ORIGINAL ARTICLE

DEPTH OF THE CAVITY AND ITS RELATIONSHIP WITH THE POST-OPERATIVE SENSITIVITY IN CLASS 1 POSTERIOR RESIN COMPOSITE RESTORATIONS ON MOLARS

[1]SHAMA ASGHAR, BDS, FCPS
[2]ASGHAR ALI, BDS, MPH, PhD Scholar

ABSTRACT

This study was conducted to assess the post-operative sensitivity in different depths of Class I cavities in molars restored with posterior composite resin. It was an Experimental study and was conducted in Fatima Jinnah Dental Hospital, Karachi from May 2010 to October 2010. One hundred and thirty one patients had Class I cavities (depth of cavities between 3-4mm) were selected after clinical and radiographic examination. After rubber dam isolation, Class 1 cavity prepared on molars teeth. Incremental technique was used to restore cavity with posterior composite resin. After finishing the filling, patient was recalled at day 7 to assess post-operative sensitivity with cold and hot stimuli. Data were collected using data collection proforma, were computerized and analyzed by using SPSS (Statistical Package of Social Sciences) version 17.

One hundred thirty one patients, 61 male and 70 female formed the study group. The mean age was 29.6 (±9.004) years. The mean score of post-operative sensitivity was 1.05 for cold (±0.226) and 1.04 (±0.192) for hot. The chi-Square test revealed significant results with p- value < 0.000 for cold and < 0.009 for hot, when both stimuli were analyzed with different cavities depths. Deeper cavities in Class I composite resin restorations showed more post-restoration sensitivity as compared to cavities with lesser depth in dentine.

Key Words: *Polymerization shrinkage, Class I cavities, post-operative sensitivity, depth of the cavity, incremental technique.*

INTRODUCTION

The introduction of composite-based resin technology to esthetic dentistry was one of the most noteworthy contributions to dentistry.[1] This technology provides patients with more tooth-conserving and highly aesthetic restoration and also avoids the mercury controversy.[2] There are problems associated with using resin composite in posterior restorations, including shrinkage that occurs on setting, and cause post-operative sensitivity.[3] Long term prognoses of resin composite posterior restorations are influenced by tooth type, size or depth of the cavity, placement technique and composition of material.[4]

[1] Shama Asghar, Assistant Prof & Head, Department of Operative Dentistry, Bahria Medical and Dental College, Karachi.
E-mail: shama.asghar@yahoo.com
[2] Associate Prof & Head, Department of Community & Preventive Dentistry, Baqai Dental College, Karachi.
E-mail: dr.shigri@ yahoo.com Cell: 0333-2154360

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Contemporary composites undergo contraction of 2% to 6% by volume during setting.[5] In polymerization resin composite may pull away from the least retentive cavity margins, where little or no enamel present on them.[6] This shrinkage is responsible for the formation of gap between resin-based composite and the cut tooth surface, which allows fluid to flow out of the tubules.[1,2] Gap formation also allows ingress of bacteria, bacterial products, acids, enzymes and ions into the margins of the restoration and is responsible for post-operative sensitivity.[3] However recent researches have proved that shrinkage occurs towards the walls of the cavity to which it is bonded.[7] Polymerization shrinkage occurs regardless of the system used to initiate the setting reaction.[6,7] Opdam et al reported 14% post-operative sensitivity of resin composite in Class 1 cavities present on the occlusal surfaces of molar teeth.[8] Briso ALF et al found in his study the occurrence of post-operative sensitivity in resin-based posterior restorations was 5% in Class I cavities.[4]

Kinomoto Y et al demonstrated in their study that dental composite contracts, or shrinks, significantly during polymerization. Contracting materials create force that may manifest stress in a confined cavity.[9] The degree of such potentially damaging stress depends on the cavity geometry (C-factor) and composite properties such as filler content, matrix composition, and curing.[10] For example, cavities with deep or multiple bonded walls are bound to restrict polymerization shrinkage in three dimensions and higher stress is anticipated as a result.[10,11]

This clinical trial was done in a dental hospital to determine the presence and absence of postoperative sensitivity in different depths of Class 1 cavities restored with posterior resin composite.

