ORIGINAL ARTICLE

Comparing The Post-Operative Sensitivity Of Bulk-Fill Versus Incremental-Fill Placement Techniques Using Nano-Hybrid Composite Resins In Class Ii Restorations: A Randomized Clinical Trial

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Abstract

Background: Composite resins have been efficiently used in dentistry recently for restoring posterior teeth and have widely substituted amalgam as a restorative material.

Objectives: The aim of this study was to compare the post-operative sensitivity of bulk-fill versus incremental-fill placement techniques using nano-hybrid composite resin in class II restorations.

Materials and Methods: A randomized controlled trial was done at (blinded) from February 2022 to August 2022. A total of 326 participants with both genders of age 20-50 years, diagnosed with carious first mandibular molars were selected from the outpatient department using purposive sampling. The patients were divided into two groups (Group A for bulk-fill technique and Group B for incremental-fill) by random allocation using single blinded technique. After restoring the tooth, patients were recalled after one week. On the recall visit, patients were asked about possible presence or absence of sensitivity in the restored tooth. Intensity of sensitivity was measured by using Visual Analogue Scale.

Result: Overall post-operative sensitivity was found 29 (8.86%). The frequency of post-operative sensitivity was higher in incremental-fill technique (11.66%) than bulk-fill (6.13%), but with no statistically significant difference (p=0.228). However, the intensity of post-operative sensitivity between the two groups was statistically significant (p=0.009). Severe sensitivity was observed more in incremental group (6.13%) than bulk group (0.61%). Chi square was used to compare the post-operative sensitivity of placement techniques among bulk-fill and incremental-fill technique.

Conclusions: There is no significant difference in post-operative sensitivity between bulk-fill versus incremental-fill placement techniques using nano-hybrid composite resin in class II restorations.

Keywords: *Post-operative sensitivity, nano-hybrid composite, bulk-fill, incremental-fill*

Introduction

Composite resins have been efficiently used in dentistry recently for restoring posterior teeth and have widely substituted amalgam as a restorative material.[1] Besides possessing an esthetic quality, the adhesive nature of composite resins have resulted in a minimally invasive approach and a stronger attachment to the tooth structure.[2] In spite of progresses that have been made regarding composite resins, numerous clinical and material impediments have limited their universal use as a posterior restoration, the primary undesirable property being its polymerization shrinkage.[3] This shrinkage can lead to gap formation between the restoration and cavity walls that may cause postoperative sensitivity, microleakage and recurrent caries.[4] Class I and Class II composite resins are more susceptible to failure due to various reasons like high C-factor, technique sensitivity etc.[5]

Various types of composite resins[6] and their placement techniques[7,8] have been recommended to reduce such problems. One such technique is an Incremental method in which composite material is placed in layers of 2mm thickness or less.[9] This approach results in certain advantages like reduction in C-factor and polymerization stresses.[9] However, it is more time consuming and there are chances of incorporation of voids within the restoration.[9] Recently, a new class of composite resin has been introduced, the so called "Bulk-fill" composites as a substitute for the highly technique sensitive incremental method.[10] This makes restorative process much simpler and reduces clinical time.[10] Compared to conventional technique, they also have an increased depth of cure due to better translucency and possibly decreased shrinkage stresses as a result of variations in the filler/resin matrix formulations.[11,12]

There are many studies available in the literature

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comparing various properties of incremental and bulk fill techniques regarding composite resins, however, only limited data is present about their effect on post-operative sensitivity. According to Rasha Al-Sheikh,[13] the post-operative sensitivity of Bulk Fill Composite resin was found to be 2.5% and of Incremental technique it was reported to be 10%. In another study, B Oter et al[14] compared the clinical performance of Bulk-Fill restorations with Incremental Fill restorations in primary molars. In their study, after one week of follow up the bulk fill restorations and incremental fill restorations showed mild post operative sensitivity in 5% and 2.5% of the patients, respectively.[14]

Complaint of postoperative sensitivity following composite restoration is at increase. It's understood that the shrinkage is an inherent quality of resin, therefore we cannot completely inhibit it. However, we can minimize the shrinkage to improve the longevity of the restoration. For that reason, different types of dental composite and different placement techniques are invented. Comparing the two techniques of composite placement will provide a useful guideline for a restorative dentist. Identifying a technique with minimal shrinkage of dental composite will enhance the long-term success of the restoration, thus benefiting both the patient and the dentist. Therefore, the aim of the study is to compare the post-operative sensitivity following the bulk-fill to incremental-fill placement techniques using nano-hybrid composite resins in class II restorations.

