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RESEARCH ARTICLE

COMPARATIVE EVALUATION OF MICROLEAKAGE AROUND CLASS V CAVITIES RESTORED WITH NEW ALKASITE MATERIAL AND TWO DIFFERENT FLOWABLE COMPOSITE RESIN- AN IN VITRO STUDY

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ABSTRACT

Background: Research has been carried out to develop biocompatible restorative materials that can preserve the health of the pulp and maintain the tight seal between the tooth and the restorative material. One of the outcomes of these studies is an alkasite restorative material, Cention N (Ivoclar Vivadent). To check it's adaptability to Class V cavities compared with the established flowable composites resins that are used routinely to restore class V cavities.

Objective: To evaluate micro leakage at enamel-restoration and dentin-restoration interface of class V cavities restored with two different flowable composite resins and new alkasite restorative material-Cention-N.

Method: Thirty Class V tooth preparations were divided into three groups of ten cavities each(n=10): Group-I restored with alkasite material- Cention-N (Ivoclar Vivadent), Group-II restored with micro hybrid flowable composite resin- Tetric-N-Flow (Ivoclar Vivadent) and Group-III restored with nanohybrid injectable composite resin- Gaenial Universal Flo (GC, Tokyo). All samples were subjected to 200 themocycles between temperature baths at 50 C and 550 C. The teeth were sectioned longitudinally through the center of the restorations with the help of Isomet diamond saw under water coolant. The sections were then observed under a binocular stereomicroscope at a magnification of 20X. The depth of dye penetration at tooth-restoration interface was blindly scored by two independent investigators.

Results: Microleakage seen in increasing order at the enamel-restoration junction is Alkasite material-Cention N followed by Tetric-N-Flow and Gaenial universal Flo. Microleakage seen in increasing order at dentin-restoration junction is Tetric-N-Flow then Cention N and Gaenial Universal flo

Conclusion: Microleakage at enamel-restoration interface was less than microleakage at dentin-restoration interface of each group, but the difference was not statistically significant. Least microleakage at the enamel-restoration junction was seen with Cention-N with Adhesive followed by the flowable composite and least microleakage at dentin-restoration interface was seen with flowable composite followed by Cention N with adhesive. More microleakage was seen with Gaenial universal Flo at both enamel/dentin –restorative interface.

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INTRODUCTION

The use of tooth-colored restorative materials is increased after the development of flowable resin composites. The flowability of these composites ensures a perfect adaptation to the prepared cavity walls.

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They bond to the tooth structure with the help of bonding systems and are free of mercury. Tetric N-Flow is a light cured, flowable nanohybrid composite. It has a good wetting ability and offers outstanding stability. Gaenial universal flo is an injectable nanohybrid composite that contains pre-polymerized resin filler and has a low modulus of elasticity and low volumetric shrinkage (Jang *et al*., 2015). The composites have the inherent problem of polymerization shrinkage. Polymerization shrinkage stress is not only trapped within the material itself, but also exerts forces on the adhesive

interfaces of the tooth and restorative material (John Burgess, 2015). This leads to the clinical problem of microleakage manifested as a marginal gap, recurrent caries, pulpal irritation, postoperative sensitivity and premature failure of restoration. Different factors that lead to the development of a marginal micro gap between restorative material and cavity walls are inadequate isolation, poor adhesion, contraction forces, polymerization shrinkage, and temperature variable or masticatory forces. Like compomer or ormocer, Cention N is a subgroup of composite resin. It is a tooth-colored, dual-cured restorative material available in powder and liquid form. It contains various alkaline ion releasing fillers like fluoride, calcium, and hydroxyl in the powder. These alkaline ions neutralize acidic ions surrounding the restoration. Monomer from liquid enhances the flowability of the material and adapts to the smear layer (Manuela Lopes, 2015). Till date, no research has been carried out to check microleakage of two different flowable composites and alkasite material in Class V tooth preparations. The null hypothesis tested was that there is no significant difference between flowable composite resin and alkasite material in microleakage at enamel restoration and dentin restoration interface.

MATERIALS AND METHODS

Institutional ethical committee grants permission to conduct this study. Inform consent was taken from the patients whose teeth were removed due to periodontal problems, to use their extracted teeth for the study. Human permanent mandibular molars extracted due to loss of periodontal support were collected from the Department of Oral and Maxillofacial Surgery. Out of these, fifteen sound teeth that were free of caries, restoration, cracks and white spots were selected. All samples were cleaned and stored in distilled water. Thirty Class V cavities, one on the buccal and another on the lingual surface of each tooth were prepared with a high-speed flat end straight diamond point (SF-41 ISO 109/010 Mani Dia-Burs) with water as a coolant. After every fifth cavity preparation, new bur was used. Occlusal margin and gingival margin of the cavities were placed in enamel and dentin respectively. The cavity preparation was standardized to 2mm of depth, 4mm mesio-distal width and 2mm height in occluso-gingival direction. The measurements were taken in millimeters using a digital Vernier caliper. All the cavities were prepared by a single operator. All thirty cavities were randomly divided into three groups of ten cavities each (n=10).

