https://doi.org/10.37723/jumdc.v17i1.1216

J. Univ. Med. Dent. Coll.2026;Vol.17(1): 1244-1247
ISSN (Print) 2221-7827, ISSN (Online) 2310-5542
https://www.jumdc.com

Original Article

Open Access

Comparison of retention of posterior Class I Composite resin fillings done by two different incremental and single placement techniques

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ABSTRACT

BACKGROUND & OBJECTIVE: Use of Composite fillings is a common and preferred practice in dentistry. Dental surgeons use various techniques to get maximum retention and better aesthetics using composite resins. The purpose of our study was to compare the retention of posterior class I fillings of composite resin fillings using increments and single-placement techniques.

METHODOLOGY: This randomized control trial study (No. #3336-R-A25) was conducted at the Restorative Department of Frontier Medical and Dental College, Abbottabad, from 10th July, 2024 to 10th January,2025. It consisted of 104 participants with occlusal class I cavities of at least 3mm deep. The Filtek Z250 (3M, ESPE) filling material was used in two different restorative techniques (incremental and single fill). Patients were divided into two groups, A and B, each of 52 participants. In Group A, the incremental filling technique was used; in Group B, the single filling technique. After 6 months, filling retentions were evaluated. Data was analyzed by using SPSS version 23.

RESULTS: After 6 months, 90.4% retention, 9.6% non-retention and 0% partial loss in incremental, 84.6% retention, 9.6% non-retention and about 5.8% partial loss in the single fill group were assessed (Figure 1). It showed a statistically insignificant ($p>0.374$) retention difference between the two groups using two different techniques.

CONCLUSION: This study showed that the retention of incremental fill composite is almost equal to that of the single fill resin in class I fillings of posterior teeth. It is mainly the skill of a dental surgeon in performing composite fillings with perfection, following the protocol and the manufacturer's instructions.

KEYWORDS: Retention, Technique, Composite Resin.

INTRODUCTION

The advancement of restorative composite resins has significantly contributed to dental restoration over the last few decades [1]. These filling materials enhance the maintenance of filling, tooth structure integrity, a strong interface with the tooth and reduce microleakage. Also, the chances of any intermittent or recurrent caries, peripheral discoloration and post-operative affectability are reduced [2]. Better bonding properties of the material achieve good tooth support, minimum tooth structure loss and better recontouring of cusps and occasional requirement of base or lining under the filling [3].

Improved material properties, advanced formulations, and filling techniques have made composite fillings much more authentic [4]. During setting, current composites experience only about 2-6% shrinkage by volume [5]. Also, the restoration may lose retention from certain contacts of the tooth cavity due to polymerization of resin composites [6].

During the incremental strategy, a composite of small depth (about 1mm) is filled and light-cured to set in small expansions before the next increment is added, till the whole cavity is filled [7]. In this technique, the material has minimal contact with the walls during setting, resulting in less shrinkage and pore formation, thus making the restoration more successful [8].

In the single one-fill method, the material is added in a single bulk to the the prepared tooth and allowed to harden [9]. Several of the latest and better products of resin materials

How to cite this: *Manan A, Shehzad A, Sadaqat S, Hussain A, Rizwan M, Umar M. Comparison of retention of posterior Class I Composite resin fillings done by two different incremental and single placement techniques. Journal of University Medical & Dental College. 2026;17(1):1244-1247.*

and procedures are being introduced in the dentistry, but it is the choice and expertise of a dentist who can better judge and explore more about the longevity or the causes of inadvertence of composite filling of posterior teeth. Therefore, the aim of our research was to clinically compare the retention of composite resin in Class I posterior cavities using bulk-fill and incremental placement techniques.

METHODOLOGY

It was a randomized controlled trial (No.# 3336-R-A25) which was carried out in the restorative dentistry department and at the Dental Hospital of Frontier Medical and Dental College, Abbottabad, Pakistan, for six months (10th July 2024 to 10th Jan 2025). Prior approval of the institutional Ethical Committee was obtained (EC#3336-R-A25). A sample size of 52 participants per group was estimated using the OpenEpi sample size calculator. The non-probability consecutive sampling technique was used. 104 patients between 15-60 years of age, having a minimum 3mm deep occlusal molar class 1 cavities clinically and Radiographically, were selected for the study. Written consent of patients was taken. Patients with mixed dentition, grossly carious teeth, or root canal-treated teeth were excluded.

Fillings were done by one dental surgeon. A rubber dam was applied to isolate the tooth cavity. A Class 1 cavity was prepared, and outlining was performed with a pear-shaped carbide bur; then, a round bur on a slow-speed handpiece was used to remove any soft, infected dentin. The cavity was disinfected with 2% chlorhexidine solution and gently air dried. The Michigan O' periodontal probe was used to measure the cavity depth. Etching (with 37.5% phosphoric acid) was performed of the prepared cavity for about 40 seconds, then washed and gently air-dried according to the manufacturer's guidelines. After it, the bonding Agent (Prime & Bond) was applied and cured for 30 seconds.

Filtek Z250 (3M, ESPE) composite restorative material was used in this study. Patients with cavities were randomly assigned to two groups, A and B, to receive either of two filling techniques. In Group A, single large composite fillings were performed. In Group B, the incremental method was used. An LED light-curing machine was used to set the composite materials. After setting, the articulating paper checked the occlusion. If adjustments were needed, they were made with multi-fluted tungsten carbide burs. Cone-shaped polishing tips finished and polished the restoration.