Material and Methods

A Randomized clinical trial was done at (blinded), from February 2022 to August 2022. An ethical approval (EC Ref No: 20-07-023) was taken from the ethical committee of the institute. Patients of both genders of age 20-50 years with carious class II (Mesio-occlusal or Disto-occlusal) first mandibular molar with healthy pulp and apical periodontium were selected from the outpatient department using non-probability consecutive sampling technique. Patients with class II cavities involving the pulpal-third of the dentin, teeth with mesio-occlusal-distal cavities, pre-existing hypersensitive teeth, teeth with severe periodontal loss, symptoms of pulpitis, allergic to any of the material being used and who fails to visit for follow-up were excluded from the study. By using WHO sample size calculator the total sample size was 326 by taking 2.5% post-operative sensitivity for bulk fill composite resin and for incremental technique composite as 10% while keeping 5% level of significance and 80% power of the test.[13] An informed consent was taken from every participant. A detailed history was taken followed by clinical examination of the patients. Pre-operative periapical radiograph for carious first mandibular molar was taken in each patient. The selected patients were randomly divided into two groups by random allocation using single blinded technique. Through block randomization, patients were assigned to group A and group B. Patients recruited in group A were treated with bulk fill placement technique and Group B patients were treated with incremental placement technique of composite resin.

The teeth were isolated using rubber dam. Caries was removed with the help of high-speed handpiece using a round carbide bur and a mesio-occlusal or disto-occlusal class II cavity was prepared. After detailed examination confirming that the cavity has been cleaned properly sectional matrix system was placed and the prepared cavity was restored with the help of composite resin using bulk-fill technique in group A patients and incremental technique in group B patients. Each increment was measured with a periodontal probe before placing in the cavity. For incremental technique, the increment was taken of 2 mm thickness using a plastic instrument. For curing, conventional visible light curing unit was used. Rubber dam removed, occlusion was checked and adjusted with the help of tungsten carbide bur. After restoring the tooth, postoperative instructions were given to the patient and a recall visit after 1 week was arranged. Any patient who fails to be complaint for the mentioned follow up was excluded from the study.

At the recall visit, patients were asked about the possible presence or absence of sensitivity in the restored tooth. If sensitivity was present, then further information regarding the intensity on the Visual analogue scale was recorded. The scale was classified as 0, indicating No sensitivity, 1-3 as mild, 4-6 as moderate and 7-10 as severe. Considering the ethical considerations, patients presenting with moderate to severe sensitivity were subjected to refilling.

The collected information was entered into SPSS version 22.0 and analyzed via its statistical package. The quantitative variables like age were presented as mean and standard deviation. Frequency and percentages were calculated for categorical variables like gender, intensity of pain (no pain, mild, moderate, and severe). The Chi square test was used to compare the post-operative sensitivity following the bulk-fill and incremental-fill placement techniques. Age and gender were stratified among two groups by using chi square test to see effect modifiers. P value ≤ 0.05 was taken as significant for all the tests.

Results

The mean age of the participants was 35.05±8.34 years with a range from 20 to 50 years. 148 (45.40%) females and 178 (54.60%) males participated in the study. Overall post-operative sensitivity was found in 29 (8.86%). The most common type of sensitivity was moderate (n=12, 3.68%) followed by severe (n=11, 3.37%) and least was mild (n=6, 1.84%). Commonest stimuli for post-operative sensitivity were hot present in 14 (4.29%) followed by cold present in 13 (3.99%) and least was sweet and sour present in 2(0.61%) participants.

A comparison of post-operative sensitivity between the bulk-fill and the incremental-fill techniques was given in Table 1. The intensity of post-operative sensitivity between two groups was statistically significant (p=0.009) (Table 1).