METHODOLOGY

It was an experimental study conducted in the Operative Department of Fatima Jinnah Dental Hospital, Karachi, Pakistan from May 2010 to October 2010 after the approval of the hospital ethics committee. One hundred and thirty one patients above 15 years with Class I cavities (depth of cavities between 3-4mm) were selected after clinical and radiographic examination. Patient with mixed dentition, cavity depth more than 4mm, endodontically treated teeth, cracked teeth, teeth with small crowns that couldn't be isolated with rubber dam, with bad oral hygiene were excluded. Patient was given a brief clarification on the kind of intervention that was done on patient's teeth by dentist. The patient was requested to sign the consent form.

After rubber dam isolation of the tooth, occlusal preparation was started with a No. 245 diamond bur in a high speed hand piece with air/ water spray to remove caries in enamel and dentine. 2% Chlorhexidine antibacterial solution was used to disinfect the cavity and lightly air dried. Cavity was lined with (glass ionomer Chemfill Dentsply Detrey). 37.5% phosphoric acid was used to etch the cavity margin and walls for 15 second, rinsed for 15 seconds and gently air dried with compressed air. Then bonding agent (Prime & Bond NT, Dentsply Detrey) was applied for 15 seconds and light cured for 20 seconds.

Tooth was restored with posterior composite (Quixfil Dentsply Detrey) using an incremental placement technique. A halogen light-curing unit was used at a distance of 0.5 mm from occlusal surface of the tooth for 40 seconds for curing the material. Rubber dam was removed, occlusion of the teeth was checked and adjusted. Then finishing and polishing was done with cone shaped polishing tips (Enhance Dentsply Caulk). After finishing the restoration, patient was recalled at day 7 to evaluate post-operative sensitivity with cold and hot stimuli. The patient was asked to record the presence and absence of sensitivity that was created by cold and hot stimuli in treated tooth.

Data were collected using data collection proforma, and were computerized and analyzed by using SPSS 17. Frequencies and percentages recorded for age, gender, tooth numbers, cavity sizes and postoperative sensitivity to cold and hot stimuli. Mean and standard deviation for age was computed. Chi-square test was performed between both stimuli and different cavities depths to see the occurrence and absences of post-operative sensitivity. The level of significance was set as $P<0.05$.

RESULTS

A total of 131 patients, ranged from 16 to 51-year-old were included in this study. The mean age was 29.6 (±9.004) years. Out of total, forty seven percent were (n=61) males and fifty three percent were (n=70) females. The high percentage of composite filling were received by the age group of 25 years that was nine percent (n=12) followed by 30 years and 20 years old that were eight percent. Out of 131 teeth (Table 1) fifty eight teeth (44.3%) had cavity depth of 3.0mm, forty two (32.1%) had 3.5mm and thirty one (23.7%) had cavity depth of 4.0mm.

Fig 1 shows the anatomic distribution of the restored teeth; frequency of left lower first molars (n=40) were highest in all teeth followed by right lower first molars (n=32) and left lower second molars (n=24).

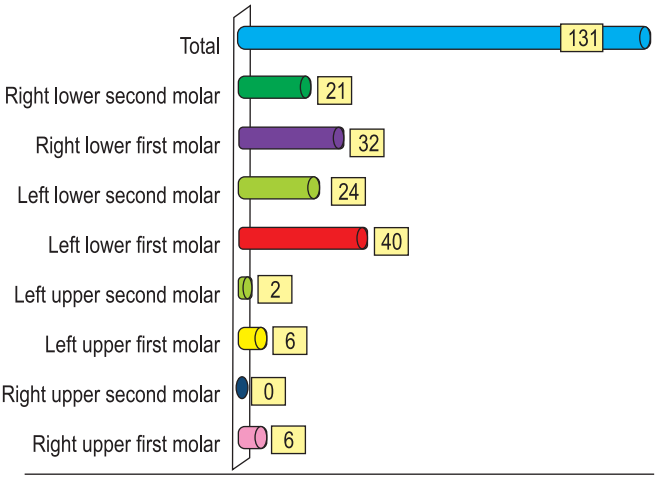

Fig 1: Anatomic Distribution of Teeth

TABLE 1: FREQUENCY OF GENDER, TEETH IN DIFFERENT DEPTH OF CAVITY & RESPONSES OF TEETH TO STIMULI (COLD & HOT)

