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Research Article

Three-years Clinical Follow-up of Layered Resin Composite Restorations Versus Bulk-Fill Resin Composite Restorations

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Abstract

Objectives: To evaluate the clinical follow-up of class II restored with layered resin composite versus bulk-fill resin composite after three years.

Materials and Methods: Thirty class II cavities were prepared. The cavities were randomly divided into three groups (n = 10) according to the restorative material used (Tetric Evoceram Bulk fill, Filtek bulk-fill and Filtek Z250). The patients were recalled every 6 months for three years. Restorations were evaluated using Modified United State Public Health Criteria (USPHS).

Results: No statistically significant difference between all the tested restorative materials.

Conclusion: Bulk fill restorative materials (Tetric Evoceram bulk fill and Filtek bulk-fill) showed clinical outcomes like that of conventional resin-based composite.

Keywords: *Bulk Fill Composite; Clinical Evaluation; Layered Composite*

Introduction

There is great interest in the beauty since the earliest civilizations; composite resins have become a part of this quest to enhance the esthetics of the teeth and mouth [1-5]. During resin polymerization, monomer molecules convert into a highly cross-linked polymer resulting in a decrease in the distance between the monomer molecules that creates volumetric shrinkage stresses transferred to the tooth restoration interface [6,7].

If the bond strength is smaller than these stresses, de-bonding might occur resulting in postoperative sensitivity, marginal discoloration, marginal gap formation and recurrent caries [8]. However if these stresses are smaller than the bond strength no de-bonding occurs, but the restoration will maintain internal stresses that pull the cusps together, decreasing the inter-cuspal distance width causing cuspal deformation which might cause micro cracks and/or cusp fracture [9,10].

Despite the controversy over the advantages of incremental build-up of composites, this technique recommended in direct resin composite restoration, because it decrease the C-factor, allowing a flow of the material [11-16]. However, entrapment of voids between the increments, bond failure between the increments and the long time taken to complete the procedure are some disadvantages of incremental technique [17-20].

Bulk-fill composites offer saving time and eliminate the risk of contamination and voids forming between the increments [22-24], as it can be applied into the prepared cavities in layers up to 4 or 5 mm thick [21].

The present study was intended to evaluate the 36-month clinical outcome of two different bulk-fill resin composites in class II cavities. The null hypothesis was that bulk-fill resin composites not significantly differed clinically than layered resin composites.

Materials and Methods

Two bulk fill composites (TetricEvoCeram and Filtek bulk-fill), and one layered composite (Filtek Z250) were evaluated (Table 1). Thirty patients (10 for each resin composite restorative system) were selected from the Dental Clinic at College of Dentistry, Prince Sattam Bin Abdul-aziz University.

Restorative system	Manufacturer	Resin	Filler	Filler size
Filtek Bulk Fill (Nanohybrid)	3MESPE	Bis–GMA, TEGDMA, EBpDMA	Zirconia/silica particles, Mixed oxide prepolymer	Unreported
Single Bond (two-step etch-and rinse)	3MESPE	Bis-GMA, HEMA, DMA, polyalkenoic acid copolymer, initiator, water, ethanol.		
TetricEvo Ceram Bulk Fill (nanohybrid)	IvoclarVivadent	UDMA, Bis-GMA	Barium glass, Ytterbium trifluoride, Mixed oxide prepolymer	550 nm average Range (40 - 3000 nm)
Excite F (two-step etch-and-rinse)	IvoclarVivadent	Etchant: 73% phosphoric acid with colloidal silica Adhesive: HEMA, DMA, phosphoric acid acrylate, silicon dioxide, initiator, stabilizers in an alcohol solution.		
FiltekZ250 (microhybrid)	3MESPE Konstanz, Germany	Bis-GMABis-EMA,TEGDMA ,UDMA.	Zirconia/silica particles	0.01 - 3.5 µm Average: 0.6 µm

Table 1: *Materials used in this study.*

Conservative preparation design was used according to the principles of minimally invasive dentistry using round diamond and fissure burs at high speed with water cooling under local anesthesia. All patients received three restorations. Cavities were randomly distributed to be restored with either the bulk-fill TetricEvoCeram resin composite, Filtek bulk-fill resin composite or the control restoration with conventional layered Filtek 250 according to manufacturer's instructions. Each resin composite restoration was finished with fine-grit diamond finishing instrument and polished with Multiple-use polishing system (Politip Ivoclar/Vivadent) [26] (Figure 1a-1c).

