

## COMPARISON OF POST-OPERATIVE SENSITIVITY IN TEETH RESTORED WITH COMPOSITE USING TWO DIFFERENT ADHESIVE SYSTEMS

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### ABSTRACT

**Introduction:** Resin composite materials are considered as adequate restorative material for posterior teeth. Unlike amalgam, resin composite can bond to enamel which is one of the main advantages of using resin composite as a restorative material. Currently, this micro-mechanical retention is considered to be the strongest adhesion in the oral cavity, however, there is scarcity of data regarding comparison of post-operative sensitivity in teeth restored with composite using two different adhesive systems. This study was designed to compare the mean post-operative sensitivity after class II restorations, in teeth restored by using self-etch and total-etch adhesive protocols.

**Material & Methods:** After meeting the inclusion criteria 370 patients were enrolled. Informed consent and demographic information was taken. Then patients were divided equally into two groups using the single blinded randomized controlled trial. Randomization was done using computer generated random allocation of numbers in each group. One group is treated with Self-Etch (SE) adhesive technique and other with Total-Etch (TE) adhesive technique. Rubber dam was applied in all cases. Post-operative sensitivity was recorded in both groups after seven days using Visual Analogue Scale. Collected data was entered and analysed using SPSS version 21.

**Results:** In our study, mean age of the patients was  $30.83 \pm 5.91$  years, male to female ratio of the patients was 1.04:1. The mean value of post-operative sensitivity of the patients was  $0.89 \pm 0.721$ . The mean value of post-operative sensitivity of group A patients was  $0.65 \pm 0.62$  while the mean value of post-operative sensitivity of group B patients was  $1.13 \pm 0.74$  (p-value <0.001).

**Conclusion:** According to our study results the total-etch adhesive technique is significantly better technique as compared to self-etch adhesive technique in terms of post-operative sensitivity in patients after class II composite restorations.

**Key Words:** Class II Restorations, Post-op Sensitivity, Self-etch, Total-Etch

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### INTRODUCTION

Due to recent advancements, resin composite materials are considered as adequate restorative material for posterior teeth.<sup>1</sup> Unlike amalgam, resin composite can bond to enamel which is one of the main advantages of using resin composite as a restorative material. Currently, this micro-mechanical retention is considered to be the strongest adhesion in the oral cavity and also is responsible for conservation of tooth structure unlike amalgam in which proper retention form is required to keep amalgam in preparation.<sup>2</sup>

The term post-operative sensitivity (POS) is characterized by pain in a tooth associated with mastication or with contact with hot, cold, sweet or sour stimuli that occurs one week or more after the treatment.<sup>3</sup> Numerous restorative procedures are

performed daily in dental offices, and some stages of procedure may produce stimuli that result in pain or aggravate already existing sensitivity.<sup>4</sup> post-operative sensitivity can be due to a number of factors including dentine etching, restoration technique, polymerization shrinkage, depth of cavity, cusp deformation by occlusal forces, over drying of dentin.<sup>5</sup>

A common reason for constant post-operative sensitivity is developing of gaps underneath the restoration sites. The latter often fills with dentinal fluid. It is common phenomena that hot stimulus causes expansion and cold stimulus causes contraction of fluid in this gap, which results in sudden movement of this fluid. This causes pain in the affected area. It has been reported that such gaps are formed either due to a void

in composite filling or the pulling away of composite from pulpal floor due to stresses. These stresses cause by polymerization shrinkage or can be a gap in hybrid layer due to inadequate resin infiltration leading to formation of a “hybrid” layer”.<sup>7</sup>

The solutions of resin monomers that make the resin dental substrate interaction possible are known as Dental Adhesives.<sup>6</sup> Current polymer adhesive systems are basically used to protect the dentin-pulp complex as well as to bond resin composite material to tooth, thereby preventing micro-leakage. Acid-etching of dentin and enamel is used commonly in procedures of dentin bonding.<sup>2</sup> The duration of acid etching process and the amount of surface wetness which is present during the application of adhesive can affect the quality of resin-dentin adhesion while using the total-etch adhesive.<sup>6</sup> Self-etch adhesives is considered as one method to decreased post-operative sensitivity as they do not remove smear plugs, therefore reducing hydraulic conductance through dentinal tubules.<sup>8</sup> Total-etch adhesive technique depends on the micro-mechanical retention formed by acidic etching of enamel and dentin prepared surfaces and penetration of a blend of polymers into etched substrate.<sup>2</sup>

