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Effect of Cavity Configuration on Postoperative Hypersensitivity of Posterior Composite Restorations

Naeimar Betama, Omer Zyou,and Abdelghffar Farge

Abstract

Purpose: To investigate the effect of cavity configuration (C-factor) on occurrence of postoperative hypersensitivity (POH) of posterior direct resin composite restorations. Methodology: A total of 247 direct posterior composite restorations were evaluated. 118 Class I (O) and 129 Class II (MO, DO, and MOD) restorations were placed in 139 males and females patients with a mean age of 31.58 ±8.62 years. Four types of cavity configurations were prepared on premolars and molars teeth, and their dimensions were measured using periodontal probe. The preparations were restored with a total-etch adhesive system Tetric® N-Bond and Tetric® N-Ceram resin composite (Ivoclar vivadent) using incremental packing technique. Patients were recalled at 1-, 4-, and 13-weeks to question about occurrence of POH to cold, hot, sweet stimuli, mastication and clinching, and answers were recorded using Visual Analog Scale (VAS). Data was collected and analyzed using SPSS version 16 to determine whether any relationship existed between different cavity configurations and the occurrence of POH. Results: Chi-Square and t-tests revealed no significant difference in occurrence of POH between class I and class II cavity configurations (P>0.05). At week 1- post-treatment, incidence of POH was 0.8% (1/118) in class I (O), and 1.6% (2/129) in class II (DO) restorations. The three reported restorations presented with mild to moderate (3-5 VAS) sensitivity to cold stimuli. 2/247 (0.8%) restorations were presented with hyperocclusion. No POH among MO and MOD restorations. No POH at week 4- and 13- recall visits. Conclusions: Cavity configurations (C-factor) had no influence on the occurrence of POH reported by patients at 1-, 4-, and 13-weeks post-treatment. POH expected in the high C-factor class I composite restorations were not detected. The restorative technique used resulted in excellent outcomes for class I and II cavity configurations.

Keywords: Posterior composite restorations, Cavity configuration, Postoperative hypersensitivity.
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Introduction:

Nowadays, the use of resin composite restorations has increased significantly, and has become a well-established predictable and successful restoration for anterior and posterior teeth. This success relies on the development and improvement of material properties, restorative technique and skill and knowledge of the operator. However, despite these achievements, light-cured resin composites undergo polymerization shrinkage and volumetric contraction,(Asmussen 2009; Schneider, et al. 2010) which creates force and produces stress at tooth-restoration interface in a restricted cavity (Kinomoto, et al. 2000; SOARES, et al. 2017) The stress is manifested clinically as cusp deflection and tooth deformation. (Kramer, et al. 2011) Contraction stress may also cause failure in the bond, producing marginal gap (Asmussen 2009; SANTOS, et al. 2007) that allow the passage of fluid or bacte ria between the dentin pulp complex and the oral environment, leading to postoperative sensitivity and secondary caries.(Opdam, et al. 1998a; Opdam, et al. 1998b; Van Dijken 2010) The high magnitude of stress and its consequences only occur when the shrinking composites are packed-in between multiple walls inside the cavity during their adaptation and light-curing, linking these walls together, and is influenced by many factors such as composition and properties of composite material, light intensity, and application technique, cavity preparation variables such as cavity size, depth, and shape/design which is described by configuration factor (C-factor).(Braga, et al. 2005; Hayashi and Wilson 2003; SANTOS, et al. 2007; Unemori, et al. 2001) The C-factor in dentistry

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Table 1: Statistical analysis of demographic distribution, clinical classes, cavity configurations, POH at week 1 among O, MO, DO, MOD cavity configurations

		Number (%)	Mean (±SD)	Age group (Yrs)			P value
				<25	25-29	30-34	
Gender	Female	108 (77.7%)	31.37 (±8.27)	(18) 16.7%	(39) 36.1%	(19) 17.6%	.577
	Male	31 (22.3%)	32.35 (±9.84)	(6) 19.4%	(9) 29.0%	(7) 22.6%	
Total		139	31.58 (±8.62)				

