

# Post-Operative Sensitivity in Posterior Composite Resin Restorations Using Etch and Rinse Versus Self-Etch Adhesive Systems

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## ABSTRACT

**Objective:** The purpose of performing this study was to weigh up the frequency of post-operative sensitivity (POS) using two-step etch and rinse against one step self-etch adhesives.

**Methodology:** This study was carried out in the Operative Dentistry's department, Fatima Memorial Hospital College of Medicine and Dentistry, Lahore and it was completed in 18 months from February 2020 to August 2021. A total of 60 patients presenting with carious lesions in maxillary and mandibular posterior teeth excluding third molars were included. Patients were divided into groups of two comprising of 30 patients each. Restoration of group A was performed using Excite (Ivoclar Vivadent, Schaan, Liechtenstein) in etch and rinse technique and restoration of group B was performed using Xeno III (Dentsply, Ballaigues, Suíça) in self-etch adhesive technique.

**Result:** The outcome of this study showed no significant difference in the frequency of POS in etch and rinse vs self-etch adhesive groups based on gender, age groups and educational status.

**Conclusion:** Composite restoration done using self-etch adhesive has similar results in terms of POS in comparison to restorations done using etch and rinse adhesive.

**Key Words:** Dental adhesives, post operative sensitivity, resin composite, restoration

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## INTRODUCTION

People go to dental practitioner for pain relief and it is confirmed that the complaint of tooth sensitivity is felt differently at different times with differing stimuli and intensities. Restorative treatment is performed to get rid of signs and symptoms of reversible pulpitis from patient's teeth. If the previous sensitivity has not resolved or has resulted in a new POS, it gets distressing for the patient and the dentist. Treatment with lower prevalence of symptoms postoperatively is considered as treatment of choice.

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Posterior composites have become a widely known filling material replacing amalgam<sup>1</sup> due to three main reasons like demand for tooth-colored fillings, patients' concerns regarding mercury toxicity<sup>2</sup> and Minamata Agreement<sup>3</sup>. Apart from various reasons for failing posterior composites, POS is a usual phenomenon. POS may show a steady decrease over time or may persist for longer. The factors responsible for POS are not clear. It can be due to many factors few of them are shrinkage occurring after polymerization, gaps at the margins, below average adhesion, inadequate polymerization, unfavorable configuration factor (C-Factor) and remaining dentinal thickness (RDT), pre-operative dental factors, such as cracks<sup>4</sup>. The mechanism of persistent POS is that polymerization shrinkage forms a gap under the restoration which is then filled with dentinal fluid. When a stimulus whether hot or cold is applied to a tooth, fluid expansion or contraction forms gap and the fluid movement in the tubules causes POS<sup>5</sup>. Pulp is packed with sensory afferents that are involved in pain perception, whereas dentin has lesser amount of innervation but is very prone to sensitivity<sup>6</sup>. It is still doubtful if the fluid movement excites the nerve ending directly within the superficial pulp or

inner ends of tubules, or if the odontoblasts have a part in transduction mechanism.

Patients that are supposed to receive posterior composite resin restoration are usually those with caries or have signs and symptoms of reversible pulpitis. As the cavity depth increases, the permeability of dentin changes too and makes the tooth prone to POS. New adhesives have been constantly introduced that bond enamel and dentin effectively but even then, POS remains a major distress for the dentist<sup>7</sup>. Two types of adhesive applications are there according to whether or not prior etching with acid is needed. Self-etch adhesives are advantageous when compared with adhesives that require acid etching as an additional step. The primer has acid in it, so no rinsing is required. Thinner hybrid layer is formed, but the etched area is formed by the adhesive, thus minimizing hydrolysis of hybrid layer and hence, decreasing the chances of POS.

Few studies found no difference in POS between both adhesive systems. Rest of the studies inferred that, in cavities with reduced RDT, the use of self-etching adhesives was successful in reducing POS in comparison to total-etch adhesive systems<sup>8</sup>. Swift et al concluded that, after 6 months of placement, 17% of the patients suffered from POS following the use of etch and rinse group in comparison to 10% in self-etch adhesive group but it decreased with time eventually producing no significant difference. In order to duplicate this study in Pakistani population, a pilot study consisting of 30 patients in each group was carried out in our department from 2018-2019, that showed sensitivity incidence of 35% in etch and rinse and 7.1% in self-etch group. Therefore, in the light of pilot study conducted in the population of Pakistan and the rest of literature, this study has been planned to compare etch and rinse and self-etch in relation to POS frequency in Pakistani population. The results of this study will add to the literature the only adhesive strategy that is less prone to POS in relation to composite restorations, so as to provide the most predictable and pain free treatment to the patient.

