A COMPARATIVE EVALUATION OF MARGINAL ADAPTABILITY OF TWO RECENT NANO-FILLED RESTORATIVE MATERIALS UNDER SCANNING ELECTRON MICROSCOPE

Dental Science

Dr. Rahul Kumar Jaiswal*	Student, Department of Conservative & Endodontics *Corresponding Author
Dr. Lalit C. Boruah	Professor, Department of Conservative & Endodontics
Dr. B. Rajkumar	Professor & Head, Department of Conservative & Endodontics

KEYWORDS

INTRODUCTION

There have been rapid changes and developments in materials and techniques used in dentistry over the past decade than in the previous hundred years combined, and the pace is accelerating in every day.

Dental caries, is one of the most prevalent chronic diseases in human population worldwide, individuals are susceptible to this disease throughout their lifetime. Dental caries forms through a complex interaction over time between acid-producing bacteria and fermentable carbohydrate, and many host factors including teeth and saliva. The disease develops in both the crown and root structure of teeth, and it can arise in early childhood as an aggressive tooth decay that affects the primary teeth of infants and toddlers. Risk for caries includes physical, biological, environmental, behavioural, and lifestyle-related factors such as high numbers of cariogenic bacteria, inadequate salivary flow, insufficient fluoride exposure, poor oral hygiene, inappropriate methods of feeding infants, and poverty.

Microleakage around dental restorative materials is a major problem in clinical dentistry. It may be defined as the clinically undetectable passage of bacteria, fluids, molecules or ion between a cavity wall and the restorative materials applied to it. This seepage can cause hypersensitivity of restored teeth, tooth discoloration, recurrent caries, pulpal injury and accelerated deterioration of some restorative materials.

Resin composites were introduced as a restorative alternative to amalgam in mid 1960. In recent years many modifications have been incorporated to it to enhance its physical & chemical properties as well as its clinical handlings. All these technical advances lead to introduction of superior group of resin composites like nanocomposites

Nanocomposites are very promising new class of composites that exhibit adequate combination of chemical, physical and mechanical properties. Only small amounts of nanofiller are sufficient to raise the values of chemomechanical properties and clinical parameters .

Flowable composites are widely used in clinical practice and are the most common resin materials that are recommend for restoration of cervical lesions instead of conventional resin composites. These materials have good aesthetic properties, and because of low viscosity, are easier to place and more self-adaptable compared to stiffer restorative materials. Also, flowable materials may act as a stress-breaker; therefore, they have also been advocated as a gingival liner in proximal surface composite resin restorations. The flowable composite resins due to their lower filler content have higher polymerization shrinkage. Stresses from shrinkage create forces that compete with the adhesive bond, and this may disrupt the bond to cavity walls, which is still one of the main causes of marginal failure and subsequent micro leakage. Whereas in cervical lesions, the lack of enamel at the gingival margin aggravates the situation. Thus, the importance of perfect seal for success and longevity of class V resin restorations must be considered at the time of restorative treatment.

AIM

To evaluate and compare the marginal adaptability of three recent nano filled restorative materials under scanning electron microscope.

OBJECTIVES

1- To evaluate the marginal adaptability of two different nanofilled materials under SEM.ie- Gaenial universal flo (GC), Brilliant flow (COLTENE).
2- To compare the marginal adaptability of two different nanofilled materials under SEM. ie- Gaenial universal flo (GC), Brilliant flow (COLTENE).

Methodology-

For this study extracted human permanent premolars during routine orthodontic treatment were selected randomly. Gross cleaning of all the teeth were done under running tap water and then with ultrasonic scalar unit. These specimen were checked under illumination for any crack or discontinuity and 30 samples were selected for the study. The inclusion and exclusion criteria for election of 30 samples are as follows:

Inclusion criteria

1. Non carious, sound and intact human maxillary premolars with normal morphology will be selected for samples

Exclusion Criteria

1. Teeth with any crack or caries.
2. Teeth with developmental anomaly.
3. Teeth with any restoration.

These 30 selected samples were stored in saline at room temperature before preparation. The selected samples were randomly divided into two groups(15 teeth each) according to the composite resins that will be used.

In group I, BRILLIANT FLOW will be used as the restorative material.

In group II G-AENIAL UNIVERSAL FLO will be used.

In each group, class V cavities of standard dimension were prepared with diamond burs and restored with the respective nanocomposites, according to manufacturer's instructions.

Marginal adaptation was evaluated under scanning electron microscope and the results thus obtained will be statistically analysed for comparisons among the groups.

