

Comparative Evaluation Of Postoperative Sensitivity Using Total-Etch Versus Self-Etch Bonding Techniques In Resin Composite Restorations: A Randomized Clinical Trial

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Abstract

Objective: To assess and compare postoperative sensitivity in resin composite restorations using the self-etch versus total-etch technique.

Methods: A randomized clinical trial conducted at the Department of Operative Dentistry & Endodontics, from April 1st, 2022, to September 30th, 2022. Patients were assigned to Group A (total-etch) or Group B (self-etch) based on odd or even outpatient department numbers, determined through randomization. Local anaesthesia was administered, following the placement of a rubber dam, a high-speed handpiece with water coolant and an ISO #15 round diamond bur (Shofu. Inc, Kyoto, Japan) used for cavity preparation. In Group A, 37% phosphoric acid etchant (3M, ESPE) was applied for 30 seconds, followed by rinsing and air-drying (triple syringe). Subsequently, the bonding agent (Scotchbond 3M, ESPE) was applied and cured with light. Group B utilized a self-etch priming adhesive (Adper™ 3M) for 20 seconds, followed by exposing the tooth to light for a 20-second curing process.

Results: In Group A, the mean and SDs for post-operative sensitivity were 2.48+1.30 VAS at 24 hours and 2.05+1.30 VAS at 2 weeks. Group B showed reduced values of mean and SDs for postoperative sensitivity at 24 hours 1.73+1.66 VAS and 2 weeks 1.25+1.18.

Conclusion: Self-etch bonding demonstrated decreased postoperative sensitivity at 24 hours and 2 weeks, suggesting its effectiveness in reducing sensitivity after resin composite restoration.

Keywords: Sensitivity, Visual Analog Scale.

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Cite this Article: Marwat SA, Maqbool H, Haq U ul, Rizwan Z, Sajid K, Khattak SUR. Comparative Evaluation Of Postoperative Sensitivity Using Total-Etch Versus Self-Etch Bonding Techniques In Resin Composite Restorations: A Randomized Clinical Trial. JRMCM. 2024 Dec. 31;28(4). 591-596. <https://doi.org/10.37939/jrmc.v28i4.2537>.

Received February 12, 2024; accepted June 09, 2024; published online December 31, 2024

1. Introduction

There has been a shift in the dental industry in recent years away from amalgam fillings and towards more aesthetically pleasing restorations, most commonly made of resin composite. The current trend suggests that dentists are increasingly favoring resin materials, which have adhesive properties, for most restorations. Resin composites and adhesive technology have advanced rapidly in recent years. Still, dentists face challenges with postoperative discomfort after composite restorations, despite these improvements.¹ Composite restoration can cause post-operative sensitivity in 5-30% of patients.² While substantial advancements have been made in adhesive systems over the past 30 years; one of the main challenges in adhesive dentistry has been the creation of a reliable bonding. These bonding agents have been used to accomplish several goals, including micromechanical restoration retention, enhanced resin-to-tooth

structure bonding strength, decreased microleakage at the dentin-resin contact and even distribution of occlusal stress.³ Recent dentin adhesives take two separate ways to achieve the aforementioned goals. The smear layer and any lingering minerals can be washed away in the first method, the etch-and-rinse process. After the etched surface has been washed, a primer and adhesive (from one or two separate bottles) are used to complete the bonding process. Self-etching adhesive systems, which use the smear layer as a bonding substrate, are a second option.^{1,3} Dentine bonding methods have advanced, reducing the incidence of post-operative pain following composite resin restorations. Modern self-etch techniques simultaneously etch, penetrate, and polymerize the dentin that has been previously prepared. This facilitates full hybridization of adhesive monomers with demineralized dentin, reducing post-operative pain.^{3,4}

Etch-and-rinse systems have several drawbacks, the most significant of which are the increased amount of time required for etching, the increased risk of dentin drying out, and the increased risk of contamination from the rinsing of the acid etchant.⁴ Self-etch bonding agents are replacing etch and rinse systems because they are more efficient and less hazardous.⁵ The reduced number of steps (no etching and rinsing), lower risk of over-drying, less technique sensitivity, and lower reported post-operative sensitivity associated with self-etch adhesives appeared to be beneficial to dentists.^{6, 7} When replacing posterior teeth with a resin composite and total-etch dentine adhesive, studies found that up to 56% of the restorations were painful.⁸