Figure 1a: *Case with multiple carious lesions.*

Figure 1b: *Cavity was prepared in lower premolars and first molar teeth.*

Figure 1c: *Teeth restored and the restorations were finished polished and occlusal adjusted.*

Each restoration was evaluated at a baseline, and then blindly at 36 months by two independent examiners according to slightly Modified United State Public Health service (USPHS) criteria [27]. All the collected data were subjected to statistical analysis using the statistical package for Social Science (SPSS Inc, Chicago, IL, US). The changes in the parameters during the 36-months evaluation period were analyzed using the Friedman test ($p < 0.05$).

Result

All restorations showed no statistically significant differences detected between their performance at base line and after 36-months recall (Table 2). For retention, Secondary Caries, Marginal Adaptation and Inter-proximal Contact criteria, there was no significant difference between all restorative materials tested at 36 months recall visits ($P < 0.05$). Regarding marginal discoloration criteria, there was no statistically significant difference ($P < 0.05$). Most of scores were Alpha, while Bravo scores were only recorded at the 36 months of evaluation in two restorations restored with Z250 composite (Figure 2). For postoperative sensitivity, there was no statistically significant difference between the tested groups ($P < 0.05$). At base line there were two restorations for TetricEvoCeram bulk-fill, one restoration for Filtek bulk-fill and one restoration for Filtek z250 were sensitive to air and tactile contact, all was relieved after a short time.

Figure 2: *A photograph showing lower right second molar restored with Z250 after 36 months and scored bravo for marginal discoloration.*

Materials	Test Values	Retention	Marginal discoloration	Secondary caries	Marginal adaptation	Post-operative sensitivity	Inter-proximal contact	Color match
Z250	Chi Square	0.000	4.714	0.000	9.000	18.000	8.760	12.000
	P Value	1.000	0.194	1.000	0.029	0.000	0.033	0.007
TEBF	Chi square	0.000	6.000	0.000	6.000	12.000	6.000	6.000
	P Value	1.000	0.112	1.000	0.112	0.007	0.112	0.112
F	Chi Square	0.000	3.000	0.000	3.000	15.000	3.000	3.000
	P Value	1.000	0.392	1.000	0.392	0.002	0.392	0.392

Table 2: *Results of Friedman test comparison of the clinical performance of the tested composites (Z250, TEBF and F) at base line and 36 months recall ($P \leq 0.05$).*

Discussion

Despite great improvements, resin composites restorations still represent some short-comings as polymerization contraction and obtaining a tight contact point. Bulk-fill composites are tooth-colored restorative materials that can be placed in 4 or 5 mm thick [29]. Bulk fill composites have been developed to enable dentists to reduce placement time and work more efficiently.

Retention

There was no loss of retention reported over 36-month follow up in the present study, indicating that the bond strength at the restoration/tooth structure interface is satisfactory in all the tested groups.

Marginal discoloration

All restorations were clinically accepted with no Charlie score all over the recall periods. A slight degree of marginal discoloration was observed after 36 months in the bulk-fill resins. This may be due to the high polish ability and filler loading of nanofillers [31].

Recurrent caries

There was no secondary caries. This may be due to good oral hygiene of the patients, adequate restorative technique and good marginal seal.

Marginal adaptation

There was no evidence of crevice along the margins of all restored cavities. The good marginal adaptation of both bulk fill resins may be due to that stresses generated during the setting process might be compensated by the flow of the material [32].

Post-operative sensitivity

The good results of postoperative sensitivity in the present study at recall visit might be related to the excellent marginal seal, using rubber dam isolation and careful occlusal adjustment [33].

Inter-proximal contact

No significant differences were found between the materials. This might be attributed to the high filler content and good mechanical properties of the tested restorations [34].

Conclusion

Within limitation of the present study, it can be concluded that all the tested restorative materials showed a satisfactory clinical performance after three-years follow-up.

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