

FREQUENCY OF POSTOPERATIVE SENSITIVITY IN POSTERIOR CLASS I COMPOSITE RESTORATIONS

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ABSTRACT

The growing demand for esthetic restorations has driven the dentists to provide composite resin restorations even in the posterior class I situations. In these load bearing locations of the teeth, composite resins are subjected to a very thorough biodynamic testing which revealed some of their shortcomings. Persistent postoperative sensitivity has been recognized to be a reason for failure of these restorations.

The objective of this study was to determine the frequency of postoperative sensitivity in posterior class I composite restorations placed in cavities less than or equal to a 3 mm depth. A total of 292 cavities were restored without any protective liners or base by one of the authors in an academic environment which were followed up at 48 hours for an objective cold test. The frequency of postoperative sensitivity was around 13% and no statistically significant relationship was found between patient age and tooth type (p value > 0.000). While the cavity depths were limited the buccolingual widths remained unchecked and in some cases resulted in considerable occlusal table correction. This may be the reason for a greater postoperative sensitivity in the present study.

Key Words: Postoperative sensitivity, composites, esthetic restorations.

INTRODUCTION

The revolution in restorative dental procedures has been the inevitable consequence of advancements in adhesive dentistry. The natural intact tooth structure is comprised of a heterogeneous dentine and homogenous enamel, which exists in a harmonious balance. This balance can be disturbed by the incidence of caries, parafunction, abrasion, erosion with an eventual loss of tooth substance requiring replacement.¹ The appreciation for the natural adhesion/cohesion of otherwise dissimilar substrates like enamel and dentin encouraged researchers and dentists to develop composite resins which brought us closer to restoring tooth structure with a material that was able to adhere and restore the harmony of enamel and dentin.²

However, these restorations encountered problems like poor wear resistance, open contacts, polymerization

shrinkage and poor dentin marginal adaptation³; polymerization shrinkage being the main culprit responsible for the episodes of postoperative sensitivity following posterior composite resin restorations. The significant improvements in the newer generations of bonding agents and the composite materials over the past 20 years have virtually eliminated the problems of wear and proximal contour management but polymerization shrinkage and ultimately postoperative sensitivity still remains a threat to restoration success.^{3,4}

Some level of postoperative pain associated with any restorative procedure is normal and the patient should be warned in advance. However, once postoperative sensitivity becomes persistent, the only treatment available is to remove the restoration. Studies investigating this phenomenon report as low as 5% to as high as 30% chance of experiencing postoperative sensitivity.⁵ The improvement in material properties and development of strict operating protocols with the passage of time has reduced the postoperative sensitivity in posterior composite restorations, based on literature review, the occurrence of postoperative sensitivity still presents as an occasional source of nuisance for the patient. This study investigated the frequency of postoperative sensitivity, in posterior class I cavities restored with composite resin at 48 hours utilizing current materials and protocols.

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METHODOLOGY

After acquiring an approval from the ethical committee of the hospital and a written informed consent from the patients, 292 restorations were placed in molars and premolars for evaluation. The patients ranged between 15 and 35 years, who were visiting the operative department of Islamic International Dental Hospital for restorative consultation. A periapical radiograph was exposed using a paralleling technique to determine a tentative cavity depth and a thorough history was obtained to ascertain the pulpal health. The restorative procedures were performed by one of the authors as part of the postgraduate residency in operative dentistry.

The patients selected for the study included those presenting with a primary carious lesion confined to the occlusal surface, secondary lesion around existing restoration or those which expressed a desire for an aesthetic replacement of restoration. Among those excluded were the patients with a history of pain suggesting irreversible pulpitis, lesions anticipated to require pulp capping procedures or proximal wall involvement and those who failed to return for a follow up after 48 hours.

After making a radiographic assessment of the cavity depth, a pear shaped carbide bur (245- Midwest) was used for initial entry for cavity preparation. The depth of preparation was measured with a periodontal probe and those exceeding 3 mm were excluded.