## METHODOLOGY

It was a randomized control trial. Sixty patients were selected as sample size using OpenEpi software. The Institutional Review Board of FMH approved this study by certifying it with IRB certificate No. FMH-03-2019-IRB-586-M. Patients were recruited at the outpatient department. Informed consent was taken from the patients. Thirty were in Group A (Two step etch and rinse) and other 30 were selected for group B (one step self-etch) with confidence level, power of test and level of significance to be 95%, 80% and 5% respectively, taking expected frequency of sensitivity

as 35% in etch and rinse and 7.1% in self etch group (cohort study). The technique applied was non-probability consecutive sampling.

Inclusion criteria was male and female patients within 18-50 years in age with posterior teeth having class 2 cavities with supra gingival margins and no preoperative signs and symptoms.

Exclusion criteria was those with previously restored teeth, deep caries with significant signs and symptoms like spontaneous pain and periapical infection and patients who do not give informed consent.

Random division of patients was done to eliminate bias consisting of 30 patients in each group using random number tables. Group A was assigned etch and rinse adhesive whereas group B was assigned self-etch. The procedures were done under isolation of rubber dam. Patients were informed to report on follow up calls after 24 hours, 15 days, and 30 days. Patients' response was graded on Visual Analogue Scale (VAS). Patient is supposed to have POS if he/she presents with pain of moderate or severe intensity (>4 on VAS), when evaluated at the end of 24 hours, 15 days, and one month. The patients were asked if they felt any sensitivity on taking hot or cold drinks/food, spontaneous pain, or pain on mastication.

Small round diamond bur was used to remove class 2 carious lesions followed by excavation. The cavity was later isolated and dried. Group A cavities were applied with two steps etch and rinse adhesives and group B cavities were applied one step self-etch adhesives. For Group A, class 2 cavities were acid etched with phosphoric acid for 15 second and then washed out for 10 second. The tooth surface was dried using triple air syringe. Excite (Ivoclar Vivadent, Schaan, Liechtenstein) was applied. Then, it was light cured for 10 seconds. Incremental technique of composite placement using Ivocalar Vivadent was applied. Group B class 2 cavities were applied with multiple coats of self-etchant using Xeno III (Dentsply, Ballaigues, Suíça), left in place for 20 seconds and air dried. Light curing was done for 10 second and finished with incremental technique of composite placement with Ivoclar Vivadent. Carbide finishing burs were used to perform minor finishing followed by polishing to achieve final luster.

The data was examined using SPSS-22.0. For descriptive analysis, means and standard deviation were calculated for the variables of quantitative nature which were age and pain at one month. To compare mean pain score, we used repeated measures ANOVA at 24 hours and one month. To assess the pain between two groups, independent sample T test was used to measure percentage of patients that have POS. Data

was stratified for age, gender, and educational status. Post stratification T test was used taking p-value <0.05 as significant.

## RESULTS

Table 1 shows pain responses of patients with etch and rinse, with 80.0% patients presented with no pain after 24 hours, 83.3% with no pain at 15 days and 90.0% patients with no pain after 30 days. Moderate pain was observed in 10.0%, 13.3% and 10.0% of patients at 24 hours, 15 days and 30 days respectively. Whereas, unbearable pain was observed in 10.0%, 3.33% and 0.00 patients at 24 hours, 15 days and 30 days respectively.

**Table 1: Pain Response of Subjects to Etch and Rinse**

| Pain responses         | 24 hours    | 15 days     | 30 days     |
|------------------------|-------------|-------------|-------------|
| <b>No pain</b>         | 24<br>80.0% | 25<br>83.3% | 27<br>90.0% |
| <b>Moderate pain</b>   | 3<br>10.0%  | 4<br>13.3%  | 3<br>10.0%  |
| <b>Unbearable pain</b> | 3<br>10.0%  | 1<br>3.33%  | 0<br>0.00   |

Table 2 shows pain responses of patients with self-etch adhesives, with 80.0% patients presented with no pain after 24 hours, 83.3% with no pain at 15 days and 90.0% patients with no pain after 30 days. Moderate pain was observed in 16.6%, 16.6% and 10.0% of patients at 24 hours, 15 days and 30 days respectively. Whereas, unbearable pain was observed in 3.33%, 0.00 and 0.00 patients at 24 hours, 15 days and 30 days respectively.