Cavity Classification		Description	Number	POH at week 1			P value
				No	Yes	Total	
Cl I	118 (47.8%)	O	108 (43.7%)	117 (99.2%)	1 (0.8%)	118	.000
Cl II	129 (52.2%)	MO	59 (23.9%)	127 (98.4%)	2 (1.6%)	129	
		DO	54 (21.9%)				
		MOD	15 (6.1%)				
Total (n)	247			244 (98.8%)	3 (1.2%)	247	

refers to the ratio of bonded to un-bonded surfaces in a dental restoration, (Feilzer, et al. 1987) C-factor in dental restorations ranges from 0.1 to 5, with higher values indicating more probability of high interfacial stresses.(SOARES, et al. 2017; Sturdevant's) In clinical situations, when resin composite restoration is bonded to one tooth surface only, stresses within the composite are relieved by flow from un-bonded surfaces and therefore no, or very minimal contraction stress would develop.(Sturdevant's) On the other hand, in posterior restorations as in class I occlusal preparation, composite is bonded to five-surfaces (walls), leaving only the occlusal surface as a free or unbounded surface (wall). In such a clinical situation the restoration has a C-factor of 5. Stress relief in this condition is limited because flow can only occur through one surface.(Cunha, et al. 2009; Davidson and de Gee 1984; Feilzer, et al. 1987) The generating stresses on the bonded interface sometimes exceed the bond strength of the setting restorative material to the cavity walls, and may lead to debonding marginal leakage and post-operative pain (Asmussen 2009; Davidson and de Gee 1984) which sequentially can affect the longevity of the restoration. The same principle is applied for class II (MO/DO) composite restorations where there are four bonded surfaces and two unbounded free surfaces, giving the restoration C-factor of 4, and C-factor =3 for MOD cavity. (Sturdevant's) Postoperative Hypersensitivity (POH) described as pain of any degree in a tooth associated with mastication/chewing or with sensitivity to hot, cold, and sweet stimuli that occurs 1 week or more after restoration placement. Pain during clenching usually indicates that a restoration is in hyperocclusion.(Berkowitz, et al. 2013) POH following restorative treatment considers as irritating experience for the patient and clinician.(Briso, et al. 2007; Unemori, et al. 2001) Mild degree of POH after restorative procedure is acceptable and the patient should be informed in advance. It usually reduces within the first few weeks after restoration placement.(Briso, et al. 2007) However, once POH becomes constant for longer period of time that means the restoration needs attention and the only management avail¬able for many operators is to remove the restoration.(Murray, et al. 2003; Wegehaupt, et al. 2009) Various studies have been performed to investigate the occurrence and causing stimuli of POH and reports diverge extensively. Literature documented that approximately from 0-40% of patients' experienced POH after placement of resin composite restorations in posterior teeth. (Opdam, et al. 1998a; Opdam, et al. 1998b), (Unemori, et al. 2001) (Celik, et al. 2010; Efes, et al. 2006; Gordan and Major 2002; Rosin, et al. 2003; Sadeghi, et al. 2010; van Dijken and Sunnegårdh-Grönberg 2003; Wegehaupt, et al. 2009; Yip, et al. 2003) This phenomenon could be attributed to the contraction stress on tooth structure resulted from polymerization shrinkage of resin composite.(Cunha, et al. 2009; SANTOS, et al. 2007) It could be also due to the excessive heat generated during cavity preparation, non effective coolant and dentine desiccation, and incomplete converge and seal of the dentinal tubules by adhesive bonding agent after acid-etching procedure.(Swift, et al. 1997) Additionally, infection caused by bacterial invasion can produce sensitivity, that encouraged some investigators to use anti-bacterial solutions prior to restoration to disinfect the remaining dentine and inhibit

Figure 1: Statistical distribution of the restorations with regards to indication for restoration.

