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A Comparison of Post-operative Sensitivity in Composite Resin Restorations Using Total-etch and Self-etch Adhesive in Posterior Teeth

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Aims: Over the period of time lot of advancement has been done in the field of dentistry. In spite of these newer materials and improvement in the properties of composite material post-operative sensitivity is still a major concern for a dentist after composite restoration placement. Dentine bonding agents; dentine adhesives are either a "total-etch technique" or "self-etch technique" which bond to the tooth structure. The purpose of this study was to evaluate the clinical efficacy of self - etch and total-etch with strict inclusion and exclusion criteria. Self-etching adhesives are used to prevent postoperative sensitivity when used before placing posterior resin-based composite restorations. The purpose of this study was to see whether self-etch adhesive would result in less postoperative sensitivity than a total-etch adhesive; Total Etch adhesive would result in a better enamel marginal integrity than Self Etch Adhesive.
Study Design: Clinical Trial.
Place and Duration of Study: Department of Operative Dentistry, Fatima Jinnah Dental College between October 2019 – February 2020.

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Methodology: Sample size was calculated using a WHO sample size determination for health studies software using power 80% and the level of significance 5%. Sample size was calculated in accordance with the literature review. The sample size required was 32 in each group. Sample technique was Non-probability purposive sampling. Total 62 teeth were restored (molars and premolars) 32 in each group, age range 18 to 40 years. Cross tab made for the pain score between self-etch and total etch or pain comparison. Man Whitney test was applied. Both adhesives were handled and applied according to manufacturer's instructions. The patients were carefully examined at recall appointments at 2 weeks, 4 weeks and 3 months.
Results: Total 62 teeth were restored (molars and premolars) 32 in each group. On the basis of frequency and percentage clinically significant difference was found but no significance was found. Patients were evaluated before treatment, 2 weeks after treatment and 3 months after treatment. When compared the sensitivity severity with self-etch technique 19.4% had moderate sensitivity before treatment which was reduced to 0% after 2 weeks and 3 months. While in total etch technique there was 16.1% sensitivity preoperatively which was reduced to 3.2% and 6.5% after 2 weeks and 3 months respectively.
Conclusion: There is lesser degree of sensitivity when total etch technique was used under composite in comparison to self-etch.

Keywords: Tooth sensitivity; self-etch; dental adhesives; composite resin.

1. INTRODUCTION

Over a period of time a lot of advancement has been made in the field of dentistry, also in restorative dentistry where newer materials have been developed which forms a mechanical bond with the tooth and require conservative cavity preparation. These newer adhesive materials bond successfully with enamel and dentin. In spite of these newer materials and improvement in the properties of composite material, post-operative sensitivity is still a major concern for a dentist after composite restoration placement. Post-operative sensitivity can be defined as "pain in a tooth associated with mastication or with sensitivity to hot, cold, and sweet stimuli that occurs one week or more after restoration" [1]. The "hydrodynamic theory" developed in 1960's and based upon two decades of research, is widely accepted as the cause of tooth sensitivity. The hydrodynamic theory states that "when the fluid within the dentinal tubules are subjected to temperature changes or physical osmotic changes, the movement stimulates the nerve receptor sensitive to pressure, which leads to the transmission of the stimuli" [2]. Enamel Bonding is very successful since Buonocore introduced the acid etch technique in 1955 [3], however problems were encountered with dentine bonding due to its moist organic composition [4].

