



Comparative evaluation of compressive strength of bulk fill composites – An in vitro study

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General Note



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ABSTRACT

The introduction of bulk fill composite into dentistry is to decrease the no. of increments and polymerization shrinkage of direct posterior composites. 40 composite specimens 20 from each group were fabricated using customized teflon mold measuring 3mm diameter and 6mm height

Nishmitha N Hegde et al.

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according to ADA specification no 27. The specimens were divided into 2 groups Group 1 -20 samples TetricEvoCeram (Ivoclar, Vivadent) Bulk fill composites. Group II-20 samples filtek bulk Fill composite. The results showed that tetric bulk fill composite had greater compressive strength compared to filtek bulk fill composite.

Key words: fracture resistance, tetric bulk fill, filtek bulk fill

1. INTRODUCTION

The introduction of posterior direct composite has helped the clinician to provide restoration with better esthetics and minimally invasive procedure. However the limitation of direct composite is the challenges in handling, wear, polymerization shrinkage and postoperative sensitivity¹. In response to the dentist needs for a material with reduced polymerization shrinkage, better handling, better wear and enhanced polishability posterior composites were introduced with smaller nanoparticles filler size range of 0.1-100nm². The bulk fill composites have light initiators and polymerization booster which enables the clinician to place the materials in bulk increments up to 4mm in the need to eliminate technique sensitivity layering protocol¹.

TetricEvoCeram Bulk Fill is a bulk fill composite, the photo initiator present in tetric bulk fill composite is ivocerin which is more reactive to light curing than the conventional initiators resulting in more efficient cure and greater depth of cure. The composite has following features, placement in single layer upto 4mm, low polymerization shrinkage, superior marginal strength, better mechanical properties, high polish, and greater wear resistance due to nano particle size.³

Filtek™ Bulk Fill Posterior Restorative is a one-step placement bulk fill material that delivers stress relief, excellent wear resistance, and the ability to place up to 5 mm in one increment. The materials uniquely formulated for stress relief, with two novel methacrylate monomers that act in combination to lower polymerization stress. This innovative technology was co-developed through collaboration with Professor Christopher Bowman from the University of Colorado, with the financial support of the National Institutes of Health (NIH). The use of these monomers enables bulk placement without sacrificing strength or wear resistance⁴.

2. OBJECTIVE

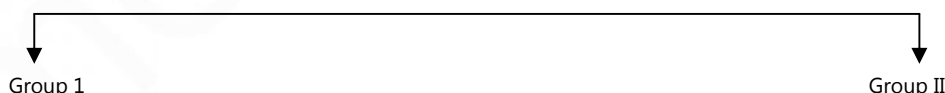
To evaluate and compare the compressive strength of two new bulk fill composites. Compressive strength is an important property for any posterior restorative material which undergoes stress during the mandibular and paramandibular movement. Compressive strength of a restorative material influences the longevity of restoration. Bulk fill composites are used to restore the posterior teeth which undergo maximum stress and strain. Hence the needs to evaluate and compare the compressive strength of newer bulk fill composite.

3. MATERIAL AND METHOD

Preparation and grouping of sample for compressive strength analysis

40 composite specimens 20 from each group were fabricated using customized teflon mold measuring 3mm diameter and 6mm height according to ADA specification no 27⁵. Composite resins applied and pack inside the mold and cured using QTH light for 40 seconds. After removing the mold the samples were again cured for 60 seconds after completion of polymerization process the specimens were conditioned for 48 hours in distilled water at 37°C and then subjected to compressive stress test using instron machine⁶

They divided into 2 groups of 20 samples each and analyzed for compressive strength using universal testing machine –instron at Manipal Institute of Technology.



20 samples TetricEvoCeram (Ivoclar, Vivadent) Bulk fill composites
20 samples filtek bulk Fill composite (3M, ESPE)

Compressive strength analysis using universal testing machine –instron

20 samples of each group were mounted and fixed to the universal instron testing machine to check the compressive strength at a cross head speed of 1mm/min till the specimen fractured.

Results obtained were statistically analyzed using independent sample T Test.

4. RESULTS

Table 1 Showing the mean compressiveloadvalue for filtek bulk fill and tetricbulk fill

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
filtek/titricbulkfill	FiltekBulkfill	20	91.84	6.158	1.856
	Tetricbulkfill	20	117.02	5.391	1.625

Table 2 Independent Samples Test

Groups	t-test for Equality of Means					
	t	df	Sig. (2-tailed) p value	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference
						Lower Upper
Filtek/tetricBulkfill						
Equal variances Assumed	10.203	20	.000	25.17808	2.46772	-30.32566 -20.03049

Table 2 is showing independent sample. The mean Compressive load among Filtek and Tetricbulkfill materials was 91.84 ± 6.12 and 117.02 ± 5.39 respectively. Independent Sample 't' test was used to compare the difference in the mean (25.17) between the materials. It was observed that the 'p' value is lesser than 0.001, hence there is a difference in mean Compressive load among the materials at 5% level of significance