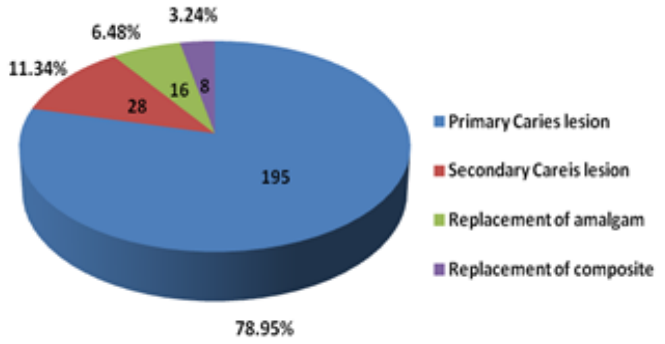
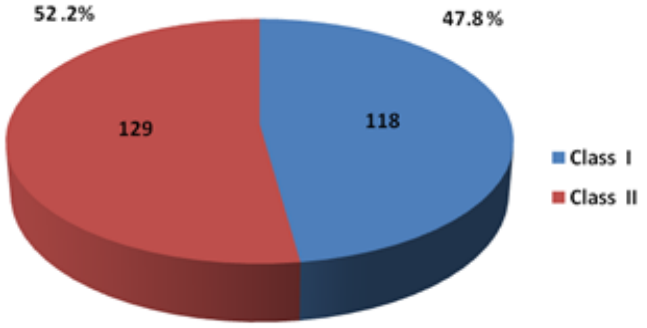


Figure 2: Statistical distribution of the restorations with regards to clinical class; Class I &II cavitie.



bacterial growth, and hence reduce or eliminate post-operative sensitivity.(Meiers and Kresin 1996) Operator skill, material properties, (Unemori, et al. 2001) curing modes, and cavity depth, (Asghar and Asghar 2014), (Bhatti, et al. 2014) are found to be influencing the occurrence of POH, particularly in class I and II posterior composite restorations. (Bhatti, et al. 2014) It has also been documented that occurrence of POH is correlated to the complexity of the cavity design and the restorative procedure.(Briso, et al. 2007) In class I and II cavity preparations only one or two walls were free or unrestrained, and hence stress relief within a three-dimensional restoration is limited by the highest C-factor and therefore great stress and postoperative pain is anticipated consequently.(Feilzer, et al. 1987), (Campos, et al. 2005; Kinomoto, et al. 2000) The aim of the present study was to investigate the effect of different cavity configurations (C-factor) of class I and II on occurrence of POH of posterior direct resin composite restorations. The null hypothesis tested was that the occurrence of POH of posterior resin composite restorations is not affected by the cavity configurations (C-factor).

2. Methodology

Study design: A total of 139 patients; 31 males and 108 females, with a mean age of 31.58 ±8.62 years (range 18 to 52) participated in the study. They were visiting the dental clinics seeking restorative treatment from March 2016 to June 2017. The Research has been approved by the Association of Dental Syndicate (number 208/004). Permission has been obtained from the patient after giving a brief clarification on the kind of investigation that was to be conducted. Patients who took part in this investigation presented with shallow- and mid-sized class I and II primary or secondary caries lesions in premolars and molars teeth, and patients who expressed a desire for replacement of amalgam, or defective composite restorations. Teeth with a history of pain, or deep caries lesions, and teeth with sever destruction of the crown or not in occlusion were excluded from the study. Cavity preparations: Following clinical and radiographic assessment of the caries lesion and administration of local anaesthesia, a # SF-S11 diamond bur (Toboom Shanghai Precise Abrasive Tool Co., Ltd) with a high speed hand-piece with constant water-cooling was used to access caries lesion and prepare the cavity. Caries enamel and dentine was

