

## FREQUENCY OF POST-OPERATIVE SENSITIVITY IN PERMANENT POSTERIOR TEETH WITH CLASS I COMPOSITE RESTORATIONS

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### ABSTRACT

**Background/objectives:** Post-operative sensitivity after placing posterior composite restorations is a problem that clinicians have experienced since 20 years ago even when a dentine liner is used. Sensitivity is associated with increased dentine permeability and with the residual stresses from shrinkage in adhesive composites resin restoration that may cause de-bonding. This study aimed at evaluating the post-operative sensitivity in composite restorations using total etch adhesive system in class I restorations in the posterior teeth of adult patients.

**Materials & Methods:** For this cross-sectional study, 139 consecutive patients with the age range of 15-40 years, presented in the Nishtar Institute of Dentistry and were included in the study fulfilling the exclusion and inclusion criteria. A thorough history, clinical examination and periapical radiograph using a standardized method for adults were performed. The whole procedure of restoration with composite P-60(3M) material was carried out after achieving standard isolation methods. Evaluation of the postoperative sensitivity was done by using the visual analogue scale.

**Results:** Among 139 patients, 20(14.4%) patients showed sensitivity. There were 12(14.3%) males and 8(14.5%) females who complained of postoperative sensitivity. There is no significant relation of gender with post-operative sensitivity.

**Conclusion:** Composite filling material has a remarkable post-operative sensitivity.

**Key words:** Tooth sensitivity, Composites, Setting shrinkage, Marginal Integrity, Posterior restorations.

### Introduction

Composite restorative materials demonstrate one of the various successes of modern research in biomaterials since they replace the function and appearance of the biological tissue. Now, at least 50% of posterior direct restoration placements depend on composite materials. Unfortunately, demands for these restorations due to the need for *in situ* treatment, placement, and mechanical properties leave considerable room for improvement, especially due to their polymerization-induced stress, mechanical properties, and polymerization shrinkage, toxicity, marginal leakage, abrasion and wear resistance, thermal expansion mismatch, and fracture. Ultimately, these shortcomings reduce a restoration's life span and represent the driving force for improvement in dental composites. Laboratory-based studies and clinical evaluations focused on composite durability also continue to emphasize the need for new materials<sup>1-4</sup>.

The development and implementation of composite dental restorative materials depend on the comprehensive understanding of each composite component and consideration of methods to change each component. In

this study, we discuss the basic components of composite restoratives and their roles in the final restoration. Composites consist of 3 distinct phases, each of which has a specific role in the dictation of material properties: the filler, and polymerizable resin, and the resin-filler interface. The resin phase consists of polymerizable monomers that upon exposure to visible light, convert from liquid to a highly crosslinked polymer that catalyzes the formation of active centers, usually radicals, which induce polymerization. The filler has various roles, including altering thermal expansion behavior, increasing modulus, radiopacity, and decreasing polymerization shrinkage by decreasing the resin fraction<sup>5-7</sup>. Finally, the resin-filler interface is used as a bridge by attaching polymerizable moieties to the particle surface. Each of the components gives an opportunity to improve the overall composite and recent investigations, reviewed here, have focused on it. Specifically, this study provides a background for the overall behavior observed in photo-polymerization, including development of new photo-polymerization mechanisms, novel explored monomers, recent investigations on these topics and the interface and filler components of the formulation, photo-initiation systems

used for the improvement of the restoration curing behavior, and the origin of shrinkage stress induced by polymerization<sup>8,9</sup>.

Increased demand of patients for tooth-colored restoration and recent progressions in adhesive dentistry have enhanced the use of resin-based composite. Resin-based composites have the advantage of protecting tooth tissue. This is because it is mostly maintained by mechanical bonding to the walls of the dentine and enamel cavities<sup>2</sup>. Although restorative dentistry has made progress, adhesive restorations may lead to microleakage, marginal discoloration, post-operative sensitivity and cause secondary caries over time and lead to restoration failure<sup>3</sup>. Post-operative sensitivity after placing posterior composite restorations is a problem that clinicians have experienced since 20 years ago even when a dentine liner is used<sup>4</sup>. According to hydrodynamic theory, a stimulus applied to dentine increases the tubular fluid flow, which in turn activates the nerves located in the outer layers of the pulp or at the inner ends of the tubules<sup>5</sup>. Sensitivity is associated with increased dentine permeability and with the residual stresses from shrinkage in adhesive composites resin restoration that may cause de-bonding<sup>5</sup>.