The failure rates of resin composite restorations are highest in Class I and II. However, there are drawbacks to using direct resin composites in the back teeth, and post-operative dentin discomfort is one of them.⁹ Cracks, fractures, dentinal sensitivity from cervical dentin exposure, and reversible and irreversible inflammatory processes in the pulp should all be ruled out before any restorative operation is performed on the patient. Other pathological disorders that could cause pulp and periapical destruction to teeth can be ruled out with the use of thorough anamnesis and clinical and radiographic examination. Clinical evidence suggests that patients experience varying degrees and types of dentinal sensitivity after resin composite restorations, especially in the posterior teeth. The two main factors contributing to postoperative sensitivity caused by saliva infiltration are microbial contamination of the cavity (which can lead to pulp inflammation) and humidity contamination (which can weaken the bond and increase the likelihood of marginal leakage), both of which can be avoided with proper isolation of the operative field.⁴ Even if there are no outward signs of damage to the restoration, this is a common occurrence.¹⁰ The objective of this study is to compare the postoperative sensitivity of composite resin restorations using self-etch technique versus total-etch techniques.

2. Materials & Methods

It was a single-blind randomized clinical trial. This study was conducted in the Department of Operative Dentistry and Endodontics at Sardar Begum Dental College & Hospital. This study was of 6 months duration from April 1st, 2022 to September 30th, 2022. Ethical approval for this study was obtained from the Ethical Review Committee (ERC) the Gandhara University. Written

informed consent was obtained from all subjects before the study (Annexure 1). The Inclusion criteria for the present study included Class I and Class II cavities with an International Caries Detection and Assessment System (ICDAS) rating of 4 or 5 and a Remaining Dentin Thickness (RDT) of > 1mm and Patients from both genders between 18 to 40 years. Exclusion criteria included patients having a history of dentin hypersensitivity, irreversible pulpitis, periodontal disease, and allergy to resin materials. Patients who were given desensitizing treatment, such as desensitizing dentifrices or rinses, patients using anti-inflammatory drugs for longer periods, and patients with parafunctional habits and a history of significant medical conditions were also excluded.

Using a Non-probability consecutive sampling technique a total sample size of 66 was taken for this study which was then allocated into two equal groups (n=33) using the coin flip method. All the patients who met the inclusion criteria completed informed permission forms after hearing verbal and written explanations of the study's design. Demographics were collected using a standard demographic form (Annexure II). Clinical examinations were performed once the necessary medical and dental histories were acquired. Patients were divided into two groups, A and B. Group A employed a total-etch bonding technique, while group B used a self-etch bonding technique (randomization). Before the start of cavity preparation, a local anaesthetic was administered. After placing the rubber dam, a high-speed hand (piece with water coolant) was used to prepare the teeth using an ISO #15 round diamond bur (Shofu. Inc, Kyoto, Japan). In Group A, 37% phosphoric acid etchant (3M, ESPE) was applied for 30 seconds before being rinsed and air-dried (triple syringe) after which the bonding agent (Scotchbond 3M, ESPE) was applied and light cured. While in Group B, self-etch priming adhesive (Adper™ 3M) was applied for 20 seconds. The tooth was then light-cured for 20 seconds to complete the curing process. Composite resin (Filtek Supreme, 3M) restorations were layered after each adhesive was applied to minimize polymerization shrinkage in both groups. After that, a 20-second light cure was applied to the composite. Rubber cups were used to apply the composite polishing paste to the restorations before the flame-shaped diamond burs were used to finish the procedure (Prisma gloss composite polishing paste, Dentsply). All of the restorations were put through a series of tests for sensitivity by a single, well-trained examiner who was unaware of which groups they were testing. The Endo cold test (Endo Ice™ Coltene) was performed at 24 hours and 2 weeks

post restoration to assess sensitivity. The patient's responses on a visual analogue scale (VAS) ranging from 0 (no sensitivity) to 10 (intolerable sensitivity) were used to determine sensitivity levels.

The data was analyzed using SPSS version 25.0. Quantitative variables such as age and sensitivity after the treatment (at 24 hours and 2 weeks, respectively) were given means and standard deviations. Stratification among post-operative sensitivity, age and gender was performed between both groups using cross-tabulation. The VAS pain difference in post-operative sensitivity between the 2 groups was analyzed using an independent sample *t*-test by comparing their means. In this study, a *p*-value of less than 0.05 was judged to be statistically

significant. All the data was presented in the form of tables.