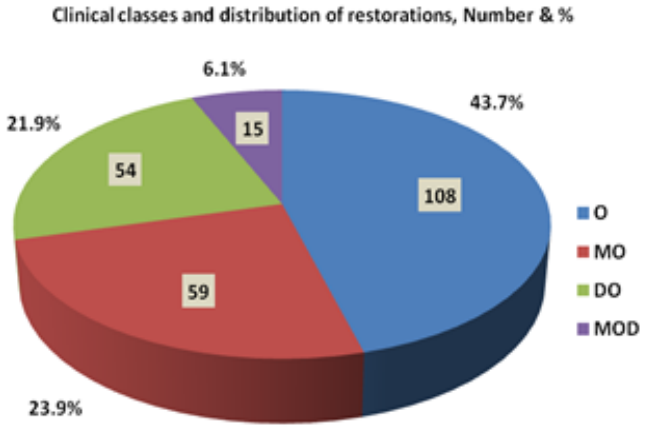


Figure 3: Statistical distribution of the restoration with regards to cavity configuration; O, MO, DO, MOD

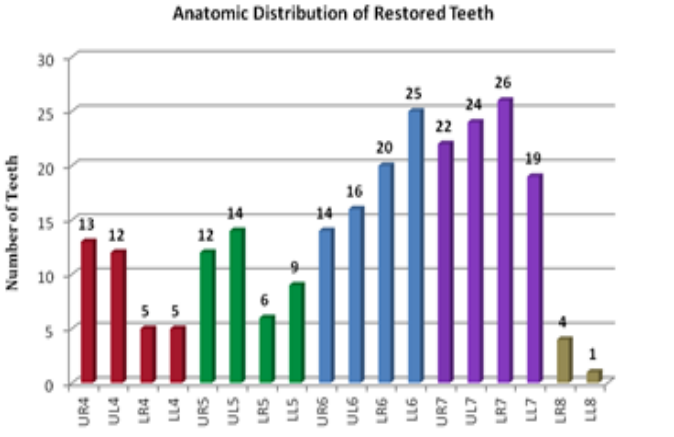


Figure 4: Anatomic distribution of the restored teeth

removed until sound tooth tissues were detected. The cavity depth, width, and length were measured using a 1-mm markings periodontal probe (William probe). The cavity depth was measured from the enamel cavosurface margin to the deepest point in the preparation. The measurement value to the nearest millimetre was recorded. The maximum and the narrowest dimensions considered as length and width of the preparation at the enamel cavosurface margins were also recorded. (Berkowitz, et al. 2013) Therfore, four types of cavity configurations were prepared, Class I of high C-factor occlusal cavities (O) and Class II of lower C-factor cavities were; mesio-occlusal, disto-occlusal, and mesio-occlusal-distal (MO, DO, and MOD). Restorative procedures: After completing cavity preparation, a rubber dam was placed to isolate the operating field. All cavity preparations were surrounded by enamel. For Class II cavities, the cavosurface angle of the gingival floor of the proximal box cavity was always located in the enamel. The enamel and dentine surfaces were etched using 37% phosphoric acid semi gel (Meta Biomed Co Ltd., Korea) for 30 and 15 seconds respectively. The cavity was thoroughly rinsed off with water and the preparation was gently air dried with compressed air to remove excess water without desiccation. For Class II cavity preparation a Tofflimire Universal Matrix Retainer and band (DentArt, Dental instrument MFG Co, Pakistan) and interdental wood wedges (PD Produits Dentaires SA, Switzerland) were placed before acid etching and bonding procedures. A layer of bonding system, nano-optimized, Tetric N-Bond (ivolclar vivadent, AG, Schaan, Liechtenstein) was applied with a microbrush and gently spread for at least 10 seconds to insure sufficient coverage of prepared tooth structure without pooling. A gentle stream of air is applied from an air syringe to remove excess material and the solvent, then light-cured for 10 second. Nano-hybrid Resin composite restorative material Tetric N-Ceram (Ivolclar Vvadent AG Schaan, Liechtenstein) was placed inside the cavity preparation with a flat-sided instrument using an incremental packing technique to minimize polymerization shrinkage and its effects and to ensure complete curing of each increment. Each increment of less than 2-mm thick was obliquely shaped inside the preparation in a way to contact only with part of the cavity floor and one side wall of the cavity (Chi 2006) and then light-cured for 20 seconds using ElibarTM S10 LED curing light unit (3M ESPE) at light intensity of 1100 mW/cm2 at a distance of 0.5 mm from occlusal surface of the tooth. A minimum of two increments were placed irrespective of the extent of the preparation. For class II preparations care was taken to insert and cure resin composite incrementally in the proximal box first then the