Dentine contains a thin smear layer with some materials forced in the tubule openings to generate a smear plug. Resin dentine adhesives use one of the two strategies to interact with the dentine smear layer: the total-etch technique or the self-etch technique<sup>6</sup>. The total etch concept originated in Japan with phosphoric acid etching of dentine before the application of phosphate ester type of bonding agent. It was a common strategy for dentine bonding in the 1990s and is still popular today<sup>7</sup>. The total etch technique uses 30 to 40% phosphoric acid to etch dentine and enamel, completely remove the smear layer, and generate reliable bonding<sup>8</sup>. Self-etch technique, simultaneously conditions and primes dentine and enamel<sup>9</sup>. According to Braz. Oral Research, 10% of composite restorations have presented post-operative sensitivity in the class I restoration<sup>5</sup>. This study planned to determine the post-operative sensitivity in composite restoration using total etch adhesive system in class I restorations in the local population of south Punjab. The results of this research generated a useful database that will be further helpful in devising a strategy for the management protocol.

### Materials and Methods:

This cross-sectional study was conducted in Operative Dentistry the Department, Nishtar Institute of Dentistry, Multan, after approval from the Institutional Review Board.

A total of 139 patients were selected for this study using the following exclusion and inclusion criteria:

### Inclusion criteria

1. Patients at the age of 15 to 40 years old.
2. Both female and male patients.
3. Patients having class I carious lesions in molars or premolars
4. Patients having no preoperative sensitivity. It was evaluated by using compressed air from a 3-way dental unit syringes before starting the procedure.

### Exclusion criteria:

1. Patients with bruxism and TMJ problems.
2. Patients with systemic diseases like mental disorders.
3. Patients with excessive salivation.

### Data collection procedure:

Patients were chosen from the Outpatient Department of Operative Dentistry, NID Multan. Permission was taken from the ethical review committee. Informed consent was obtained from the patients. A history was taken from the patients followed by an examination. All patients were selected according to the exclusion and inclusion criteria. Carious lesions were removed by an appropriate size carbide bur. Outline form was given to the cavity by using cylindrical fissure bur of medium grit and then finished with a fine-grit bur. Cavities were cleaned, dried, and isolated. The lining was given if needed and cavities were etched for 30 seconds. The cavities were rinsed for 15 s and gently air-dried to remove excess moisture. The bonding agent was applied and treated for 20 seconds. Then cavities were filled with the composite filling material. Evaluation of postoperative sensitivities was done by using a visual analogue scale.

Postoperative Sensitivity	No (0)
Postoperative Sensitivity	Yes (1-3) (4-7) (8-10)

### Data analysis

The data collected were entered and analyzed using SPSS 24. Frequencies and proportions were presented for qualitative variables such as gender and for postoperative sensitivity after the completion of the restoration. Mean and standard deviation were presented for quantitative variables such as age. The effect of modifiers such as gender and age were controlled by stratifications. Chi-square test was applied and P-value  $\leq 0.05$  was taken significant.

**Results**

In this investigation, 139 patients were treated for the class-I restoration with composite material using total etch technique. After treatment, all patients were clinically evaluated and for their feedback. For the 84 male

participants, the age range was 15 - 39 years with the mean age of 29.488 ±6.15560. Whereas, for the 55 female participants of this study, the age range was 15 - 40 years with the mean age of 29.0909 ±7.7728. These gender-related findings were compared by using chi-square test. The level of significance used was p<0.05 [Table 1].