Dentine bonding agents; dentine adhesives are either a "total-etch technique" or "self-etch technique" which bond to the tooth structure. In the Total-etch technique, a separate acidic conditioner (phosphoric acid) is rinsed off before applying the primer and bonding resin. The new self-etch adhesives technique uses acidic monomers that are not rinsed off after placement. They potentially infiltrate the dentine to the same depth of demineralization. Their relatively low acidity may not completely eliminate the smear layer causing a decrease in postoperative sensitivity. However these self-etch adhesives do not etch enamel to the same extent as phosphoric acid, which causes increased marginal discoloration. The purpose of the study is to evaluate the clinical efficacy of self -etch and total-etch with strict inclusion and exclusion criteria. Self-etching adhesives are used to prevent postoperative sensitivity when used before placing posterior resin-based composite restorations. The purpose of this study was to determine whether self-etch adhesive would result in less postoperative sensitivity than a total-etch adhesive; Total Etch adhesive would result in a better enamel marginal integrity than Self-Etch Adhesive. The objective of the study is to compare the severity of post-operative sensitivity in class I and class II composite resin restorations restored with total-etch versus self-etch adhesive.

2. MATERIALS AND METHODS

Sample size was calculated using a WHO sample size determination for health studies software using power 80% and the level of significance 5%. Sample size was calculated in accordance with the literature review. The sample size required in each group was 32. Sampling technique was Non-probability purposive sampling.

2.1 Inclusion Criteria

- Age 18-40
- Both Male and female patients coming to the dental section of Fatima Jinnah dental hospital
- Class I cavities on the occlusal surface of posterior teeth 3-4 mm deep measured on digital radiograph (DIGORA Optime)
- Class II cavities on the proximal surface of posterior teeth 3-4 mm deep measured on digital radiograph(DIGORA Optime)
- Previous defective composite and amalgam restorations
- No previous sensitivity
- Good oral hygiene
- Vital teeth

2.2 Exclusion Criteria

- Non-vital teeth
- History of tooth sensitivity
- Xerostomia
- Periodontal disease
- Bruxism
- Subject receiving desensitizing therapy
- Medical, psychiatric or pharmaco-therapeutic history that might compromise the protocol, including the long-term use of anti-inflammatory, analgesic and psychotropic drugs
- Allergies and idiosyncratic responses to product ingredients
- Teeth restored in the previous three months
- Abutment teeth utilized for fixed or removable prostheses

Group allocation was done on alternate basis allocation. A sealed envelope method was used and patients were asked to pick one envelope. Group A Patients were given composite resin restorations with Total-etch adhesive Adper™ Single Bond 2 Adhesive, (3M™ ESPE™ Adper™). Group B Patients were given composite restorations with Self-etch Scotchbond Universal Adhesive (3M ESPE). Preoperative sensitivity was checked by using compressed air on to the tooth from 4cm away for 10 seconds. Response to cold stimulus was tested by using ice cubes on cotton pellet applied to tooth surface for 10 seconds.

A total of 62 teeth were restored (molars and premolars) 32 in each group, age range 18 to 40 years. The whole study was carried out in an ideal condition, each appointment was scheduled for 1 to 1.5 hour per patient. Local anesthesia was given to the patient (lower mandibular unilateral block or maxillary infiltration technique) using lidocaine 2% solution available for dental use in 1.8 ml. Rubber dam was used for moisture control of working field. Cavity was prepared using a high speed dental drill (NSK) with round diamond bur (no 1/6 or 1/4). After gaining access through the enamel, the carious lesion was excavated using spoon shaped excavator or slowly revolving carbide bur in a slow speed hand piece (drill). Operator applied an appropriate matrix and wedge around the cervical margins of class II preparations. 34% phosphoric acid was applied on enamel and dentine walls for 15 seconds and washed for 10 seconds. Additional coats were only applied if tooth surface did not look completely wet, the operator made sure entire tooth surface was covered with bond so that there were no white spots present because direct contact of resin based composite to the tooth result in postoperative complication.

Both adhesives were handled and applied according to manufacturer's instructions. Composite restorations (QuiXfil, Dentsply DeTrey GmbH, Germany) was placed in two-millimeter increments and cured for 20 seconds per increment. After final polymerization rubber dam was removed and occlusal adjustment was done. Premature contacts detected with articulating paper and were removed using diamond shape bur in high speed hand piece. Two variables were evaluated in this research air sensitivity and cold sensitivity. Both the variables was repeated in each subjects at 2 weeks and 3 months. Patient's response to air and cold stimulus at baseline, two weeks and 3 months was recorded by the Visual analogue pain scale. No pain (0-2), Moderate (3-7), Severe (8-10). During each appointment the evaluation of sensitivity was done by applying compressed air through triple syringe at a distance of 4 mm for 10 seconds. Cold was applied in the form of ice. The patients were carefully examined at recall appointments at 2 weeks, 4 weeks and 3 months.