occlusal part of the preparation to guarantee a better adaptation and cure of the composite in the gingival margin. When Class II MOD preparations were restored, each proximal box was individually filled incrementally; the resin composite was built up in each proximal box then the occlusal part of the cavity. For all types of class II cavities; after complete composite build up and band removal; the restoration was further polymerized for 20 seconds from the buccal and lingual sides to ensure a full polymerization of the restoration. Care was taken to insert the right amount of resin composite material just to fill–in the cavity to avoid excessive finishing procedure of the restoration at the cavity margins to avoid trauma to the bonded interface. Rubber dam was removed and the restoration was checked for any high spots or heavy contacts. The occlusal adjustment was performed in maximum intercuspation and eccentric movements using an articulating paper with the patient seated and the occlusal plane parallel to the ground. Any detected high spots were carefully removed using extra fine grit diamond burs EX-17EF, FO-23EF (Toboom Shanghai Precise Abrasive Tool Co., Ltd) in a high-speed handpiece under air-water cooling. White stones were used for any further adjustments of the anatomical shape of the restoration. The restorations were then polished with polishing tips to eliminate any surfaces scratches (Enhance Dentsply Caulk). The quality of the interproximale contact area was checked by means of dental floss. Occasionally several teeth were being restored in the same patient, however, no more than one tooth being restored per clinical visit. Evaluation of Postoperative Hypersensitivity (POH): After finishing the restorations, patients were recalled at 1-, 4-, and 13-week post-treatment to evaluate the occurrence of POH by verbally questioning the patient regarding sensitivity to cold, hot, sweet stimuli, mastication/chewing and clinching. Their answers about presence and degree of severity in sensitivity were measured using Visual Analogue Scale (VAS).(McCormack, et al. 1988; Younger, et al. 2009) The VAS is presented as a 10 cm horizontal line anchored by two extremes '' no pain'' (score 0) and 'pain as bad as it could be' (score 10). Patients were asked to choose the mark that represented their level of pain. Pain level was assigned to one of four categorical score: None; (0), Mild (1-3), Moderate (4-6) and Sever (7-10). All the readings (marks) stated by the patients were recorded and then the amount of pain was assessed. All the restorative procedures were performed by one clinician to minimize the technical and procedural variations. Data was collected, computerized and statistically analyzed using SPSS version 16. Frequencies and percentage for age, gender, tooth number and site, cavity preparation class, depth, width and length, and volume of restorations and occurrence of POH to different stimuli were calculated and analyzed. Chi-Square and t-tests were used for statistical analysis. The level of significance was set as $P<0.05$.