**Table 2: Pain Response of Subjects to Self-etch**

| Pain Responses         | 24 hours   | 15 days     | 30 days   |
|------------------------|------------|-------------|-----------|
| <b>No Pain</b>         | 24<br>80%  | 25<br>83.3% | 27<br>90% |
| <b>Moderate Pain</b>   | 5<br>16.6% | 5<br>16.6%  | 3<br>10%  |
| <b>Unbearable Pain</b> | 1<br>3.33% | 0<br>0.00   | 0<br>0.00 |

Table 3 shows association of gender distribution POS and technique used. Statistically, there was no notable variation in POS based on technique used in male group with p value 1.00 and female group with p value 1.00.

**Table 3: Association of Gender Distribution, Post-Operative Sensitivity and Technique Used**

| Gender |     | POS        |            | Technique      |           |       | P value |
|--------|-----|------------|------------|----------------|-----------|-------|---------|
|        |     |            |            | Etch and Rinse | Self-etch | Total |         |
| Male   | Yes | No         | Count      | 1              | 1         | 2     | 1.00    |
|        |     |            | % of Total | 3.3%           | 3.3%      | 6.7%  |         |
|        | No  | Count      | 14         | 14             | 28        |       |         |
|        |     | % of Total | 46.7%      | 46.7%          | 93.3%     |       |         |
| Female | Yes | No         | Count      | 2              | 2         | 4     | 1.00    |
|        |     |            | % of Total | 6.7%           | 6.7%      | 13.3% |         |
|        | No  | Count      | 13         | 13             | 26        |       |         |
|        |     | % of Total | 43.3%      | 43.3%          | 86.7%     |       |         |

\* p-value is significant at <0.05

Table 4 shows association of age distribution, POS and technique used. Statistically, there was no notable variation in POS based on technique used in 18-30 age group with p value 0.935, 31-40 age group with p value 0.952 and 41-50 age group with p value 1.00.

**Table 4: Association of Age Distribution, Post-Operative Sensitivity and Technique Used**

| Age   |     |            | Technique      |           | Total | P value |
|-------|-----|------------|----------------|-----------|-------|---------|
|       |     |            | Etch and Rinse | Self-etch |       |         |
| 18-30 | POS | Yes        | Count          | 1         | 1     | 0.935   |
|       |     |            | % of Total     | 5.9%      | 5.9%  |         |
|       | No  | Count      | 7              | 8         | 15    |         |
|       |     | % of Total | 41.2%          | 47.1%     | 88.2% |         |
| 31-40 | POS | Yes        | Count          | 1         | 1     | 0.952   |
|       |     |            | % of Total     | 4.3%      | 4.3%  |         |
|       | No  | Count      | 11             | 10        | 21    |         |
|       |     | % of Total | 47.8%          | 43.5%     | 91.3% |         |
| 41-50 | POS | Yes        | Count          | 1         | 1     | 1.00    |
|       |     |            | % of Total     | 5.0%      | 5.0%  |         |
|       | No  | Count      | 9              | 9         | 18    |         |
|       |     | % of Total | 45.0%          | 45.0%     | 90.0% |         |

\* p-value is significant at <0.05

Table 5 shows association of educational status, POS and technique used. Statistically, there was no notable variation in POS based on technique used in primary group with p value 0.704, middle group with p value 0.615 and matric and above group with p value 0.815.

**Table 5: Association of Educational Status, Post-Operative Sensitivity and Technique Used**

| Educational Status |     |            | Technique      |           | Total | P value |
|--------------------|-----|------------|----------------|-----------|-------|---------|
|                    |     |            | Etch and Rinse | Self-etch |       |         |
| Illiterate         | POS | No         | Count          | 3         | 3     | -       |
|                    |     |            | % of Total     | 50%       | 50%   |         |
| Primary            | Yes | No         | Count          | 1         | 0     | 0.704   |
|                    |     |            | % of Total     | 16.7%     | 0     |         |
|                    | No  | Count      | 4              | 1         | 5     |         |
|                    |     | % of Total | 66.7%          | 16.7%     | 83.3% |         |
| Middle             | Yes | No         | Count          | 1         | 2     | 0.615   |
|                    |     |            | % of Total     | 5.3%      | 10.5% |         |
|                    | No  | Count      | 8              | 8         | 16    |         |
|                    |     | % of Total | 42.1%          | 42.1%     | 84.2% |         |
| Matric and Above   | Yes | No         | Count          | 1         | 1     | 0.815   |
|                    |     |            | % of Total     | 3.4%      | 3.4%  |         |
|                    | No  | Count      | 12             | 15        | 27    |         |
|                    |     | % of Total | 41.4%          | 51.7%     | 93.1% |         |

\* p-value is significant at <0.05

Table 6 shows frequency of POS in etch and rinse versus self-etch with 5.0% patients having POS in each group and 45.0% patients having no POS in each group.