Rubber dam placement was deferred to the placement of composite in some cases due to an extended working time when multiple teeth were being restored in the same patient. The enamel and dentin were selectively etched with 37% phosphoric acid for 30 and 15 seconds respectively. The etchant was rinsed off with water for 15 seconds and the preparation was gently dried with air to reduce excess water without desiccation. For adhesion, a thin layer of bonding agent (Adper single bond- 3M ESPE) was applied and gently air dried. The bonding agent was light cured for 60 seconds. A small increment of composite (Filtek Z250 XT-3M ESPE) was obliquely sculpted in the preparation to simulate the cusps followed by a curing cycle of 20 seconds. A minimum of two increments were placed irrespective of the extent of the preparation and each increment would be no more than 2 mm thick. The final increment was cured for 40 seconds and restoration was checked for any high spots or heavy contacts in centric and eccentric locations using an articulating paper. These were carefully trimmed along with marginal flash using a fine grit diamond and aluminum oxide stone. A rebonding of the finished margins was carried out under cotton roll isolation. 48 hours after culmination of the procedure the patients were recalled and a cold

stimulus was applied to the teeth to see any heightened sensitivity in comparison to the normal control teeth which was verbally stated by the patient. Any complain of spontaneous pain was also recorded and in case of pain on biting occlusal adjustments were made.

RESULTS

A total of 292 composite resin restorations were placed despite the large sample size, there was no loss of patient as a large majority of them were recalled for subsequent restorative procedures after 48 hours which allowed evaluation of postoperative sensitivity. Patient age showed the greatest variance, while postoperative sensitivity exhibited the least variance. Frequency of postoperative sensitivity was determined with a standard deviation of + 0.3% as shown in Fig 1.

The age of patients ranged from 13 years to 72 years, with the median age of patients receiving composite resin restorations being 32 years. From the total number of patients included in the study, most of the patients belonged to the young adult age group (21-30 years). While the oldest patients included in the study

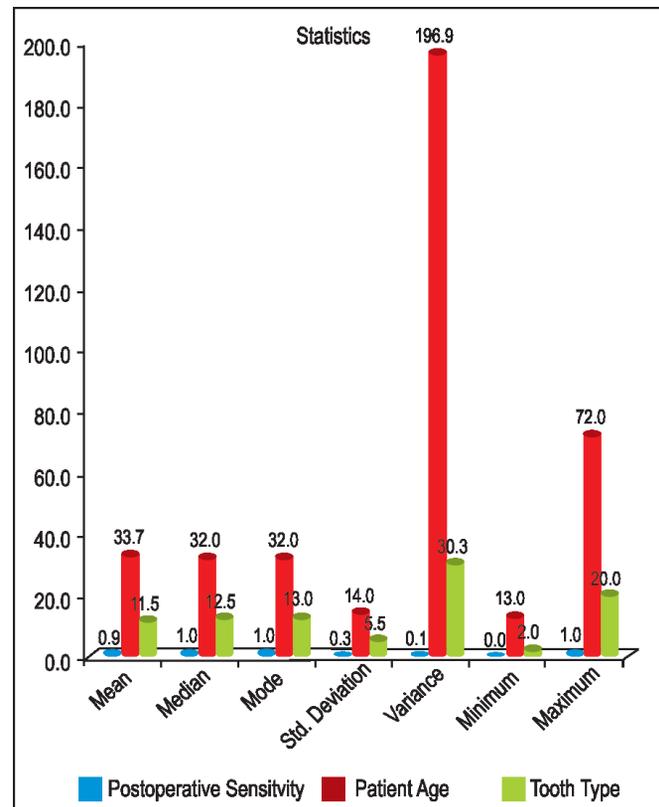


Fig 1: Statistics for postoperative sensitivity, patient age and tooth type

TABLE 1

	Tooth type	Patient age
Chi-square (p-value)	>0.000	>0.000

TABLE 2: COEFFICIENTS^A

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig
		B	Std. Error	Beta		
1	(Constant)	.907	.058		15.621	.000
	Patient Age	.006	.014	.024	.415	.679
	Tooth Type	-.004	.004	-.071	-1.209	.228

a. Dependent Variable: Postoperative Sensitivity

accounted for the smallest fraction of the sample. Considering the gender distribution in the sample, a total of 164 females and 128 males participated in the study. The frequency of postoperative sensitivity reported by the patients was about a staggering 13%. While the remaining 87% did not identify any appreciable difference in the sensitivity levels when compared to the control tooth in the arch.

Prior to the start of the restorative procedure some patients had complains of heightened sensitivity to cold stimulus, among these most had resolution of symptoms after culmination of the restorative procedure. Interestingly, none of the patients developed sensitivity to biting pressure, only two patients developed persistent postoperative sensitivity to cold stimulus which resolved spontaneously in one of the patients after 6 weeks.