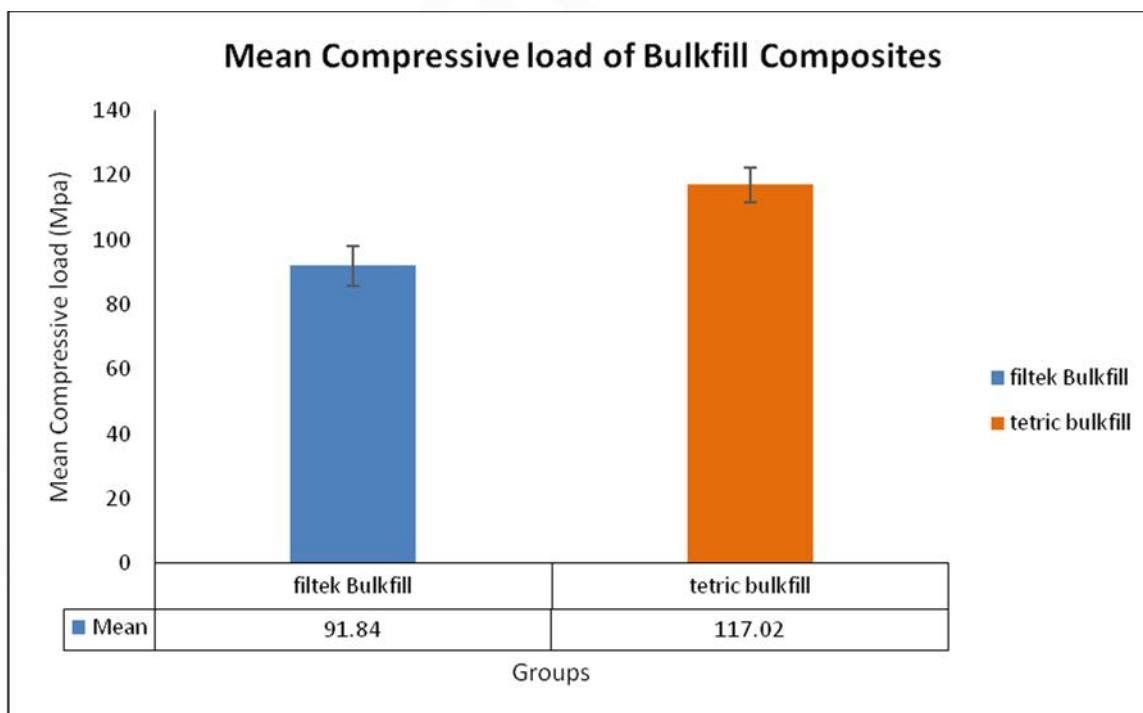


Figure 1 Shows the graphical representation of mean value of filtek bulk fill and tetric bulk fill

5. DISCUSSION

Composite resins are used as an alternative to silver amalgam due to the increased demand for esthetics. However the major disadvantages of these composites are 1) technique sensitive 2) increased polymerization shrinkage 3) decreased depth of cure. To overcome these limitations newer generation bulk fill resins were introduced for use in posterior teeth⁷.

A new generation of bulk-fill resin composites has been recently introduced which can be placed in bulk into the cavity and light cured. The bulk-fill technology have the following advantages: 1) fewer no of voids since bulk of the material is placed rather than incremental built up 2) time consuming⁸.

The compressive strength is an important property of any restorative material since the masticatory forces in the oral cavity are compressive in nature. The fracture related property of the material is important especially when the material is been used in high load bearing areas for class I, II OR IV. Composite should be able to withstand polymerization stress the modulus of elasticity and coefficient of thermal expansion between the tooth structure and the restorative material should be similar for the material to be clinically efficient⁵.

An ideal bulk-fill composite should have low polymerization shrinkage, high degree of conversion, superior depths of cure, good mechanical property, should be biocompatible.

The composition of Tetric N-Ceram Bulk-Fill contains -Dimethacrylates, barium glass, ytterbium trifluoride, mixed oxide, additives, catalysts, stabilizers, and pigments⁷.

Filtek bulk fill composite contains : BisGMA, UDMA, Fillers -Zirconia/silica Ytterbium trifluoride⁴.

According to table 1 and fig 1 tetric bulk fill showed higher compressive strength value compared to that of filtek bulk fill and there was a statistical significant difference between the two groups (table 2). This difference in compressive strength may be due to the reason that tetricoceram bulk fill contains a special type of filler that relieves shrinkage strains. Due to its lower elastic modulus, this filler is flexible like a microscopic spring and thus reduces shrinkage stress which improves the marginal integrity of the restoration.

6. CONCLUSION

Within the limitation of this study TetricEvoceram showed better compressive strength than filtek bulk fill composite

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