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A COMPARATIVE STUDY OF SHEAR BOND STRENGTH OF SELF ADHERING FLOWABLE COMPOSITE WITH CONVENTIONAL FLOWABLE COMPOSITE TO DENTIN: AN IN VITRO STUDY

Endodontic

Dr. Vishakha Nilawar* Resident, Dept. Of conservative dentistry and endodontics, Rungta college of Dental sciences and research, Bhilai (C.G.), India *Corresponding Author

Dr. Rashmi Nair Reader, Dept. Of conservative dentistry and endodontics, Rungta college of Dental sciences and research, Bhilai (C.G.), India

Dr. Pankaj Kumar Gupta Reader, Dept. Of conservative dentistry and endodontics, Rungta college of Dental sciences and research, Bhilai (C.G.), India

Dr. Pradeep N. Tavane Professor & HOD, Dept. Of conservative dentistry and endodontics, Rungta college of Dental sciences and research, Bhilai (C.G.), India

ABSTRACT

Introduction- Evaluation for bonding durability is important since the long-term clinical success of tooth colored restorstions might be dependent on the stability of the bond between restoration and tooth substrate. The purpose of this study was to measure and compare the shear bond strength of self adhering Flowable composite with conventional Flowable Composite.

Material and methods- The present cross sectional hospital based study was carried out in the Dept. Of conservative dentistry and endodontics, Rungta college of Dental sciences and research, Bhilai (C.G.), India during study period March 2016 to Feb 2017. 20 extracted caries free permanent molar teeth were selected. Each patient was informed & informed consent has been taken. Independent t test was applied to determine statistical difference between the materials.

Result: Mean shear bond strength of 3M ESPE Filtek Z350 XT (16.32) was more than that of Constic (6.70). The difference was found statistically significant.

Conclusion- Minimizing the bonding procedures decrease the bond strength.

KEYWORDS

Shear bond strength, Conventional Flowable Composite, Self adhering Flowable composite

Introduction

The primary cause of tooth substance loss is dental caries, however there are certain other non carious conditions which eventually results in loss of tooth structure. The cervical area which is located in the gingival one third of the facial and lingual tooth surfaces is an area that exhibits unique clinical characteristics. The restoration of this region is challenging. [1, 2] To restore these higher degree of cavities, initially flowable composites were developed. Many previous studies showed that microleakage and the occurrence of voids were reduced by using the flowable composite. Flowable composites adapt well to the cavity wall and reduce the risk of gap formation due to their low viscosity. [3,4] The flowable composite materials are a modification of restorative resin composites, so they tend to contain a lower filler content than their hybrid analogs. Reduced filler loading of flowable composites leads to enhanced flow and reduced elastic modulus. Thus, this material may act as a stress-breaker. Evaluation for bonding durability is important since the long-term clinical success of tooth colored restorations might be dependent on the stability of the bond between restoration and tooth substrate. Bonding durability of the adhesive system is affected by technique sensitivity. Therefore, to reduce the sensitivity, steps required for bonding procedures have been reduced. When selecting an adhesive system, bond strength is one of the significant factors that play a major role for the long-term clinical success of the restoration. Adhesion in dentistry could be stated as the relationship between bonding and stress. The restoration would be successful if the bonding could withstand the stress. Strong and durable bonding between restorative material and tooth substrate are essential when judging mechanical, biological, and esthetic aspects. When compared to enamel bonding, the bonding of resin based restorative materials to dentin has always been more challenging. [5, 6, 7] Therefore in the present study; we aimed to test the bond strength of a self-adhering flowable composite to dentin.

New approaches have been introduced such as self-etch and self adhesive systems for bonding restorative materials to tooth substrate. According to previous study in 2016 with vertise flow shows that the self-adhering flowable resin composite had the lowest shear bond strength values. The newer formulation has been introduced which is the self etched self-adhering flowable composite; Constic. Constic is new 3 in 1 flowable composite which combines etching gel, bonding agent and flowable composite in one single syringe. The purpose of this in vitro study is to compare the shear bond strength of self adhering Flowable composite (Constic) with Conventional Flowable Composite (Filtek Z350 XT Flowable Restorative).

Material and methods

The present cross sectional hospital based study was carried out in the Dept. Of conservative dentistry and endodontics, Rungta college of Dental sciences and research, Bhilai (C.G.), India during study period March 2016 to Feb 2017**.** Twenty extracted caries free permanent molar teeth were selected. Each patient was informed & informed consent has been taken. The roots of the teeth were removed and the crowns were embedded into autopolimerizing acrylic resin with buccal surfaces facing up. Enamel surfaces were flattened with a diamond bur until the dentin was exposed. Constic and Filtek Z350 XT Flowable Restorative were applied according to the manufacturer's instructions to dentin surfaces by packing the material into a cylindrical shaped plastic matrix with an internal diameter of 3 mm and height of 3 mm. The specimens were subjected to shear loading using the universal testing machine, after load testing, the type of failure was detected under ×10 magnification with an illuminated microscope.