3. Results

A total of 66 patients participated in this study out of which 17 (25%) were male while 49 (75%) were female. In Group A, the Mean and SDs for post-operative sensitivity at 24 hours were 2.48 ± 1.30 VAS. The mean and SDs for post-operative at 2 weeks were 2.05 ± 1.30 VAS. In Group B, the mean and SDs for post-operative sensitivity at 24 hours were 1.73 ± 1.66 VAS. The mean and SDs for post-operative sensitivity at 2 weeks were 1.25 ± 1.18 VAS (Table 1).

Table 1: Descriptives of the study

Treatment Group		Mean	Std. Deviation
Group A (Total Etch Bonding Method) n=33	Age (Years)	33.06	7.124
	Post-Operative Sensitivity at 24 Hours (VAS)	2.48	1.302
	Post-Operative Sensitivity at 2 Weeks (VAS)	2.05	1.30
Group B (Self-Etch Bonding Method) n=33	Age (Years)	29.30	5.034
	Post-Operative Sensitivity at 24 Hours (VAS)	1.73	1.663
	Post-Operative Sensitivity at 2 Weeks (VAS)	1.25	1.18

Table 2: Stratification of Post Operative Sensitivity between both groups concerning Age (n=66)

Treatment Group		Age Groups	N	Mean	Std. Deviation	Mean Difference	P Value
Group A (Total Etch Bonding Method) n=33	Post Operative Sensitivity at 24 Hours (VAS)	≤ 25 Years	6	1.17	1.169	-1.611	0.004
		> 25 Years	27	2.78	1.155		
	Post Operative Sensitivity at 2 Weeks (VAS)	≤ 25 Years	6	2.33	2.944	0.963	0.464
		> 25 Years	27	1.37	1.079		
Group B (Self-Etch Bonding Method) n=33	Post Operative Sensitivity at 24 Hours (VAS)	≤ 25 Years	8	2.25	1.832	0.690	0.361
		> 25 Years	25	1.56	1.609		
	Post Operative Sensitivity at 2 Weeks (VAS)	≤ 25 Years	8	1.75	2.053	0.750	0.275
		> 25 Years	25	1.00	1.528		

Table 3: Stratification of Post Operative Sensitivity between both groups concerning Gender (n=66)

Treatment Group		Gender	N	Mean	Std. Deviation	Mean difference	P Value
Group A (Total Etch Bonding Method) n=33	Post Operative	Male	9	1.56	1.424	1.278	0.010
	Sensitivity at 24 Hours (VAS)	Female	24	2.83	1.090		
	Post Operative	Male	9	1.56	2.603	0.014	0.982
	Sensitivity at 2 Weeks (VAS)	Female	24	1.54	1.021		
Group B (Self-Etch Bonding Method) n=33	Post Operative	Male	8	.88	1.458	1.125	0.096
	Sensitivity at 24 Hours (VAS)	Female	25	2.00	1.658		
	Post Operative	Male	8	1.25	2.188	0.090	0.897
	Sensitivity at 2 Weeks (VAS)	Female	25	1.16	1.519		

Table 4: Comparative means of post-operative sensitivity between 2 groups using Independent Sample t-test (n=66)**At 24 Hours**

	Mean $\pm$ SD at 24 hr	df	t	p
Group A	2.48 $\pm$ 1.73	64	2.04	0.045
Group B	1.73 $\pm$ 1.66			

At 2 Weeks

	Mean $\pm$ SD at 2 weeks	df	t	p
Group A	2.05 $\pm$ 1.30	64	2.61	0.011
Group B	1.25 $\pm$ 1.18			

4. Discussion

After 20 years of treating patients, researchers have found that roughly 11% of all composite restorations suffer from postoperative discomfort after having posterior restorations placed.¹¹ Microleakage, whether from the restorative material, bonding failure, or the method itself, has been linked to postoperative sensitivity.¹² In the current study, all the restorations were performed by the same operator to reduce the possibility of inter-operator variance in the restorative method. Patients frequently experience postoperative sensitivity during the first week after the restorative surgery, with the prevalence gradually decreasing afterwards.¹²