3. RESULTS

Total Etch works well against sensitivity compared to self-etch, however postoperative sensitivity was observed with both the etchant but was less with Total Etch.

Cross tab made for the pain score between self-etch and total etch or pain comparison. Man Whitney test was applied. On the basis of

frequency and percentage clinically significant difference was found but no statistical significance was found. The result is as shown in the Table 1.

As described, patients were evaluated before treatment, 2 weeks after treatment and 3 months after treatment. When compared the sensitivity severity with self-etch technique 19.4% had moderate sensitivity before treatment which was reduced to 0% after 2 weeks and 3 months. While in total etch technique there was 16.1% sensitivity preoperatively which was reduced to 3.2% and 6.5% after 2 weeks and 3 months respectively.

4. DISCUSSION

In the recent years, the use of composite restoration is on the rise, not only in anterior teeth but also in posterior teeth. Aesthetics is not the only reason for increased popularity of composite restoration; another reason for preference is health concern due to presence of mercury in amalgam. In certain cases patients develop postoperative sensitivity. Post-operative sensitivity is related to multiple factors; which includes dentin etching, bacterial penetration into the pulp, and cuspal deformation due to the shrinkage stresses and the occlusal forces that results in cuspal deformation. Post-operative sensitivity after composite placement is still a major concern for dentists. Various techniques have been used, and numerous new materials are now available to overcome post-operative sensitivity. Several studies have claimed adhesive system play a major role to intercept sensitivity. Adhesives are classified as Total Etch and Self-Etch and this depends on their procedural application and adhesion mechanism.

Several studies have been done to compare the efficacy of self-etch and etch and rinse adhesives. According to research done by Ozer F in 2013 [1] the decision of choosing self-etch or etch and rinse adhesives system is usually clinician personal wish. It is seen that phosphoric acid develops a strong and more promising etching pattern in enamel, whereas self-etch works best for dentine. Perdiago [2], his research shows SE did not result in less postoperative sensitivity in comparison to TE, both adhesives are same but in our study total etch results in less sensitivity in comparison to self-etch. M Amin [3], his study claims that total etch results in decreased rate of sensitivity then self-etch which is similar to our study Baratieri et al. [4], 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. Baratieri et al. [4] states that post-operative sensitivity increased with self-etchant

Table 1. Cross tab for pain score between self-etch and total etch (Mann Whitney Test)

Severity comparison					
	Mild	**Moderate**	**Severe**	**Total**	**P-value**
Before treatment					
Self-etch	25 (80.6%)	6 (19.4%)	0 (0.0%)	31	0.7
Total etch	26 (83.9%)	5 (16.1%)	0 (0.0%)	31	
Two weeks					
Self-etch	31 (100.0%)	0 (0.0%)	0 (0.0%)	31	0.3
Total etch	30 (96.8%)	1 (3.2%)	0 (0.0%)	31	
Three months					
Self-etch	31 (100.0%)	0 (0.0%)	0 (0.0%)	31	0.1
Total etch	29 (93.5%)	2 (6.5%)	0 (0.0%)	31	
Cold					
	Mild	**Moderate**	**Severe**	**Total**	**P-value**
Before treatment					
Total Etch	24 (80.0%)	6 (20.0%)	0 (0.0%)	30	0.1
Self-etch	20 (62.5%)	12 (37.5%)	0 (0.0%)	32	
Two weeks					
Total Etch	20 (66.7%)	10 (33.3%)	0 (0.0%)	30	0.4
Self-Etch	18 (56.2)	14 (43.8%)	0 (0.0%)	32	
Three months					
Total Etch	19 (63.3%)	11 (36.7%)	0 (0.0%)	30	0.5
Self-Etch	18 (56.2%)	14 (43.8%)	0(0.0%)	32	