Class V cavities were prepared of standard dimension (W =1.5 H=2.0 L=3.0) All the teeth which were randomly divided into two groups of 15 teeth in each group according to the restorative nano-composite used. Group 1- BRILLIANT FLOW, (COLTENE) Switzwerland Group 2- G-AENIAL UNIVERSAL FLO (GC) JAPAN was used.)

After preparation of the cavities dentin bonding agents were applied to each tooth and light cured according to the manufacturers instructions in each group . Then the teeth were restored in increments with nano restorative flowable materials for each group and polymerized.(60 sec) After these process, tooth was sectioned with the help of discs bur (2mm diameter) in a straight hand piece (speed 22,000-27,000 rpm)in the buccolingual direction showing 3 wall of the preparation. After sectionng all the samples were prepared for scanning under SEM .

Samples were gold splatter then this samples were placed on acrylic button and observed under 1500 X.
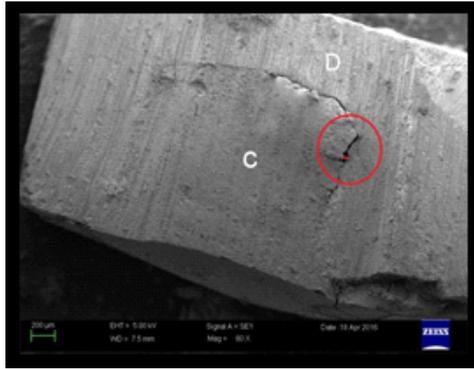
Group -1 BRILLIANT FLOW
C - COMPOSITE
D – DENTIN - MARGINAL GAPS
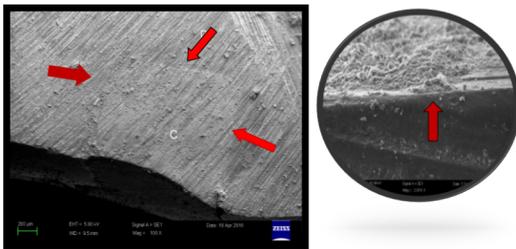
Group 2 G-AENIAL UNIVERSAL FLO
C - COMPOSITE
D - DENTIN

Result-
Observed marginal gap at interface (µm) of three groups

SNO	Group 1	Group 2
1	6.9	0
2	7.8	0
3	5	1.4
4	6	0.8
5	0	0.7
6	4.6	2.1
7	4	0.9
8	0	1
9	7.1	1
10	0	0.7
11	0	0
12	0	0
13	4.7	2.3
14	0	0
15	5.2	0

The marginal gap at interface (µm) of two groups is summarized. The marginal gap at interface of Group 1 and Group 2 ranged from 0.0-7.8 and 0.0-2.3 respectively with mean (± SE) 3.42 ± 0.79 and 0.73 ± 0.20 respectively and median 4.6, and 0.7 respectively. The mean marginal gap at interface of Group 1 was the highest and Group 2 the least

Marginal gap at interface (µm) summary statistics of two groups

Group	Min	Max	Mean	SE	Median
Group 1	0.0	7.8	3.42	0.79	4.6
Group 2	0.0	2.3	0.73	0.20	0.7

Comparison of mean marginal gap at interface between the groups by Tukey test

Comparison	Mean difference	q value	P value	95% CI (mean difference)
Group 1 vs. Group 2	2.69	5.23	0.002	0.922 to 4.465

G-aenial universal Flo < Brilliant Flow

- Maximum marginal gaps were observed in Group 1 (Brilliant flow, coltene) as the filler content is low (63% by wt; 42% by vol) as compared to Group 2 (69.0% by wt; 50.0% by vol). The revealer penetrated to a very little depth into the composite layer: 0.021-0.026 mm. The composite material correctly seals the grooves and pits. The resulting occlusal surface is slightly rough, with small air bubbles incorporated into the sealant revealed by the increased adherence of the revealer in the respective areas. Partical size is 0.6µm as compared to other groups i.e. in group II(G-aenial flo-0.2µm) observed. In the cases of Brilliant Flow there are areas where marginal closure is not perfect.
- Whereas minimum marginal gaps were observed in Group 2 (G-aneal flow) as compared to other Groups. G-aenial is unique because for the first time, strontium glass fillers with the smallest particle size seen in current flowables and composites (200 nm) are homogeneously dispersed in an amorphous complex. The use of spherical nano-fillers and nano-aggregates in composite resins are firmly established in composite technology. The amorphous nano-particle formulation significantly enhances the physical properties of G-aenial. Several clinical studies conducted by GC America conclude that the wear resistance and flexural strength of this material exceeds not only most of the competitive brands of currently available flowables, but many nano- and microhybrid traditional restorative composites as well. Internal studies within GC America also indicate that volumetric shrinkage, polymerization shrinkage stress, fracture toughness, and elastic modulus are either comparable or superior to several major traditional posterior restorative materials, expanding the clinical indications of G-aenial to use in small to moderate Class I, Class II, Class III, Class IV, and Class V restorations.

