (Group B). The difference between the two groups was statistically significant  $p=0.046$  and  $p=0.034$  on follow-up visits (after 24 hours and at 7th day respectively).

**Conclusion:** The comparison of two dentin liners determined that dentin adhesive liner provided greater control of postoperative sensitivity when used under amalgam restorations.

**Keywords:** Postoperative Sensitivity, Amalgam Restorations, Cavity liners, Dentine adhesives

### Introduction

Tooth structure loss can result from multiple causes including caries, trauma and paranasal functions, etc. However carious lesion is considered the most common reason for the loss of tooth structure<sup>1,2</sup>. With the advancement in restorative

dentistry, various dental materials and techniques have been developed to restore and replace the lost tooth structure. Amalgam is one of them and has been efficiently used in dentistry to restore teeth for more than a century<sup>3</sup>. It is more prevalent due to its greater properties, such as ease of manipulation, higher strength and durability, low technique sensitivity and cheaper cost<sup>4</sup>. However, its demerits are low aesthetics,<sup>5</sup> allergic reactions, and mercury toxicity<sup>6</sup>. Postoperative sensitivity is one of its undesirable effects, which has a negative influence on patient satisfaction and attitude towards continuing

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dental care.

The most common factor causing the sensitivity after tooth restoration with amalgam is microleakage<sup>7</sup>. Brännström's renowned hydrodynamic theory of pulpal sensitivity<sup>8</sup>, states that pain is caused by the stimulation of pulpal mechano-receptors because of movement of fluid in dentinal tubules due to microleakage. Therefore, sealing dentinal tubules in the walls of the cavity would inhibit microleakage and ultimately decreasing/ eliminating pain post-operatively. Miniature spaces between cavity walls and amalgam restoration do exist when it is placed initially. This micro area along with permeability of dentine causes free movement of fluid in dentinal tubules resulting in stimulation of mechanoreceptors in pulp and pain sensation. Although sensitivity diminishes few weeks after amalgam restoration as a result of corrosion products producing partial seal at tooth cavity and amalgam interface<sup>9</sup>, it still poses an impact on patients' attitude towards seeking dental care. To counter this problem, dentists have been using different insulating materials (bases, liners, varnishes) between tooth cavity and amalgam restoration<sup>10,11</sup>.

Cavity liners eliminate postoperative sensitivity by sealing the dentine of cavity walls. Numerous dental materials have been used as cavity liners due to their cavity sealing properties, which includes Copal Varnish, calcium hydroxide cement, zinc oxide and eugenol bases, zinc phosphate bases and many more<sup>12,13</sup>. Recently, the newest feature of the enamel and dentin bonding characteristic of dentin adhesive resin liner, gained popularity for its extensive use as desensitizing agent<sup>14</sup>. This study aims to compare two lining materials for their efficacy in reduction of postoperative sensitivity in amalgam restorations.

## Materials and Methods

This randomized control study was conducted for 12 weeks. Patients who were diagnosed as having pits and fissure caries on clinical examination were included in the study. Already restored, hypersensitive and tooth with carious lesion more than 2mm deep, and patients not willing to visit for follow-ups were excluded from the study.

A total of 100 patients were divided equally into two groups by blocked randomization as a block of 10 in which even numbers were assigned to Group

A while odd numbers were put in Group B. Group A included the patients in which dentine adhesive liner was used under amalgam restoration, while in Group B, Copal Varnish was used. Ethical approval was taken, and informed consent was obtained from the patients after explaining the study and treatment procedure and outcomes to them.

Class I cavity with a maximum depth of 2mm was prepared after isolation of a tooth with rubber dam for study. All the patients were educated and told to mark on the VAS (visual analogue scale) according to the intensity of the sensitivity in test tooth when a cold stimulus (Ethyl Chloride Spray on cotton pellet) was applied maximally for 5 seconds.

In group A, the enamel and dentin surfaces of the prepared cavity were acid etchant for 15 seconds and rinsed for 10 seconds with water from the three-way dental unit syringe. After removal of excess water using a cotton pellet, a thin layer of dentin adhesive liner was applied for 15 seconds, followed by light curing for 10 seconds. Enamel and dentin surfaces of group B were lined with two coats Copal varnish using applicator brush and gently air-dried each coat. All the cavities were later filled with dental amalgam.

Patients were called for follow-up visits, after 24 hours and on the 7th postoperative day, to assess sensitivity in test tooth, as evaluated at first appointment with the help of VAS scale, and the response was recorded on proforma. All collected data was entered on SPSS 20 and analyzed. Descriptive statistics were calculated for both qualitative and quantitative variables. Mean  $\pm$  S.D was estimated for age and VAS score at 24 hours and one week. Frequencies and percentages for descriptive variables, e.g., gender and age were calculated. Independent sample t-test was used to compare the mean differences of operative sensitivity with a cold application for group A and B at baseline, after 24 hours and one-week interval. A p-value of  $\leq 0.05$  was considered as statistically significant.