POS following composite resin restorations, can show varying results ranging from as high as 31% to as low as 5%.<sup>9</sup> According to another study, up to 56% of the restorations resulted in sensitivity when total etch adhesive was used to restore posterior teeth with resin composite.<sup>7</sup> There are various publications that compared total-etch and self-etch adhesives in causing POS after posterior composite restorations. According to Amin et al, self-etch group ( $1.08 \pm 1.2$ ) showed more POS initially as compared to total etch group ( $0.70 \pm 1.4$ ) on Day 1 ( $p=0.027$ ). At the 7th day, there was no significant difference between the two groups ( $p=0.67$ ).<sup>10</sup> According to a study, increased cavity depth maybe the cause of at least six percent of complaints of sensitivity after direct composite resin restorations.<sup>11</sup>

Many international and local studies have done research on self-etch and total etch adhesive system in causing the POS after composite restorations, but contradictory results have been obtained. Hence the rationale of this study was to compare the total-etch and self-etch adhesive in causing POS after Class-II composite restoration.

#### MATERIAL AND METHODS

Formal approval was taken from ethical review committee before commencement of the study. The study design was Randomized Controlled Trial. Simple random sampling was done. Inclusion criteria included patient of either gender, aged between 20-40 years, Class II cavity design with vital pulp, teeth with medium depth cavities (1-3mm from the pulp) evaluated with the help of bitewing radiograph, no history of previous restorations and no preoperative sensitivity. Exclusion criteria included patients with visible plaque deposits, patients with history of para-functional habits, patients with allergies to restorative materials, all teeth with enamel dentin fractures or cracks, teeth with abnormal occlusion and abutment of a fixed or removable prosthesis.

Rubber dam was applied in all the cases to provide complete isolation. Access to the carious lesion was

obtained with a diamond bur mounted on a high-speed hand piece. Once the cavity preparation was complete, patients were divided equally into two groups, Group A and B, using random allocation method. (Randomization was done by computer generated random allocation sequence). Each step was performed by the principal investigator. Both the adhesives were applied according to the manufacturers guide. Randomization was done using computer generated random allocation of numbers in each group.

Group A = Three step etch and rinse adhesive system

Group B= Two step self-etch adhesive system

**Total-etch adhesive (Group A):** Preparation was etched for 15 seconds and rinsed thoroughly. An equal number of drops of Part A and B (1:1) were dispensed into a mixing well. Using a brush, adhesive was mixed for 5 seconds. 1-2 coats were applied onto the tooth preparation. Gently air-dried, started with 5 seconds. Light cured for 10 seconds. One thin coat of total-etch adhesive was applied. Air-thin if necessary. Light cured for 10 seconds.

**Self-etch adhesive (Group B):** 1. Primer was applied gently on the surface and left undisturbed for 20 seconds. Gentle air flowed and bond was applied. Air-thin and light cured for 10 seconds

A sectional metal matrix was placed in all cavities and stabilized with appropriate wedges. Restorations were carried out using a thin layer (< 1 mm) of flowable composite on the cavity floor and a nanohybrid composite in oblique stratification to minimize polymerization shrinkage stresses. Each increment was light cured for 20 seconds. Coarse finishing was accomplished with carbide burs under water irrigation and final polishing of the occlusal surface was done with a fine grit diamond rotating bur, diamond-impregnated resin polishers, pastes, and aluminium oxide disks with decreasing abrasiveness.

Subjects were then dismissed and given post-operative instructions and a prescription for optional analgesics. Subjects were recalled for a follow-up visit after 7 days. Follow up was ensured by keeping contact number and address. For each restoration, the presence of POS was noted by placing an ice stick upon the junction of restoration and natural tooth structure on the occlusal surface for five seconds. The degree of severity in sensitivity was marked by using Visual Analogue Scale (VAS), with readings from 0-10. On the scale, 0 indicating absence of sensitivity and 10 indicating severe sensitivity. A postoperative bitewing radiograph was also performed to confirm the depth of the restoration and its distance to the pulp chamber (1-3 mm).