Results

The results are summarized in Table 1. From 154 pa-

tients originally enrolled in this investigation, complete one-week post-treatment POH sensitivity information was available from 151 patients, and at the week 4- recall visit, there were 146 patients, and at week 13- recall visit, there were 139 patients with complete data available for 247 teeth. A total of 247 direct resin composite restorations were evaluated throughout the study periods. The distribution of the restorations were nearly similar between class I; 118 (47.8 %) and Class II; 129 (52.2 %) cavities. Resin composite restorations were placed in 139 patients with a mean age of 31.58 ±8.62 (range 18 to 52) years old, 77.7% (108) were females and 22.3% were males (31). For both; male and female patients, the high percentage of composite restorations were received by the age group of 25-29 years followed by 30-34 years and less than 25 years old. The mean and standard deviation for depth, width, and length of the cavity preparations were 3±0.29, 2.1±0.25, 5.1±1.12 mm respectively. The mean volume of the composite restorations was 32 mm3 . A total number of restored premolars was 76 (30.76%), and molars was 171 (69.23%). Figures 1-4 show the statistical distribution of the 247 restorations with regards to indication for composite restoration, clinical classes; I and II, anatomic distribution of the restored teeth. Chi-Square and t-tests revealed no significant difference in occurrence of POH between class I of a high C-factor and class II of lower C-factor than class I cavity configurations (P>0.05). At week 1- post-treatment evaluation period revealed that incidence of POH was 0.8% (1/118) in class I (O) restorations of C-factor of 5, and 1.6% (2/129) in class II (DO) restorations of C-factor of 4 i.e. there was no significant differences among the types of cavity preparations and occurrence of POH (Table 1). The three restorations 3/247 (1.2%) presented with POH at week 1 have VAS scores of pain intensity between mild to moderate (3.5-5 VAS) sensitivity to cold stimulus, with mean score of 4.17±6.76. Two restorations 2/247 (0.8%) belonging to class I and class II cavity configurations were being in hyperocclusion. The latter two cases were relieved immediately after occlusal adjustment of the restorations using fine finishing diamond and articulating paper. No POH reported due to any other stimuli. Also no POH detected among MO and MOD composite restorations. At week 4- post-treatment, the POH had completely resolved as reported by patients. Likewise, no POH to any stimuli had occurred at week 13-post treatment recall visit as reported by the patients.

Discussion

Stress relieving flow in a cavity preparation should be sufficient to preserve a well adhesion to cavity walls and margins. Among various clinical classes of cavity preparation; class I and II posterior composite restorations are more susceptible to clinical failure, due to the technique sensitivity of restorative procedures in posterior teeth, material properties, cavity size and stress developed from polymerization shrinkage that might cause restorations failure in a form of enamel cracks, debonding of the composite from the tooth, pain and postoperative sensitivity. (Asmussen 2009; Braga, et al. 2005; SOARES, et al. 2017) In clinical situations such as in a box-like class I occlusal cavity preparation, it was anticipated that the bonded surface area is more than the unbounded surface area by five times, and therefore maximum C-factor. (Cunha, et al. 2009; Sturdevant's) Therefore, it is anticipated that with an increasing c-factor the contraction stresses of bonded composite restorations expected to increases as well, (Braga, et al. 2005; Feilzer, et al. 1987; Kinomoto, et al. 2000), (SOARES, et al. 2017) leading to increase incidence of POH. However, these observations were not experienced in the current study. Results of our study showed no significant difference in the occurrence of POH between two levels of C-factors; class I restorations of the highest C-factor (C-factor=5) and class II restorations of lower C-factor than class I cavity (C-factor=4), which means that cavity configuration had no influence on the incidence of POH. At week 1- post-treatment evaluation period only 1 restoration out of 118 class I (O) and 2 (DO) out of 129 class II restorations presented with mild to moderate (3-5) POH to cold stimuli, and have been totally eliminated in the subsequent recall visits at week 4 and 13 post-treatment. The occurrence of POH in this study was very low compared with many other studies. There were only 3 (1.2%) restorations out of 247 restorations reported with POH at week-1 post-treatment. The explanations for our findings could be attributed to the proper and accurate clinical procedures performed during cavity preparation and restorative techniques. In addition, all clinical procedures had been performed by single clinician to minimize the technical and procedural variations. It is important to highlight that the criteria used for selection of patients and cavity preparations were standardized. The restorative procedures were undertaken in best clinical conditions under rubber dam isolation avoiding moisture, bacterial contamination and occlusal interferences that could be contributed to the low incidence of POH.(Sobral, et al. 2005) During performing cavity preparation, extreme cares was taken during removal of the caries tissues and prepare cavity walls using an intermittent cutting and light pressure with the high speed handpiece and generous water spray to avoid dehydration of dental tissues and therefore POH. Beside studies have established that larger and deeper cavities showed more POH compared with lesser depth cavities,(Asghar and Asghar 2014; Unemori, et al. 2001) i.e. the larger the volume of the restoration, the more the possibility of high stress leading to gaps, margin microleakage and pulpal stimulation through fluid flow down dentinal tubules during mastication and POH. (Berkowitz, et al. 2013), (Sun, et al. 2009) In the current study, majority of the cavity preparations were shallow- to mid-