When postoperative sensitivity to cold stimulation was evaluated 24 hours after the treatment, the current study found that the self-etch adhesive had a lower mean pain score than the entire etch adhesive in class II composite

restoration. Comparing the sensitivity of a class II restoration placed with a total-etch and a self-etch adhesive is one of the rare clinical research projects that have been conducted.^{13, 14} The current investigation found that the postoperative sensitivity only differed significantly at the 24-hour recall, with differences being minor at all other assessments. Körner P et al found that postoperative sensitivity decreased during the study's 3-year follow-up period, with no significant difference between Self etch and Total etch at any time point, which is unlike the present study.¹⁵ Luz MA et al also noted that self-etch treatments caused essentially little postoperative sensitivity, but total-etch products caused unpredictable and often irreparable sensitivity which is comparable to the current study.¹⁶ Neither Self etch nor Total etch significantly affected postoperative sensitivity, according to a meta-analysis by Krithikadatta et al.¹⁷ Opdam et al found that 56% of restorations in posterior teeth implanted with the Total etch technique were sensitive on loading, and an additional 14% of teeth exhibited spontaneous postoperative sensitivity at five to seven weeks. In the group that received the self-etch, postoperative sensitivity was reduced to a significantly lower rate. These stats also resemble the stats of the current study.¹⁸ Other studies confirmed the lack of a correlation between postoperative sensitivity and tooth classification, therefore the findings were consistent with those of other researchers.¹⁹⁻²¹ The results of this study indicate that the self-etch bonding technique may lessen patients' sensitivity to cold stimuli 24 hours following restoration and especially up to a greater

extent at 2 weeks. However, to further evaluate the efficacy of the self-etch bonding technology, more clinical investigations on the long-term clinical outcome of class II restorations placed using self-etch and total-etch adhesive are required. The limitations of this study were its smaller sample size, limited study duration and being a single-centered study, its findings cannot be generalized to the overall population. Moreover using different brands of adhesives might have different results on the outcome of the study.

The limitations of this study were its smaller sample size, limited study duration and being a single-centre trial, its findings cannot be generalized to the overall population of the Khyber Pakhtunkhwa.

5. Conclusion

This research showed that the Self Etch Bonding Method resulted in decreased postoperative sensitivity 24 hours and 2 weeks after surgery. Thus, Self Etch Bonding was useful in lowering postoperative sensitivity at both the 24-hour and 2-week follow-up points after restoration placement. So using Self Etch bonding compared to Total Etch technique is recommended to use in daily practice.

Institutional Review Board Approval

07-02-2022

Gandhara University

CONFLICTS OF INTEREST- None

Financial support: None to report.

Potential competing interests: None to report

Contributions:

S.A.M H.M, ,- Conception of study

- Experimentation/Study Conduction

H.M, U.U.H,K.S, Z.R,S.U.R.K -

Analysis/Interpretation/Discussion

S.A.M,H.M, U.U.H, K.S, Z.R,S.U.R.K - Manuscript

Writing

H.M, - Critical Review

All authors approved the final version to be published & agreed to be accountable for all aspects of the work.