**Table 6: Frequency of Post-Operative Sensitivity in Etch and Rinse Versus Self-etch**

| Technique      |            | Post Operative Sensitivity |     | Total |
|----------------|------------|----------------------------|-----|-------|
|                |            | Yes                        | No  |       |
| Etch and Rinse | Count      | 3                          | 27  | 30    |
|                | % of Total | 5%                         | 45% | 50%   |
| Self-etch      | Count      | 3                          | 27  | 30    |
|                | % of Total | 5%                         | 45% | 50%   |

\* p-value is significant at <0.05



## DISCUSSION

This study aimed at comparing the frequency of POS in posterior composite resin restoration utilizing two steps etch and rinse and self-etch adhesives. A total of 60 patients, out of which 5% of the patients in whom etch and rinse was used had POS, 45% of the patients who received etch and rinse adhesive did not have POS. Same was the response with self-etch adhesives with 5.0% of patients having POS and 45% of the patients had no POS. Statistically, no difference was found in POS based on technique used (p value 1.00).

The outcome showed the occurrence of POS in etch and rinse and self-etch adhesives had no significant difference during both immediate post operative period and 30 days post operative. Previous studies showed conflicting results regarding the frequency of POS in etch and rinse and self-etch technique.

A study of randomized control trial nature was done to compare POS in etch and rinse versus self-etch which concluded that the adhesive did not influence the occurrence of POS<sup>9</sup>. Another study done by Scotti N et al showed that the use of a three-step etch-and-rinse versus a two-step self-etch adhesive did not significantly affect the POS experienced by the patient<sup>10</sup>. In both adhesive groups, an increase in POS was observed on the day immediately after the restoration placement. But, in both groups, POS decreased significantly after 1 week which showed the initial POS was due to pulpal insult and operative procedure. Ausschill et al evaluated POS after adhesive treatments and the different stimuli causing it. Depth of the cavity was the one factor to have effect on the occurrence of POS and adhesive systems did not affect it. A study conducted by Muhammad Amin in 2018 showed there seemed more sensitivity initially in self-etch group but after a week no notable difference in POS was found between etch and rinse group and self-etch group<sup>11</sup>. Whereas, another study conducted by Ali et al<sup>12</sup> showed that etch and rinse resulted in less POS as compared to self-etch adhesive. Somewhat similar result was shown in a study done by Ajmal et al. where class 5 cavities were restored using self-etch and etch and rinse adhesives. POS was reduced during the first 24 hours in self-etch group but no notable variation was elicited on other assessments<sup>13</sup>.

Few of the variables that were thought to affect POS, were age, gender and education status which were considered in this study but were found to be statistically insignificant. The educational status may be a significant predictor of postoperative pain due to various reasons, including the poor understanding of the preoperative

information, the level of anxiety and depression caused by that and the suboptimal request and use of analgesia. POS in composite is thought to be influenced by many factors like anesthesia use, rubber dam isolation, cavity design, adhesive used and clinical cavity depth in many clinical trials. The results of a lot of researches do not support that self-etch being better than etch and rinse in terms of POS or vice versa. With the exception of cavity depth, none of the other parameters had a prominent effect on occurrence of POS.

To the best of our knowledge, comparison of frequency of etch and rinse and self-etch adhesives based on gender, age & educational status was done in our study for the first time in Pakistan. It would be beneficial to conduct similar studies on posterior teeth with different cavity designs and cavity depths. Further studies are also needed to assess POS with regard to restorative technique, operator experience which would provide dentists and patients with better choices to reduce incidence of POS. The limitations of this study are that only posterior teeth were chosen and class 2 cavity design was assessed, other cavity designs and teeth type also influence POS.

## CONCLUSION

The present study concluded, no significant difference in frequency of POS in posterior composites using etch and rinse versus self-etch adhesive.

**Conflict of interest:** The authors declared no conflict of interest.

**Authors' Contribution:** HAK: Conceived idea, designed study, collected data, and drafted manuscript; SE: Conceptualization and guidance; HNQ: Contributed to data collection, analysis, interpretation, and result compilation; ZA: Contributed to result interpretation and critically revised the manuscript; MUK: Assisted in manuscript writing and proofreading.

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