A structured Performa was specifically designed to record findings of the study (Performa attached). The outcome variable i.e. the POS after self-etch and total etch adhesive system was noted on the Performa by the researcher on the 7th day.

**Data Analysis:** Data was entered and analysed using SPSS 21.0. Descriptive statistics was calculated for qualitative & quantitative variables. For quantitative variables like age, sensitivity score, mean  $\pm$  SD was calculated. For qualitative variable like gender frequency and percentages were calculated. Student's t test was used to compare mean reduction in POS in two

groups. P-value <0.05 was considered significant. Data was stratified for age, gender, education status. Post stratification t test was used taking p-value<0.05 as significant.

## RESULTS

A total of 370 patients were enrolled in this study. The mean age of the patients was  $30.83 \pm 5.91$  years with maximum and minimum ages of 20 & 40 years respectively. According to this study, 185 patients were from group A and 185 were from group B. the mean age of the patients from group A was  $30.64 \pm 5.73$  years while the mean age of the patients from group B was  $31.02 \pm 6.09$  years. In our study 189 (51.08%) patients were male while 181 (48.92%) patients were females. Male to female ratio of the patients was 1.04:1. Out of 370 patients, 137 (37.03%) patients were illiterate, 98 (26.49%) patients had primary education, 69 (18.65 %) patients had middle and 66 (17.84%) patients had matric and above education. (Table 1)

The study results showed that the mean value of POS of the patients was  $0.89 \pm 0.721$  with minimum and maximum VAS values of 0 & 2 respectively. The mean value of POS of group A patients was  $0.65 \pm 0.62$  while the mean value of POS of group B patients was  $1.13 \pm 0.74$ . This difference was statistically significant. i. e p-value= $<0.001$  (Table 2).

The study results showed that patients with age< 30 years the mean value of postoperative sensitivity from group A was  $0.65 \pm 0.61$  and from group B was  $1.04 \pm 0.76$  (p value<0.001). Similarly in patients with age > 30 years the mean value of postoperative sensitivity from group A was  $0.66 \pm 0.62$  and from group B was  $1.21 \pm 0.72$  (p-value= $<0.001$ ). The study results showed that among male patients the mean value of POS of the patients from group A was  $0.60 \pm 0.61$  and the mean value of POS from group B patients was  $1.15 \pm 0.71$  (p= $<0.001$ ). Similarly, among female patients the mean value of POS of the patients from group A was  $0.72 \pm 0.62$  and the mean value of POS from group B patients was  $1.11 \pm 0.77$  (p= $<0.001$ ) (Table 3)

## DISCUSSION

This single blinded randomized controlled study was carried out in the Operative dentistry department of Watim Dental Hospital, Rawapindi to compare the mean POS after class II restorations in the tooth by using self-adhesive and complete etch adhesive procedures. POS following application of posterior dental composite material restoration is reported as a common issue by the dentists. It has been revealed that POS reduces within the first few weeks after the composite restoration, but sometimes it may persist for a longer period of time. POS may be caused by a number of variables, including etching, bacterial penetration of the pulp, occlusion discrepancies, method of restoration placement, over-drying of dentin, depth of cavity deformation of the cusps by shrinkage stress during polymerization of the posterior resin composite restorations, deformation of the cusps by polymerization shrinkage stress, and deformation of the composite by occlusal forces.<sup>12</sup>

The mean of POS of the included patients was  $0.89 \pm 0.721$ . The mean value of POS of total-etch adhesive group patients was  $0.65 \pm 0.62$  while the mean

value of POS of Self-etch adhesive group patients was  $1.13 \pm 0.74$ . Statistically Total-etch group showed significantly lower POS as compared to the self-etch adhesive group i.e. p-value=0.001. The results of our study are similar to earlier studies, however, few studies showed contrary results to our study. Krithikadatta et al. conducted a meta-analysis that compared different clinical outcome of composite restoration placed with Self-etch and Total-Etch found that there was no significant difference in POS.<sup>13</sup> Different testing material could be a reason or bonding failure as self-etch adhesives have weak etchant so weak etchant. The clinical technique is more related to POS than the type of adhesive system used.<sup>14</sup>

Amin et al conducted a study to evaluate the POS in teeth restored with posterior dental composites using self-etch and total-etch adhesives. The results of his study are consistent with our results. Statistically significant difference was found in the level of POS in both total-etch and self-etch adhesive groups between the day one and later follow up visits. In each group, the VAS score of day 1 was higher than day 7 for POS. In first four days of restoration placement, the POS was lesser in total etch adhesives as compared to self-etch group but after that, difference was not noticeable.<sup>10</sup> Most of the studies have used the VAS measure the sensitivity score from 0 to 10 which is in accordance with our study.