Particularly noteworthy are G-aenial's handling characteristics. It is a highly thixotropic material that flows evenly and smoothly, yet stays in place at the point of application, even on vertical slopes. Whereas more fluid flowable materials tend to drip or run when placed in cavity preparations oriented against gravity, G-aenial remains adapted and stacks upon itself during application. This is particularly advantageous in Class III and Class V restorations where excess flow can lead to the material drifting out of the preparation, into interproximal spaces, and onto adjacent teeth. G-aenial Universal Flo is dispensed through a unique syringe that features a large arched-shaped ergonomic plunger that fits nicely in the palm of the hand. Rather than using a typical metal cannula, this material is dispensed through a long plastic nozzle with a fine tip so that access to tight, difficult spaces is enhanced. With superior physical properties, ideal flow and adaptation and ease of dispensing, G-aenial is truly a universal flowable material.

CONCLUSION-
Considering the results and observations pertaining to marginal gaps in class V cavity were minimum when restored with flowable composite G-aenial flow, GC.(Group-2) in the present study .Although further clinical and evidence based studies are necessary to reaffirm these finding in clinical situation.

REFERENCES:-
1- Keith H. S. Chan, Yanjie Mai , Harry Kim , Keith C. T. Tong , Desmond Ng and Jimmy C. M. Hsiao Review -Resin Composite Filling, Materials 2010,3,1228-1243.
2- Mohamed El-Nawawy, Koraitim L, Abouelatta O, Hegazi H Marginal Adaptation of Nanofilled, Packable and Hybrid Dental Composite Resins Stored in Artificial Saliva Am.J.Biomed Eng.2012; 2(3): 105-114.
3- Syrek A, Reich G, Ranftl D, Klein C, Cerny B, Brodesser J. Clinical evaluation of all–ceramic crowns fabricated from intra-oral digital impressions based on the principle of active wavefront sampling. J Dent. 2010;3 8(7):553-559.
4- Beschnidt SM, Strub JR. Evaluation of the marginal accuracy of different all–ceramic crown systems after simulation in the artificial mouth. J Oral Rehabil. 1999;26(7):582-593.
5- McLean JW, Fraunhofer JA. The estimation of cement film thickness by an in vivo technique. Br Dent J. 1971;131(3):10.
6- Duncalf WV, Wilson NH. Marginal adaptation of amalgam and resin composite restorations in Class II conservative preparations. :Quintessence Int. 2001 May;32(5):391-5.
7- Sharma R D, Sharma J, Rani A Comparative evaluation of marginal adaptation between nanocomposites and microhybrid composites exposed to twolight cure units 2W2QWIndian J Dent Res. Year : 2011 | Volume : 22 | Issue : 3 | Page : 495.
8- Mohamed El-Nawawy, Koraitim L, Abouelatta O, Hegazi H Marginal Adaptation of Nanofilled, Packable and Hybrid Dental Composite Resins Stored in Artificial Saliva Am.J.Biomed Eng.2012; 2(3): 105-114.
9- Denise Sá Maia CASSELLI, André Luis FARIA-E-SILVA, Henrique CASSELLI, and Luis Roberto Marcondes MARTINS J; Marginal adaptation of class V composite restorations submitted to thermal and mechanical cycling .J Appl Oral Sci. 2013 Jan-Feb; 21(1): 68–73. 1802.
10- Agarwal R S , Hiremath H , Agarwal J, and Garg A, J Conserv; Evaluation of cervical marginal and internal adaptation using newer bulk fill composites: An in vitro study Dent. 2015 Jan-Feb; 18(1): 56–61.
11- Ballal S N, Gopikrishna V, Kandaswamy G, Mamatha Y, Satish G; Evaluation of the marginal sealing ability of a total etch adhesive in comparison with a self-etching adhesive and a resin modified glass ionomer adhesive - An in-vitro fluorescent dye penetration test;s J. Conserv.Dent. Vol. 9, No. 2, March-April, 2006, pp. 55-62.