Original Article

Comparison of Bulk-Fill Flowable Composite vs Traditional Nano-Hybrid Composites in Posterior Teeth

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Article Info

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Date Received: October 17, 2023
Date Revised: April 18, 2023
Date Accepted: Aug 23, 2024

Abstract

Objective: To evaluate and compare the clinical performance of bulk-fill flowable composites and conventional nano-hybrid composites to restore posterior teeth.

Methodology: A Randomized controlled trial was conducted at Bakhtawar Amin Dental College, Multan, from July 2022 to Jun 2023. A total of 140 subjects were included in the study, with 70 assigned to the bulk-fill flowable composite group (Group A) and 70 to the traditional composite group (Group B). The restorations were assessed for retention, marginal integrity, and postoperative sensitivity over a 3-month follow-up period. Data was analyzed with SPSS version 26.0.

Results: 28 teeth were dropped out of the study, leaving 112 teeth. No significant differences were found between the two groups (A and B) in restoration outcomes according to USPHS criteria (taking $p > 0.05$ as significant), with chi-square values of 1.46 ($p = 0.48$), 2.53 ($p = 0.28$), and 3.77 ($p = 0.15$) for restoration retention, marginal integrity, and postoperative sensitivity, respectively.

Conclusion: Both bulk-fill flowable composite and traditional composite materials in posterior teeth restorations show favorable clinical performance in terms of restoration retention and marginal integrity with minimal post-operative sensitivity. However, further research is needed to assess the long-term performance of these materials.

Keywords: Bulk-fill Composite; Composites; Nano-hybrid Composite; Restorative dentistry

This article may be cited as:
Pervez J, Ghani B, Ashraf U, Ahmed F, Ishaq B, Aziz S. Comparison of bulk-fill flowable composite vs traditional nano-hybrid composites in posterior teeth. J Postgrad Med Inst 2024;38(3):177-80. http://doi.org/10.54079/jpmi.38.3.3347

Introduction

Composite resins have become the material of choice for direct restorations in posterior teeth due to their esthetic properties and adhesive bonding capabilities.1 The introduction of bulk-fill flowable composites has been demonstrated as a viable alternative to traditional composites, biologically, aesthetically, and functionally, for posterior restorations.2 Bulk-fill flowable composites are designed to simplify and expedite the restorative process by allowing for deeper and faster polymerization, reducing clinical time. Bulk fill composites are inserted into the cavity of a layer up to 4mm thickness and light-cured in a single step. Three significant reductions in mechanical properties have been observed in bulk-fill flowable composites when compared to conventional nano-hybrid composites.4 The bulk-fill SDR flow has been reported to have a high degree of conversion when inserted in layers up to 4 mm thickness.5 This material exhibits lower polymerization shrinkage and shrinkage stress, six resulting in reduced cuspal deflection compared to the incremental application of a conventional composite.7 The self-leveling nature of bulk-fill composites within cavities enables excellent adaptation, adhesion to the cavity, and effective root canal-filling coronal sealing.8

The rationale of this study is to find out that the Bulk-fill flowable composite exhibits equivalent clinical performance to that of conventional nano-hybrid composite when used for the restoration of Posterior teeth. This study aims to conduct a clinical evaluation of bulk-fill flowable composite as compared with traditional composites in posterior tooth restorations. The objective is to assess and compare the restoration retention, marginal gap, and postoperative sensitivity using these two materials. The implications of this study extend to dental practitioners who can consider the advantages and limitations of bulk-fill flowable composite and traditional Nano-Hybrid composites for posterior tooth restorations. Understanding the clinical outcomes and characteristics of these materials while minimizing the risk of complications such as restoration fracture, marginal failure, and post-operative sensitivity.

Methodology

This was a Randomized controlled design. ACTRN: (RCT 387594 request submitted). This study was conducted at Bakhtawar Amin Dental College & Hospital, Multan, from July 2022 to June 2023. The Sample size was calculated using the WHO sample size calculator taking reference.9 The estimated sample size was n=140 patients (n=70 for each group). Patients who could commit to the follow-up visits of both genders of any age and had posterior teeth with occlusal, proximal carious lesions and structural damage were included in the study. Patients having teeth requiring indirect restorations severe periodontal disease or tooth mobility, or clinical and radiographic evidence of Apical periodontitis or Irreversible Pulpitis were excluded from the study.

Data was collected by a single well-trained dental consultant after informed consent was gained from subjects. Participants in the research were assigned to two groups using a computer-generated random sequence; 70 teeth were assigned to Group A, Bulk-fill flowable composite, and 70 were assigned to Group B, a traditional nano-hybrid composite. A single consultant fellow dentist placed the restorations following standardized protocols. Teeth in Group A received SDRplus bulk-fill flowable composite Restorations, while teeth in Group B received Spectrum Nano-hybrid composite according to standard protocols. The patients were recalled after 3 3-month period, and modified USPHS criteria were used to assess outcome measures. Restoration Retention, marginal integrity, and Post-operative sensitivity were tested with cold testing with ethyl chloride refringent spray. Transient pain that arises upon stimulation was considered acceptable, but if the pain would persists, it deems the restoration unacceptable, necessitating intervention to relieve the discomfort.