The patients were recalled after six (6) months to check the retention of the fillings clinically. To maximize recall rates, the importance of the revisit was emphasized at the beginning. Phone call reminders and messages were sent. Tokens such as toothpaste, free check-ups, and fillings were offered during regular follow-up visits. For some patients, the authors visited them personally and encouraged attendance. This resulted in a 100% patient revisit rate after 6 months.

Clinical Examination was performed by a calibrated author dentist/examiner using a standardized criteria by FDI (World Dental Federation criteria) called USPHS/ Ryge criteria, to examine the filling status of marginal adaptation/discoloration, Anatomic form/contour and any Fracture/retention [10]. The Inclusion criteria are 104 patients aged 15-60 years having a minimum 3mm deep occlusal class 1 cavities of molar teeth, who were clinically and radiographically included in this study. The Exclusion criteria are patients with mixed dentition, grossly carious and those with root canal treated were excluded.

Data was analyzed using SPSS version. 23. The chi-square test was run to assess the retention of fillings using two different filling techniques to find any significance at $P<0.05$.

RESULTS

104 patients (47.1% males and 52.9% females) participated in our study. The distribution of teeth filled in both jaws and related posterior teeth is mentioned in Table 1.

The findings after 6 months of retention, partial loss, and non-retention of composite resin fillings using two different filling techniques in both groups A and B are shown in Table 2. Results show that the difference of retention is statistically insignificant ($p>0.05$).

Table-I: Study variables.

Variables	Categories	n (%)
Gender	Female	55 (52.9)
	Male	49 (47.1)
Jaw	Mandibular	66(63.5)
	Maxilla	38 (36.5)
Tooth	1st Molar	55 (52.9)
	2nd Molar	49 (47.1)
Age in years	(Mean ±SD)	31.55±9.4

Table-II: Retention and Not-retention data of two groups with percentages.

Group	Categories	Retention n(%)	Non-retention/ Partial loss n(%)	Total n(%)	P-value
	Group A	47(90.4)	5(9.6)	52 (50)	0.374
	Group B	44 (84.6)	8(15.4)	52(50)	
	Total	91 (87.5)	13 (12.5)	104(100)	

Chi-Square test was applied. All expected counts ≥ 5 (valid for chi-square test). Conclusion: No statistically significant difference in retention rates between Group A (90.4%) and Group B (84.6%) was observed at $p<0.05$.

DISCUSSION

Since the mid-1950s, the popularity and preference for the use of resin-based fillings has been constantly increasing. The raised aesthetic concerns over amalgam restorative materials have contributed to increased preferences for resin-based materials [11]. Although the dentists have to struggle to control certain troublesome factors for the successful composite resin restorations, the manufacturers are still

trying to enhance handling characteristics by improving their properties and changing segments to minimize retention loss for such filling materials [12].

It is clinically evident that, the dental surgeon must carefully decide the use of type of resin-based material and filling method depending upon the patient's hygiene status and tooth conditions like position of tooth in oral cavity, its cavity size, type and surfaces involved and then decide materials appropriately [13,14].

In order to decrease the chances of shrinkage after insertion and polymerization, many authors suggest the utilization of small increments for posterior composite restorations. However, in anterior teeth, where strength is not of concern, using the increment technique may result in cosmetic errors in the restoration, such as excessive opacity or translucency. So, for better esthetics and natural-looking anterior fillings, the technique needs to be error-free, standardized and precise rules for all clinicians need to be followed while using different opacities, shades and translucencies [15] . On the other hand, some authors consider that bulk filling reduces the stress at the cavo surface margins [16].

This study evaluated the retention of a low-shrinkage posterior resin composite using incremental and single-fill techniques in Class I cavities [17]. In this study, a higher percentage of restorations were fully retained in the incremental group (90.4%) than in the bulk-fill group (84.6%); however, this difference was not statistically significant compared to the single large filling. The retention of 91.4% retention observed in incremental filling was somewhat different from that reported in some previous studies [18,19]. Single-dose filling showed good retention, closely similar to incremental fillings, and very similar to the results seen in previous studies [20].

RECOMMENDATIONS

As this study was a single-centered experience in which fillings were done by a single dentist. Experience of different dental surgeons can be added. And also the size of participants in present study seems less limiting its applicability. Generalized larger population and extended time period of assessment (more than 6-months) should be included for more authenticated results.

CONCLUSION

Our study concludes that the retention of composite resin during incremental filling is similar to that of a single large filling in class I cavities of molar teeth. Hence, both techniques can be used depending on the dental surgeon's skills.

ACKNOWLEDGEMENT: None.
CONFLICT OF INTEREST: None.
GRANT SUPPORT AND FINANCIAL DISCLOSURE: None.

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Submitted for publication: 24-04-2025
Accepted after revision: 5-03-2026

Authors Contributions:

Abdul Manan: Substantial contributions to the conception or design of the work

Aamir Shehzad: The acquisition, and analysis of data for the work.

Saveela Sadaqat: Interpretation of data for the work.

Ashar Hussain: Drafting the work.

Muhammad Rizwan: Reviewing it critically for important intellectual content.

Muhammad bin Umar: Final approval of the version to be published.