Table 1: Comparison of post-operative sensitivity among bulk fill and incremental composite
[1] n (%), [2] Pearson's Chi-squared test, [3]Fisher exact

Characteristic	bulk fill placement technique, N = 163[1]	Incremental placement technique, N = 163[1]	p-value[2]
Post-operative Sensitivity			
absent	153 (93.87)	144 (88.34)	0.228
present	10 (6.13)	19 (11.66)	
Intensity of Post - Operative Sensitivity			
No	153 (93.87)	144 (88.34)	0.009
Mild	5 (3.07)	1 (0.61)	
Moderate	4 (2.45)	8 (4.91)	
Severe	1 (0.61)	10 (6.13)	

Discussion

Postoperative sensitivity following composite restoration is one of the major limitations that could affect the longevity of the restoration. In the present study 8.86% of the participants reported postoperative sensitivity following composite restoration. Literature research has shown that postoperative sensitivity following composite restoration reports 5% to 30%.[15]

This study was aimed to compare the post-operative sensitivity of bulk-fill versus incremental-fill placement techniques using nano-hybrid composite resin in class II restorations. Our findings showed that the frequency of post-operative sensitivity was higher in incremental placed composite (11.66%) than bulk filled (6.13%) but with no statistically significant difference (0.228). The result of our study is not in accordance with a lab-based study by D Kaisarly[5], in which shrinkage in bulk-fill and conventional incremental-fill composites were assessed. According to this study the bulk-fill technique shows greater shrinkage and a higher tendency to debond than the incremental-fill technique.

However, according to Rasha Al-Sheikh[13], the post-operative sensitivity for bulk-fill composite resin was found to be 2.5% and for Incremental technique it was reported to be 10% with a statistical difference (=0.0109). In another study, B Oter et al[14] compared the clinical performance of Bulk-Fill restorations with Incremental Fill restorations in primary molars. In their study, after one week of follow up the bulk fill restorations and incremental fill restorations showed mild post operational sensitivity in 5% and 2.5% of the patients, respectively.

In the present study, the intensity of postoperative pain was also recorded. 23 (79%) out of 29 participants were presented with moderate to severe sensitivity in the previously filled tooth. In the incremental-fill technique increase number of participants reported moderate to severe sensitivity as compared to bulk-fill technique participants (p value 0.009). In this study, the type of stimuli causing sensitivity following the composite restoration was also identified. Commonest stimuli for post-operative sensitivity were hot present in 14 (4.29%) followed by cold present in 13 (3.99%) and least was sweet and sour present in 2(0.61%) participants. According to TM Auschill,[16] hot and cold are the commonest stimuli causing sensitivity in the composite filled tooth.

One of the major causes of postoperative sensitivity in composite restoration is the inherent polymerization shrinkage. Various types of composite resins and their placement techniques have been recommended to reduce the polymerization shrinkage and postoperative sensitivity.[7,8] One such technique is Conventional Incremental method in which composite material is placed in layers of 2mm thickness or less.[9] This approach results in certain advantages like reduction in C-factor and polymerization stresses.[10] However, it is more time consuming and there are chances of incorporation of voids within the restoration.[10,11] Recently, a new class of composite resins has been introduced, the so called “Bulk-fill” composites as a substitute for the highly technique sensitive incremental method.[9] This makes restorative process much simpler and reduces clinical time.[9] Compared to conventional technique, they also have an increased depth of cure due to better translucency and possibly decreased shrinkage stresses as a result of variations in the filler/resin matrix formulations.[11,12]

This study has some limitation like short follow up time, single center and multiple operators. More studies are needed to address this area further.

Conclusion

There is no significant difference in post-operative sensitivity between bulk-fill versus incremental-fill placement techniques using nano-hybrid composite resin in class II restorations.

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Author Contributions

1. **Khizer Asif**: Conceptualization of the study, clinical procedures, and overall supervision.
2. **Komal Tanweer**: Data collection, patient management, and assistance in manuscript drafting.
3. **Ahsan Ali** : Statistical analysis, interpretation of results, and critical revision of the manuscript.