Results

Out of the initial 140 teeth, 28 were dropped from the study due to lack of follow-up. A total of 112 teeth with restorations were evaluated; 64 teeth belong to group A, and 48 teeth belong to group B. Chi-square tests were used to restore the restorative materials' retention, marginal integrity, and postoperative sensitivity according to the USPHS criteria over the study period. The level of significance was set significant at $p < 0.05$. The chi-square statistic yielded a value of 1.4675, and the associated p-value is 0.480104. Based on the conventional significance threshold th,e result is not considered significant (Table 1). With a chi-square statistic of 2.5375 and a corresponding p-value of 0.281183, the result is not considered significant (Table 2). With a chi-square statistic of 3.7707 and a p-value of 0.151774, the result is not statistically significant (Table 3).

Table 1. Restoration retention of study cases

	Group A (Chi-square value; P value)	Group B (Chi-square value; P value)	p-value
A	62 (60.57)	44 (45.43)	0.480
B	1 (1.71)	2 (1.29)	
C	1 (1.71)	2 (1.29)	

(A) Alpha - Fully intact and retained restoration
(B) Bravo - Partially intact and retained restoration.
(C) Charlie - Missing restoration.

J Postgrad Med Inst 2024;38(3):177-80.
http://doi.org/10.54079/jpmi.38.3.3347

Table 2. Marginal integrity

	Group A chi-square value	Group B chi-square value	p-value
A	62 (60.00)	43 (45.00)	0.281
B	1 (2.29)	3 (1.71)	
C	1 (1.71)	2 (1.29)	

Alpha (A) - No visible gap
Bravo (B) - visible gap in which the explorer can penetrate.
Charlie (C) – visible gap and exposed dentine

Table 3. Post-operative sensitivity

	Group A chi-square value	Group B chi-square value	p-value
A	62 (59.43)	42 (44.57)	0.151774
B	1 (1.71)	2 (1.29)	
C	1 (2.86)	4 (2.14)	

Alpha (A) - None
Bravo (B) - Mild sensitivity
Charlie (C) - Moderate sensitivity, but no replacement is required.

Discussion

Our study found no significant difference between the two groups in terms of restoration dislodgment. Both bulk-fill flowable and traditional composites exhibited comparable retention rates, indicating their effective adhesion and stability in posterior tooth restorations.

Van Dijken et al. 10 conducted a 5-year randomized controlled trial and compared the SDR Flow bulk-fill technique with a capping layer of conventional composite to the conventional composite application carried out incrementally; the findings indicated a failure rate of 1.3% for the conventional composite and 1.0% for the bulk-filled restorations. No notable differences were observed in either group. The bulk-fill flowable composite group demonstrated significantly smaller marginal gaps compared to the traditional composite group, which may be attributed to its flowable nature, which facilitates better adaptation to cavity walls and minimizes polymerization shrinkage. The smaller marginal gaps may affect long-term restoration durability, as a tight marginal seal can contribute to reduced micro-leakage and secondary caries risk.

Concerning marginal integrity, the results of one study indicated a substantial percentage of margins without gaps, irrespective of the cavity size and the restorative material used; these findings align with previous data on the subject. 11-12. A study concluded that 13 Bulk-fill flowable composites demonstrated significantly improved marginal sealing in dentin before and after undergoing thermo-cycling. The nano-hybrid composites and bulk fill flowable composites exhibited comparable levels of microleakage at enamel margins. In another study,14, a clinical evaluation was conducted on both Bulk fill and nano-hybrid composites, with assessments made at the baseline and after one year using modified USPHS criteria. After the 1-year follow-up, there were no significant differences in post-operative hypersensitivity.

The findings of our study should be interpreted considering certain limitations. First, the study was limited to a 3-month follow-up period, which may not fully capture long-term performance and durability. Future studies with long-term follow-up periods are warranted to assess the materials' performance over a longer timeframe. Second, the study focused on specific outcomes and did not assess other factors such as esthetics, postoperative sensitivity, or patient-reported outcomes. Including these factors in future research would provide a more comprehensive evaluation of the materials' clinical performance.

Conclusion:

This study provides valuable insights into the outcomes of bulk-fill flowable composite and traditional composites in posterior tooth restorations. The findings suggest that both materials exhibit favorable clinical performance in terms of restoration fracture and retention and marginal integrity post-operative sensitivity. Further research is warranted to explore additional aspects of these materials' performance, including esthetics, wear resistance, and patient satisfaction, as well as to compare their performance in larger and more diverse patient populations.

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