Gender (frequency)	Males	Females	Total
	61	70	131
Frequency of teeth in different cavity depth	S. No	Cavity sizes Range (3-4mm)	(Frequency) / % of Teeth
	1.	3.0	58 (44.3%)
	2.	3.5	42 (32.1%)
	3.	4.0	31 (23.7%)
	Total		131 (100.0%)
Frequency of the restored teeth to the Stimuli (Cold & Hot)	Responses of teeth to stimuli	Cold test	Hot test
	No sensitivity	124	126
	sensitivity	7	5
	Total	131	131

TABLE 2: POST-OPERATIVE SENSITIVITY WITH DIFFERENT CAVITY DEPTHS IN CLASS 1 RESTORATION

	Cavity depth	3.0mm	3.5mm	4.0mm	Total	Chi-square p-value
Cold test	No sensitivity	58	41	25	124	<0.000
	Sensitivity	0	1	6	7	
Hot test	No sensitivity	58	41	27	16	<0.00
	Sensitivity	0	1	4	5	

A 2 items questionnaire was used to evaluate the postoperative sensitivity. 5.3% teeth reported sensitivity to cold and 3.8% to hot. Seven out of thirty one (22.58%) restored teeth had cavity depth 4mm showed sensitivity to cold while five out of thirty one (16.13%) teeth with 4mm cavity depth showed sensitivity to hot. No post-operative sensitivity was reported when depth of the cavities was 3.0mm for both stimuli. The mean score of post-operative sensitivity was 1.05 for cold (±0.226) and 1.04 (±0.192) for hot.

The chi-Square test showed significant results with p- value < 0.000 for cold and < 0.009 for hot (Table 2) when both stimuli were analyzed with different cavities depth.

DISCUSSION

The main advantage of resin composite as a material for restoring posterior teeth is preservation of tooth structure; it bonds to tooth structure with the use of adhesive which supports the modern concept of a conservative approach to restorative dentistry.[12] As the number of patients included in the study was 131 and all of them were available for the follow up so the percentage is equal to the frequency. This study revealed that number of teeth with sensitivity was very low whereas the number of teeth with no sensitivity was high. Low postoperative sensitivity in the present study was due to the application of an intermediate layer of glass ionomer cement between the dentine. Another reason for low sensitivity was use of an incremental technique that can increase the gel phase, thus improving the flowability of the material and, consequently, the marginal adaptation and minimizing the occurrence of post-operative sensitivity.

Current study showed that no post-operative sensitivity was found in cavity size of 3.0mm, when the cavity size increased upto 3.5mm, 2.4% out of 42 had sensitivity to both stimuli. In cavity size of 4.0mm, 22.58% teeth reported sensitivity to cold and 16.13% to hot. This revealed when depth of the cavity increased, polymerization shrinkage and post-operative sensitivity is also increased. Mjor IA and Ferrari M reported that shallow cavities located in superficial or sclerotic dentin do not pose a major biological risk, because the permeability of the dentin is low and the thickness of the remaining dentin is adequate to prevent any adverse effects from diffusing materials.[13] On the other hand, deep cavities closer to the pulp are more challenging for the clinician

because of the intrinsic permeability and wetness of the dentinal substrate.[14] Poon CME, and Smales JR also reported significant differences between postoperative sensitivity and cavity depth with (P = .001).[15] Auschill TM et al analyzed that cavity depth turned out to be the only factor to have a significant influence on the appearance of postoperative sensitivity.[16] Polymerization shrinkage, inherent to resin composites, can induce stresses at the adhesive interface and result in cusp deflection due to an unfavorable cavity configuration.[17] Resin composites should be handled so as to generate the least amount of stress at the tooth and bonded interfaces. Excessive stress during polymerization has been related to the formation of dentin cracks on the pulp floor and sensitivity during chewing.[18]

This study highlights that when the restorative procedure is properly accomplished, only a minor percentage of restored teeth become sensitive postoperatively. During the study, all the steps of the restoration technique were carefully followed, from radiographic investigation and pulp testing to the polishing of the fillings. Maybe this is the best explanation for the results described in this study. There were statistically significant differences between various depths of cavities and both stimuli. Sobral MAP et al determined in his study that in daily clinical treatment, when the accurate procedure is used and all the cavity preparation and filling guidelines are carefully followed, restoration is mostly successful and the frequency of postoperative sensitivity nears nil.[19]

CONCLUSION

Based on the results, it was possible to accomplish that the postoperative sensitivity was high in deeper cavities that were near to pulp as compared to shallower cavities in Class I restorations present on molars.

No Conflict of Interest

Authors declare that there was no conflict of interest involved in carrying out this study.

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