In order to determine the correlation between tooth type and patient age with postoperative sensitivity non parametric test chi square was applied and the p value obtained as shown in Table 1.

However, the strength and direction of this relationship was not evident. Hence, a parametric test in the form of a multiple layered regression model was used and the results shown in Table 3. After applying the regression instrument to the patient age and tooth type from both the results it was concluded that they are insignificantly related to the postoperative sensitivity ($p > 0.000$).

The improvement in material properties and academic inculcation of composite training in undergraduate programs heralded the growth in the number of composite resin restorations. With the notable benefits of using composite resins also came the disadvantage of polymerization shrinkage and associated issues like postoperative sensitivity.

Over the years studies attempting to quantify the postoperative sensitivity following composite resin restorations, gave varying results ranging from as high as 31% to as low as 5%.^{5,6} The reasons for this dramatic difference among many things can be explained as the continual improvement in material technology and the difference in study designs.⁷

In this present study, a 13% frequency of postoperative sensitivity was determined which was considerably

higher than the study conducted by Briso et al which reported 5% for class I restorations; while the result closely matched that published by Unemori et al which reported 11% percentage of postoperative sensitivity.^{5,8} Although there was no hypothesis being tested in this study but it was expected that the postoperative sensitivity issue associated with contemporary composite resins would have become less frequent.

There exist two avenues in this research which could be responsible for increased postoperative sensitivity following composite resin restorations; the quality of restorative treatment delivered and the reporting of any experienced postoperative sensitivity by the patient.⁹

The literature proposes that cavity depth is an important determining factor of postoperative sensitivity.¹⁰ The depth delimitation used in this study allowed the operator to avoid such an occurrence. Also, the lack of an objective definition for cavity depth results in clinicians arbitrarily making depth assessment based on experience, which contributes to unnecessary utilization of pulpal protection measures.⁸

The questionable biocompatibility of some components of resin composites and adhesives made many clinicians skeptic to the idea of placing composite resins in deep preparations without placing a protective lining or base.^{8,10,11} In the present study no liners or base were used following the recommendations of Unemori et al, in which they proposed that liners and base application beneath composite resins reduce the extent of bonding substrate available for bonding and hence contribute to increased postoperative sensitivity despite efforts to protect the pulp.⁸ However, in another study the authors used measures for dentin protection and still reported a much lower frequency of postoperative sensitivity.¹²

Studies that recommend the use of visual analogue scales to prevent underestimation of postoperative sensitivity overlook the potential for subjective responses to overestimate the postoperative sensitivity as seen in the study by Berkowitz et al.^{6,10,13} The documentation of postoperative sensitivity in the present study was made more objective by using a cold stimulus to compare any difference in sensitivity levels 48 hours after the procedure. This according to the authors was a more reliable method in objectively recording postoperative sensitivity.

Polymerization shrinkage continues to challenge the adhesive interface; the stresses that concentrate contribute to the eventual demise of the restoration.¹⁴ These shrinkage stresses can be significant enough to induce cuspal deformation, enamel crazing or even cracking, all of which is capable of causing sensitivity. The degree of cuspal deformation is influenced by the configuration factor.¹⁵ A high configuration factor, as observed in class I cavities, means the absence of adequate free surface for flow related stress compensation.¹⁶ The reasons discussed in literature for postoperative sensitivity are many fold and procedural protocols have evolved to counter most of these reasons. Incremental placement and rubber dam isolation for example have become a sine qua non for composite restorations.¹⁷ In this study though the shrinking mass was reduced by incremental placement and limited cavity depths; the buccolingual widths remained unchecked and in some cases resulted in considerable occlusal table correction which perhaps may be the reason for unchecked polymerization shrinkage and postoperative sensitivity.

Since the restorative procedure is associated with some level of transient pulpal inflammation, the heightened sensitivity may not be entirely associated with the composite restoration placement. The major limitation of this study was that it did not utilize a control group, future studies should be based on a randomized control trial instead of a cross sectional study design. A possible control group should be used in future studies to allow comparison and identify the sensitivity resulting strictly from composite resins.

CONCLUSION

Even when restorations are delivered in an academic setting like in the present study, a high percentage of restorations encounter postoperative sensitivity; which may very well be more frequent in private clinic settings. It is the responsibility of clinicians to stay abreast current guidelines and possible limitations of composite resins to maximize their restorative potential without provoking the nuisance of postoperative sensitivity.

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