sized cavities, which was important to avoid the need for cavity liners or bases in deep cavities which could affect the standardization of the study and therefore the outcomes. Our results go in line with this concept, where the mean values for depth, width, length and volume of composite restorations were 3±0.29, 2.1±0.25, 5.1±1.12 mm, 32 mm3 respectively, and as a result only few cases reported POH. Additionally, since polymerization shrinkage induces stresses at the adhesive bonded interface, different approaches and several suggestions have been adopted by researchers to minimize the adverse effects of polymerization shrinkage and internal stress in a restoration and possibility of subsequent POH. One of those approaches was incremental layering technique for placement of the resin composite filling material.(Chi 2006; Katona and Barrak 2016; SOARES, et al. 2017) Oblique incremental packing technique was used in our study. This technique is widely applied in everyday practice, since it can influence the value of cavity configuration factor (C-factor) and the extent of polymerization shrinkage (Katona and Barrak 2016; Yumei, et al. 2009) This is because, during the application of the resin composite in multiple thin increments of less than 2mm thickness, polymerization shrinkage occurs in each increment individually. Shrinkage of each thin layer of resin composite generates much less force than the contraction of a composite in bulk that fills the whole cavity.(Schneider, et al. 2010) Therefore, the C-factor is also significantly reduced, which further decreases the stress associated with polymerization shrinkage, leading to improvement in the bond of the composite to the dentin, as well as possibility of reducing or even eliminating POH. (Yumei, N et al 2009). In the current study, extreme care was taken during placement on the composite inside the cavity. Each increment of resin composite was obliquely shaped inside the cavity preparation and contacts only with part of the cavity floor and one side wall of the cavity and then light-cured. That was to increase the free surface of the restorative material, therefore to reduce the C-factor and and its consequences. (Chi 2006) Furthermore, great care was taken in a way as to reproduce the anatomy of the tooth structure and that minimal amount of contouring is done with the handpiece to avoid trauma to the adhesive bonded interface and therefore to eliminate POH. This may explain the low incidence of POH obtained in this study. In the current clinical investigation, authors have adopted a study design of having patients who reported presence of POH experience by self-report at particular intervals; week 1, 4, and 13 following posterior composite restorations, using a 10-point VAS scale which is a numeric pain assessment scale for sensitivity to cold, hot, sweets, clenching, and mastication/chewing. The VAS is a commonly used method to measure pain intensity, and has been widely used for clinical pain research.(McCormack, et al. 1988) The VAS method is simple, reliable and valid method and provides a high degree of resolution and is probably the most sensitive single-item method that makes the VAS the optimal tool for describing pain intensity and hence to guide pain treatment. (McCormack, et al. 1988), (Younger, et al. 2009) The three cases reported with POH to cold from both class I and II composite restorations presented with mean VAS score of 4.17±0.76. However, it is worth mention that fear and apprehension towards dental procedures are among other factors that trigger patient's pain reactions threshold. In addition, pain threshold and discomfort exhibits individual differences, previous painful dental experiences and communication or relationship between the patient and the clinician may have influence on patient reactions towards restorative procedure. (Berggren and Meynert 1984) Occurrence of POH was asked to be reported for a variety of stimuli, however cold sensitivity being the only reported stimuli that caused POH. No POH were reported to hot and sweet stimuli. Mastication/chewing and clenching hypersensitivity were included in an attempt to distinguish the postoperative hypersensitivity of a restoration in hyperocclusion (clenching sensitivity) from hypersensitivity of a restoration related to mastication/chewing which is considered a form of POH related to gap formation between the restoration and dentin due to polymerization shrinkage. This gap could be accumulated with fluid, and during mastication the restoration and tooth deform causing flow of the fluid down the dentin tubules leading to hypersensitivity, (Opdam, et al. 1998a) this condition occasionally referred to as occlusal loading sensitivity. (Berkowitz, et al. 2013) Results of this study demonstrated that only two patients presented with hyperocclusion at week 1 recall visit, and were totally resolved after occlusal adjustment. Our findings were in contrast with other researchers (Opdam, et al. 1998a) who found that 14% of class I composite restorations showed POH while 56% of restorations exhibited occlusal loading (mastication) hypersensitivity. Literature reported vast variation in the results between studies. This could be due to differences in the variable tested such as cavity depth and size, different in adhesive bonding system, resin composite materials and restorative technique used, in addition to different in skills, knowledge, and number of the clinicians performing the procedures. Our findings are in line with some studies and disagree with others. Our results were in agreement with some investigators (Efes, et al. 2006) who found no POH was reported in a 2-year clinical study of RBC restorations with or without a flowable liner. Gordan, V. et al (Gordan and Major 2002) found that 4% of class I and class II composite restorations were reporting POH at 7 days, whereas no reports of POH were recorded at 30 days. (Rosin, et al. 2003) Similarly, other researchers have reported that 5% of restorations were having sensitivity at 1 week post-treatment and 2% of the resto-