adhesive. The same study also showed that the incidence of post-operative sensitivity decreased over a period time for the self-etch adhesive system. Krithikadatta [5], conducted a meta-analysis in which different clinical outcomes of composite restoration placed with SE and TE concluded that, there was no difference in post-operative sensitivity. Herrero et al. [6], Casselli DSM [7], Burrow MF [8] exhibited that there was no statistically significant difference in both adhesives related to postoperative sensitivity.

According to Briso [9], found that postoperative sensitivity is related to cavity design and operator's skills and with time postoperative sensitivity decreases with time in posterior teeth. Postoperative sensitivity is not merely related to the use of adhesives but it also related to the clinical technique, isolation and the clinician's skills. Self-etch adhesives can prevent sensitivity or use of self-etch results in lesser levels of sensitivity [10], this research was conducted to see if self-etch prevent sensitivity and works better than total etch.

Since total etch is a multistep procedure, it is not very popular among dentists. Several studies have been conducted which prove in some cases that total etch works well against postoperative sensitivity and in some cases SE is more effective. Some of them observed postoperative sensitivity with both the adhesive. However, some studies show both adhesives do not cure postoperative sensitivity. Adhesives are classified as Total Etch and Self-Etch and this depends on their procedural application and adhesion mechanism [10–12].

Self-Etch Adhesives; in a self-etch adhesive system, the etching and subsequent penetration of resin monomers into the demineralized dentin and enamel is carried out without a separate etch and rinse step. This technique is mostly preferred by dentists as it is less technique sensitive but there are certain limitations for self-etch, that it does not effectively prepare the enamel surface and the sclerotic dentine [13]. In the case of total etch 30 to 40% phosphoric gel is utilized to etch the enamel and the dentin surface for 30 seconds, rinsed water for 10 seconds, dry the pool of water and apply primer cured it for 20 seconds [13]. In our research additional coats were only applied if tooth surface did not look completely wet. The operator made sure entire tooth surface was covered with bond so that there were no white spots present which would result in postoperative sensitivity due to the direct contact of resin based composite to the tooth surface.

The reason of postoperative sensitivity also involved around location of the teeth, anatomy, margins of the prepared cavity, heavy occlusal loads and operator's skills. Since composite requires an uncompromised or a strict isolation protocol, this would also reduce the postoperative sensitivity and increase the bond strength [14].

Polymerization shrinkage has been a significant cause of postoperative sensitivity due to the shrinkage stresses that results in gap formation which causes bacterial infiltration and dentinal fluid movement into the tubule resulting in pulpal inflammation and sensitivity. Gap formation also permits the outward flow of dentinal fluid from pulp to the gap. Inadequate curing can also result in premature bond failure which leads to postoperative sensitivity [15]. In our study we used incremental technique. 2 mm increment was placed to minimize the shrinkage stresses and to develop an adequate bond with the tooth substrate. It improves marginal adaptation and bond strength which decreases post-operative sensitivity.

5. CONCLUSION

Research reveals that there is lesser degree of sensitivity when total etch was used under composite in comparison to self-etch. Postoperative sensitivity is not merely related to the use of adhesives but it also related to the clinical technique, isolation and the clinician skills.

CONSENT

As per standard, participant's written consent form has been collected and preserved by the authors. Consent form was filled by each participant. Patients visiting Fatima Jinnah Dental Hospital who fulfilled the inclusion criteria after taking informed consent were recruited in the study.

ETHICAL APPROVAL

Study design is Clinical trial of 3 months at Fatima Jinnah Dental College after the approval of Ethical Review Committee. Ethical approval was obtained from Institutional Ethical and Scientific Review Board of Fatima Jinnah Dental College via letter no OCT-2018-OPR01.

Institutional Ethical Review Committee provided the ethical clearance before recruitment of the study participants.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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