Baratieri et al. compared the clinical performance of the self-etching adhesive system and the total-etch adhesive system in classes-I and -II for a period of 4 years. This study stated that POS was found with self-etch adhesives. The same study also showed that the occurrence of POS decreased with the passage of time for the self-etch adhesive system.<sup>15</sup>

According to Perdigao et al, no difference in POS were found between total-etch adhesive and self-etch adhesive at 2 weeks.<sup>16</sup> Swift et al, stated that POS decreased with time and no significant difference was found between total- etch and self-etch adhesives during 3 years follow up study time.<sup>17</sup> Similar results were reported by Burrow.<sup>18</sup> One more study by Ajmal Yousaf et al demonstrated that less POS was observed at postoperative 24 hours evaluation in restoration placed using self-etch adhesives compared to total etch adhesives. Therefore, the use of self-etch adhesives may be helpful in decreasing POS during 24 hours after placement of restoration.<sup>5</sup>

In another study, POS was observed with self-etch adhesives which reduced at the end of 30 days. <sup>8</sup>POS observed in posterior composite resin restorations in Class II cavities showed that there is a significant difference in POS in the first 24 hours after treatment, with the level of sensitivity decreasing over time.<sup>19</sup> Cavity configuration (C-factor) of class II preparations is more suitable as it results in dissipation of polymerization stresses but the damage of dental structure has been found to be a determining factor in the incidence of POS.<sup>20</sup>

A study was conducted in Iran which compared POS after posterior composite restorations and gender or age. POS was found to be greater in younger age groups as compared to adults and the elderly, which is most likely due to the tertiary dentin over time. A significant

association was found between age groups and POS frequency, whereas no association was found between POS and gender.<sup>21</sup> In our study, significant association was found between self-etch and total etch groups among patients with age ≤30 years and >30years(p-value=<0.001).

A significant association was found among male and female patients and POS in both group A and B, in our study (p-value= 0.05).<sup>21</sup> Our study showed significant association was found among literate and illiterate patients and POS after composite restoration in both group A and group B. According to results of our study, the total etch adhesive technique was found to be significantly better technique as compared to self-etch adhesive technique in terms of POS after class II composite restoration in patients.

**CONCLUSION**

According to results of our study, the total etch adhesive technique is better technique compared to self-etch adhesive technique in terms of POS after class II restorations in patients

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Table -1 Descriptive Statistics of Age, Gender, Educational status and Post-operative Hypersensitivity

Age		Gender			Education al status			POS	
mean	SD	Male	Female	Illiterate	Primary	Middle	Matric & above	mean	SD
		189	181	137	98	69	66		
30.83	5.91	51.08%	48.92%	37.03%	26.49%	18.65%	17.84%	0.721	0.89

Table 2. Age, gender and post-operative hypersensitivity of study groups

Study groups	Age		Gender		POS		P value
	Mean	St. d	Male	Female	Mean	St. d	
Self-etch adhesive	30.64	5.73	97 (52.4%)	88 (47.6%)	0.65	0.62	<0.001
Total-etch adhesive	31.02	6.09	92 (49.7%)	93 (50.3%)	1.13	0.74	<0.001

Table 3. POS stratified by age, gender and educational status

POS	Age		Gender		Educational Status		P-VALUE
	>30 years	<30 years	M	F	Literate	Illiterate	
Total etch adhesive	0.66±0.62	0.65±0.61	0.60±0.61	0.72±0.62	0.63±0.62	0.71±0.60	<0.001
Self-etch adhesive	1.21±0.72	1.04±0.76	1.15±0.71	1.11±0.77	1.12±0.75	1.15±0.72	<0.001