Group I: Constic (DMG, Hamburg, Germany)
Self adhering Flowable Resin Composite
Group II: 3M ESPE (Filtek Z350 XT Flowable Restorative)

Type of failure

Type 1: Adhesive failure between material and teeth
Type 2: Partial adhesive failure between material and teeth and Partial cohesive failures within the restorative material
Type 3: Partial cohesive failures within the teeth
Type 4: Cohesive failures within the restorative material
Type 5: Mixed failure (Partial adhesive failures within the teeth and Partial cohesive failure between material and teeth

Descriptive statistics were employed to characterize the data. Independent t test was applied to determine statistical difference between the materials. The analysis was carried out using the Statistical Package for the Social Sciences (SPSS 12.0 version; SPSS, Inc., Chicago, IL, USA).

Result:

Table-1. Comparison of Failure Mode Type among 2 groups

S.N.	Group I : Constic (Self Adhesive Flowable Composite)		Group II : Filtek Z 350 (Flowable Composite)	
	Sample No.	Failure Mode Type	Sample No.	Failure Mode Type
1.	1.	1	1.	2
2.	2.	2	2.	1
3.	3.	1	3.	1
4.	4.	1	4.	1
5.	5.	1	5.	2
6.	6.	1	6.	2
7.	7.	1	7.	2
8.	8.	1	8.	2
9.	9.	1	9.	3
10.	10.	1	10.	2

Table-2. Comparison of Load & Shear bond Strength among 2 groups

S.N.	Group I : Constic (Self Adhesive Flowable Composite)		Group II : Filtek Z 350 (Flowable Composite)		Sig. (2-tailed)
	Maximum Load (N)	Shear bond Strength (MPa)	Maximum Load (N)	Shear bond Strength (MPa)	
1.	186.2	9.47	198.94	10.12	P<0.01 Significant
2.	246.96	12.57	310.66	15.81	
3.	30.38	1.54	126.42	6.43	
4.	165.62	8.43	363.58	18.5	
5.	152.88	7.78	622.3	31.68	
6.	156.8	7.98	423.36	21.55	
7.	46.06	2.34	204.82	10.42	
8.	57.82	2.94	391.02	19.9	
9.	108.78	5.53	324.38	16.51	
10.	165.62	8.43	243.04	12.37	
Mean	131.71	6.70	320.85	16.32	
SD	69.29	3.52	141.58	7.20	

Mean shear bond strength of 3M ESPE Filtek Z350 XT (16.32) was more than that of Constic (6.70). The difference was found statistically significant (p value < 0.01). **[Table-1, 2]**

Discussion

Flowable composites adapt well to the cavity wall and reduce the risk of gap formation due to their low viscosity & low mechanical properties. Which results in higher polymerization shrinkage and lower elastic modulus, because of the lower filler content. The interfacial shrinkage stresses between dental tissue and composites indicate a potential to increase the possibility of microleakage. The bonding of composite resin to enamel and dentine is provided through the use of an adhesive system. The efficacy of adhesive systems varies significantly among the different brands and types of systems. [7,8,9]

In this study Filtek Z350 supreme XT is used to compare the shear bond strength with self-etching and self- adhering flowable composite (constic). Filtek Z350XT is a Low viscosity, visible light-cured, radiopaque flowable restorative composite, which includes etching, bonding procedure followed by composite restoration.

In the year 2000 a self-adhering, flowable composite resin were introduced with an addition functional monomer that is responsible for etching the tooth structure & chemically bonding to the calcium ions within the tooth structure (eg: Vertise flow). According to previous study by Almaz et al (2016) Vertise Flow displayed the lowest bond strength among the other flowable composites and showed that simplified bonding agents did not necessarily affect the bond strength of flowable composites. To assess the bond strength of restorative materials, various tests have been presented. Shear bond strength test is comparatively simple, reproducible and commonly accepted. Accordingly we have used the shear bond strength test.[10]

In the present study it was seen that self adhering flowable composite have lower shear bond strength (6.70 Mpa) than conventional flowable composite (16.32 Mpa). After shear loading Type 1 Failure (Adhesive failure between material and teeth) is mostly seen with samples followed by Type 2 Failure (Partial adhesive failure between material and teeth and partial cohesive failures within the restorative material) and Type 3 Failure (Partial cohesive failures within the teeth).

Conclusion

It was concluded from the current study that minimizing the bonding procedures decreases the bond strength.

Limitations

Further in vivo studies should be conducted to obtain valid results.

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