**Table 1: Descriptive statistics of age- and gender-related findings**

GENDER			Statistic	Std. Error	
Age	Male	Mean	29.4881	.67163	
		95% Confidence Interval for Mean	Lower Bound		28.1522
			Upper Bound		30.8239
		5% Trimmed Mean	29.7513		
		Median	29.0000		
		Variance	7.891		
		Std. Deviation	6.15560		
		Minimum	15.00		
	Maximum	39.00			
	Female	Mean	29.0909	1.04809	
		95% Confidence Interval for Mean	Lower Bound		26.9896
			Upper Bound		31.1922
		5% Trimmed Mean	29.2879		
		Median	29.0000		
		Variance	60.418		
		Std. Deviation	7.77287		
Minimum		15.00			
Maximum	40.00				

In this study, out of 139 patients, 84(60.4%) were males and 55(39.6%) were females. Among 139 treated patients, 20(14.4%) patients complained of sensitivity with

12(14.3%) males and 8(14.5%) females showed post-operative sensitivity.

**Table 2: Comparison of gender and postoperative sensitivity**

		Post-Operative Sensitivity		Total
		No Sensitivity	Yes Sensitivity	
Gender	Male	72	12	84
		85.7%	14.3%	100.0%
	Female	47	8	55
		85.5%	14.5%	100.0%
Total		119	20	139
		85.6%	14.4%	100.0%

In this study, out of 139 patients, 55 (39.6%) were 15-27 years old and 84(60.4%) were 28-40 years old. Among 139 patients, 44(80.0%) patients from the age group of 15-27 years and 75(89.3%) patients from the age group of 28-40

years patients were post-operatively normal. While 11(20.0%) patients in the age group of 15-27 years and 9(10.7%) patients in the age group of 28-40 years showed the postoperative sensitivity [Table 3].

**Table 3: Comparison of age groups and postoperative sensitivity**

		Post Operativesensitivity		Total
		Not Sensitive	Sensitive	
Age Group	15-27years	44	11	55
		80.0%	20.0%	100.0%
	28-40 YEARS	75	9	84
		89.3%	10.7%	100.0%
Total		119	20	139
		85.6%	14.4%	100.0%

## Discussion

With an increased sense of esthetics in posterior teeth, the use of high-strength composites, specifically formulated for posterior teeth, is in high demand. There are many concerns regarding the side effects of these composite restorations. Different studies have been conducted to study the after-effects of these restorations. Most studies showed post-operative sensitivity with these composite restorations. This gives a critical clinical challenge for the clinicians. This study discussed the causes of this post-operative sensitivity following composite placement<sup>10</sup>. Different factors like gender and age were studied in this study to evaluate their effects on post-operative composite restoration. It has been observed that there is not a significant difference between post-operative pain among male and female patients. Furthermore, our study confirmed this by where data showed an equal prevalence of pain in both genders. The other major factor that is well known for post-operative pain is age. A team of researchers has reported that in the age group below 20 years of age, a significantly appreciable hypersensitivity has been observed as compared to age groups 20-30 and above 30 years old<sup>11</sup>. But this reported finding is not unexpected because by increasing age, the thickness of dentine and its sclerosis increases, which may lead to decreased nerve stimulation through dentinal tubules.

Another study carried out in Iran on class II composite restorations has studied the relationship of post-operative sensitivity with age and gender. It reported a mean frequency post-operative sensitivity 0.76 and 0.75 in females and males, respectively. This study has reported a significant association between post-operative sensitivity and age but the non-significant relationship was observed with gender. These findings are similar to the findings of our study<sup>12</sup>.

In the current study, first, cavity preparation was done using a high-speed traditional rotary instrument because it is quick, relatively clean, and simple. It was shown that preparation with mechanical abrasions does not provide clearly identifiable and precise outlines. Thus, this

investigation attempted to combine the advantages of both high-speed cutting and mechanical abrasion. Other factors should also be kept in mind that in the *in vivo* studies, inconsistencies in post-operative sensitivity may arise due to inter-operator variability, as experience, competence, and skill of the operators may vary.

## Conclusion

Composite filling material has a remarkable post-operative sensitivity. In the present study, there was almost 14.4% of post-operative sensitivity after class-I composite restorations, which was very close to the other studies.

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