References

1. Aboelenein AZ, Riad MI, Haridy MF. Effect of a self-etch adhesive containing nanobioglass on postoperative sensitivity of posterior composite restorations-a randomized trial. *Open access Macedonian journal of medical sciences*. 2019 Jul 7;7(14):2313. <https://doi.org/10.3889/oamjms.2019.585>
2. Bhatti UA. The Phenomenon of Postoperative Sensitivity and Composite Restorations-A Review. *Journal of the Pakistan Dental Association*. 2019 Jan 1;28. <https://doi.org/10.25301/JPDA.281.33>
3. Nahar AB, Gupta A. Comparative evaluation of post operative sensitivity in etch and rinse and self etch adhesives: A longitudinal study. *Int. Dent. J. Stud. Res*. 2019 Apr 1;7:35-7. <https://doi.org/10.18231/j.idjsr.2019.008>
4. Perdigao J, Swift EJ Jr. Critical appraisal: Post-op sensitivity with direct composite restorations. *J EsthetRestor Dent*. 2013;25(4):284-88. <https://doi.org/10.1111/jerd.12045>
5. Souza-Junior EJ, Prieto LT, Araújo CT. Selective enamel etching: effect on marginal adaptation of self-etch LED-cured bond systems in aged Class I composite restorations. *Oper Dent*. 2012;37(2):195-204. <https://doi.org/10.2341/11-184L>
6. Manchorova NA, Vladimirov Cardoso MV, de Almeida Neves A, Mine A, Coutinho E, Van Landuyt K, De Munck J, Van Meerbeek B. Current aspects on bonding effectiveness and stability in adhesive dentistry. *Aust Dent J*. 2011;56 :31-44. <https://doi.org/10.1111/j.1834-7819.2011.01294.x>
7. Schroeder M, Correa IC, Bauer J, Loguercio AD, Reis A. Influence of adhesive strategy on clinical parameters in cervical restorations: A systematic review and meta-analysis. *J Dent*. 2017;62:36-53. <https://doi.org/10.1016/j.jdent.2017.05.006>
8. Perdigão J, Geraldeli S, Hodges JS. Total-etch versus self-etch adhesive: effect on postoperative sensitivity. *J Am Dent Assoc*. 2018; 134(12):1621-9. <https://doi.org/10.14219/jada.archive.2018.0109>
9. Holland GR. Morphological features of dentin pulp related to dentin sensitivity. *Archs Oral Biol*. 2017;39, 3S-11S. [https://doi.org/10.1016/0003-9969\(94\)90182-1](https://doi.org/10.1016/0003-9969(94)90182-1)
10. Szesz A, Parreiras S, Reis A, Loguercio A. Selective enamel etching in cervical lesions for self-etch adhesives: A systematic review and meta-analysis. *J Dent*. 2018; 53:1-11. <https://doi.org/10.1016/j.jdent.2016.05.009>
11. Guney T, Yazici AR. 24-month clinical evaluation of different bulk-fill restorative resins in class ii restorations. *Operative Dentistry*. 2020 Mar 1;45(2):123-33. DOI: 10.2341/18-144-C
12. Reis A, DouradoLoguercio A, Schroeder M, Luque-Martinez. Does the adhesive strategy influence the post-operative sensitivity in adult patients with posterior resin composite restorations? A systematic review and meta-analysis. *Dent Mater*. 2015; 31(9):1052-67. <https://doi.org/10.1016/j.dental.2015.06.001>
13. Kunz PVM, Wambier LM, Kaizer MDR, Correr GM. Is the clinical performance of composite resin restorations in posterior teeth similar if restored with incremental or bulk-filling techniques? A systematic review and meta-analysis. *Clin Oral Investig*. 2022; 26(3):2281-2297. <https://doi.org/10.1007/s00784-021-04337-1>
14. El Gedaily M, Attin T, Wiedemeier DB, Tauböck TT. Impact of Different Etching Strategies on Margin Integrity of Conservative Composite Restorations in Demineralized Enamel. *Materials (Basel)*. 2020; 13(20):4500. <https://doi.org/10.3390/ma13204500>

15. Körner P, Sulejmani A, Wiedemeier DB, Attin T. Demineralized enamel reduces margin integrity of self-etch, but not of etch-and-rinse bonded composite restorations. *Odontology*. 2019; 107(3):308-315. <https://doi.org/10.1007/s10266-018-0398-6>
16. Luz MA, Sobral MA, Garone-Netto N, Santos AP. Prevention of postoperative tooth sensitivity: a preliminary clinical trial. *J Oral Rehabil*. 2015; 32:661-8. <https://doi.org/10.1111/j.1365-2842.2005.01479.x>
17. Krithikadatta J. Clinical effectiveness of contemporary dentin bonding agents. *J Conserv Dent*. 2020; 13:173-83. <https://doi.org/10.4103/0972-0707.73376>
18. Opdam NJ, Feilzer AJ, Roeters JJ. Class-I occlusal composite resin restorations: in vivo postoperative sensitivity, wall adaptation, and microleakage. *Am J Dent* 2018; 11:229-34. PMID: 10388382
19. Valizadeh S, Moradi A, Mirazei M, Amiri H, Kharazifard MJ. Microshear Bond Strength of Different Adhesive Systems to Dentin. *Front Dent*. 2019; 16(4):265-271. <https://doi.org/10.18502/fid.v16i4.2085>
20. Rosa WL, Piva E, Silva AF. Bond strength of universal adhesives: A systematic review and meta-analysis. *J Dent*. 2015; 43(7):765-76. <https://doi.org/10.1016/j.jdent.2015.04.003>
21. Perdigão J, Araujo E, Ramos RQ, Gomes G, Pizzolotto L. Adhesive dentistry: Current concepts and clinical considerations. *Journal of Esthetic and restorative Dentistry*. 2021 Jan;33(1):51-68.<https://doi.org/10.1111/jerd.12692>