## Results

The study was comprised of a total number of 100 patients (both genders) with class I cavity, with an age range of 18-45 years. Each group included an equal number of patients. The mean age in Group A was  $31.96 \pm 8.27$  years, and in the group, B was  $29.24 \pm 7.58$  years. The gender distribution was 64

males (64%) and 36 females (36%) in group A, while Group B comprised of 56 male (56%) and 44 females (44%). There was no statistically significant difference between the ages and gender distribution of the treatment groups ( $p= 0.223$  and  $p=0.538$ ) respectively.

Values of sensitivities to the cold application (mean VAS score) before the treatment for group A and B were recorded to be  $2.08\pm 0.528$  and  $2.12\pm 0.627$  respectively. No statistically significant difference was present between the sensitivities of the two groups at baseline ( $p = 0.716$ ) (Table 1).

Follow-up assessment, group A and group B showed a mean VAS score of  $3.22\pm 0.974$  and  $3.60\pm 0.903$  at 24 hours interval respectively. Whereas on the evaluation on 7<sup>th</sup> postoperative day mean VAS score for group A and group B were recorded  $2.88\pm 0.961$  and  $3.30\pm 0.994$  respectively (Table 1). Comparison of both groups after the procedure showed that group A has statistically significant lower mean VAS score than group B at 24 hours ( $p = 0.046$ ) and one-week interval ( $p=0.034$ ) (Table 1). Comparison of sensitivities of group A and group B at follow-up visits was carried out which showed statistically significant differences,  $p<0.05$ , (Tables 2).

The results of our study demonstrated that Dentin adhesively is more efficient than Copal varnish in reducing postoperative sensitivity when used under amalgam restorations.

**Table 1: Comparison of VAS values in both groups before and after treatment**

VAS Value	Group A	Group B
At baseline	$2.08\pm 0.528$	$2.12 \pm 0.627$
At 24 hours	$3.22\pm 0.974$	$3.60\pm 0.903$
At 7th day	$2.88\pm 0.961$	$3.30\pm 0.994$

**Table 2: Comparison of VAS at follow-up visits within Group**

Groups	VAS values on Follow-up		P-value
	24 Hours	7th Day	
Group A	$3.22\pm 0.974$	$2.88\pm 0.961$	0.004
Group B	$3.60\pm 0.903$	$3.30\pm 0.994$	0.002

## Discussion

The study aimed to get a comparative analysis of two cavity liners in amalgam restorations regarding their effect on postoperative sensitivity as very few comparative studies are available on this subject. Postoperative sensitivity is thought to be a frequently occurring phenomenon as a consequence of micro-leakage around the restoration<sup>15</sup> by some researcher. They found that mild to moderate pain after dental restorations were present even with the application of cavity liners and varnishes. Brännström and Nordenvall for the first time investigated the effects of micro-leakage on the pulp. He emphasized the removal of smear layer to eradicate the bacteria, and the placement of material to seal the dentinal tubules, therefore reducing postoperative sensitivity<sup>16</sup>.

Results of our study have established that the dentin adhesive liner is more effective than Copal varnish in the prevention of postoperative pain and sensitivity under amalgam restorations. The outcomes of various studies conducted in vivo and in vitro; different researchers support this research. Despite the difference of methods employed to evaluate micro-leakage and sensitivity in these studies, the result remained the same as of our study.

Sepetcioglu and Ataman analyzed the sealing ability of a cavity varnish and dental adhesive for the micro-leakage reduction in high copper amalgam restorations by chemical diffusion technique. They established that use of dental adhesive as an intermediate liner had a significant advantage in reducing micro-leakage when compared with conventional Copal varnish<sup>17</sup>.

A similar study was conducted in primary teeth by Michael and his colleagues to compare dentin adhesive liner with Copal varnish for micro-leakage under amalgam restorations<sup>15</sup>. They observed that apart from dentin adhesive liner, all the specimens showed micro-leakage around the margins of the restorations.

In another in vitro study by Moosavi and Sadeghi on the short-term evaluation of resin sealing and rebonding for amalgam micro-leakage demonstrated that multi-step adhesive system was significantly more effective in reducing micro-leakage as compared to copalite.<sup>18</sup>

The studies conducted by Gallato et al. (2005)

and by Eskadaril, [Torabi](#) and [Mirzaie](#) (2003) for assessment of micro-leakage using varnish and dentine adhesives, demonstrated significantly superior sealing and least microleakage for the amalgams with the adhesive liner<sup>19,20</sup>. Hajizadeh and his co-workers also concluded from their study that patients who received dentine adhesives showed decreased sensitivity to cold postoperatively than the patients in whom Copalite was used under amalgam restoration<sup>21</sup>.

Most of the investigators have established that dentin etching is the best method for removal of smear layer, also dentin adhesive liners reduce micro-leakage by blocking dentinal tubules<sup>22</sup>. No harmful effects were found in the pulp. The outcome of this clinical study and other clinical trials cited endorses the routine use of dentin adhesives as a liner for amalgam restorations for the prevention of postoperative sensitivity.

### Conclusion

The comparison made between two dentin liners concluded that dentin adhesive liners provided greater control of postoperative sensitivity when used under amalgam restorations. The superior sealing property and dentine bonding of cavity liners control micro-leakage and thus result in reduced pain.

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