rations were replaced because of a sever hypersensitivity. They were evaluated a new resin based composite formulation Ormocer in a mix of Class I to class V restorations. Yip, K. H. et al (Yip, et al. 2003) investigated class I and II composite restorations using the same dentin bonding agent, and found that 7% of restorations showed hypersensitivity to cold stimulus at 1 week. Similar results have been obtained by van, Dijken, J.(van Dijken and Sunnegårdh-Grönberg 2003) who found 7% of patients reported POH. Others found that 3% of class I restorations of microhybrid, packable, or nanofilled composite restorations were replaced after 6 months due to POH.(Sadeghi, et al. 2010) In contrast to our findings, no severe POH or cases that need replacement were reported by the patients. In regard to the adhesive system and restorative material used in our study; only one bonding agent; (Tetric® N-Bond) is a light-curing, nano-filled single-component adhesive which is used in combination with the total etch technique. Applied in one homogeneous layer for complete coverage and improved adhesion to the tooth structure, claimed by the manufacturer, and one restorative material; nano-hybrid resin composite (Tetric® N-Ceram), and only few cases reported POH to cold at week 1. The function of bonding agent is to bond restorative material to tooth structure simultaneously produces well-sealed dentinal tubules and prevent invasion of bacteria and outside stimuli, and hence prevent POH. (Opdam, et al. 1998a) (Scherman and Jacobsen 1992) In the present study, just appropriate amount of the bonding liquid is applied into cavity walls by a small microbrush avoiding excess liquid that might irritate soft tissues surrounding the tooth, this might add another explanation to our results. This study highlights that direct resin composite restorations require a technique sensitive approach, when all steps of cavity preparation and restorative procedure guidelines are carefully followed and is properly accomplished in daily clinical practice, restoration is mostly successful and only minor or nearly none of restored teeth showed POH. Our findings are in agreement with Sobral MAP et al study.(Sobral, et al. 2005) During current study, all the steps of cavity preparation and restorative technique were performed very carefully. Maybe this is the best explanation for the results described in this study. The null hypothesis was accepted, as the occurrence of postoperative sensitivity in posterior composite restorations, though it was in very limited cases, not varied among class I and II cavity configurations with different cavity designs.

Conclusions

Within the limitations of the current study, the following conclusions were drawn. Cavity configurations (C-factor) had no influence on the occurrence of POH reported by patients at 1-, 4-, and 13-weeks post-treatment. POH expected in the high C-factor class I composite restorations was not observed. The restorative technique performed through the study resulted in excellent outcomes for class I and II cavity configurations.

CLINICAL RELEVANCE

Direct resin composite restorations can achieve successful results with proper clinical procedures and techniques. It is the duty of clinicians to stay side by side with current guiding principles and limitations of resin composites to avoid irritating experience of postoperative hypersensitivity.

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