- **Group I:** Universal bonding agent (3M ESPE, Single Bond Universal Adhesive) was applied and light cured (Bluephase, Ivoclar Vivadent) for 20 seconds then Cention N was placed in bulk and light-cured for 20 seconds.
- **Group II:** Universal bonding agent was applied and light-cured for 20 seconds then flowable composite resin (Tetric-N-Flow, Ivoclar Vivadent) was placed in bulk and light-cured for 20 seconds.
- **Group III:** Universal bonding agent was applied and light-cured for 20 seconds then highly filled flowable composite resin (Gaenial Universal Flo, GC) was placed in bulk and light-cured for 20 seconds.

After restoration, teeth were stored in distilled water at 37^0 C. Finishing was done after 24 hours with abrasive discs (Sof-Lex ^{TM} 3M ESPE, St Paul, USA) and fine grit diamond burs.

Samples were then subjected to 200 thermocycles between temperature baths at 5^0 C and 55^0 C. Cycle in each bath lasted for 30 seconds with 10 seconds transfer time. With the help of composite resin, the root apices were sealed. The teeth were then painted with two coats of nail varnish to leaving 1mm of the margins around the restorations. The samples were immersed in methylene blue dye (Always, Wadi, Nagpur) for 24 hours at 37^0 C and then washed for one minute under running tap water and dried. The teeth were sectioned longitudinally through the center of the restorations with the help of Isomet diamond saw under water coolant. All sections were observed under a binocular stereomicroscope at 20X magnification. Representative stereomicroscopic photographs are shown in Figure 1, 2 and 3. The depth of dye penetration at tooth restoration interface was blindly scored by two independent precalibrated investigators. The samples were coded and mixed for blinding so that the investigators could not identify the group of samples. The microleakage score was recorded separately for both occlusal and cervical margins on a nonparametric ordinal scale from 0 to 3 (Alani and Toh, 1997).

Figure 1. a Digital photograph of a specimen shows no dye penetration at restoration-enamel and restoration –dentin junction "Score –0"

Value and its inference used in the present study are as follows

- 0 - No Evidence of Microleakage (figure 1)
- 1 - Dye Penetration Up to Half of the Cavity Depth (Figure 2)
- 2 - Microleakage more than half of the Depth of Cavity Wall (figure 2)
- 3 - Dye Leakage Involves Axial Wall (figure 3)

Mean leakage scores for all groups were calculated. The data were analyzed with Kruskal –Wallis non-parametric analysis followed by Dunn's multiple comparison tests to evaluate differences among the experimental groups at a significant level of p=0.05. Combined occlusal and gingival scores within each restoration were compared using the Mann-Whitney test.

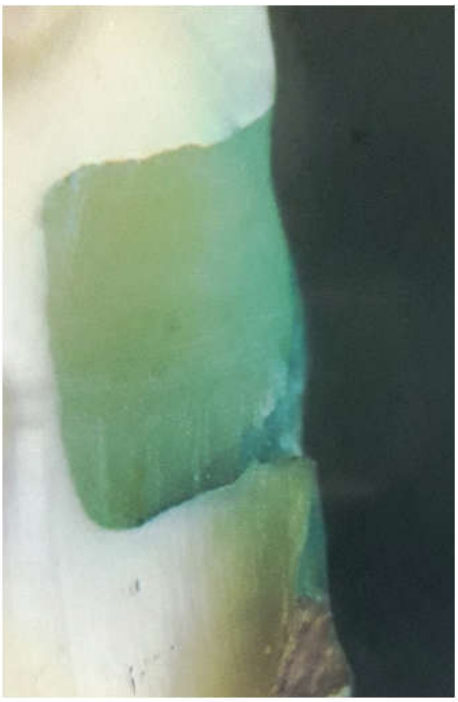

Figure 2. ration-enamel junction shows dye penetration up to half of the cavity depth-"score-1".& restoration-dentin junction shows microleakage more than half of the depth of cavity wall -"Score-2"

Figure 3. Specimen shows dye leakage involving axial wall- "Score 3"

RESULTS

Microleakage values for all groups were lesser at the enamel-restoration junction as compared to those at dentin-restoration interface. However, the difference was not statistically significant. The difference in microleakage values at the enamel-restoration junction between Group I(16.5) & Group II (13.5), Group I (16.5) & Group III(16.5) and Group II (13.5) & Group III(16.5) were insignificant ($p>0.05$). The comparison is given in table no. 1.The difference in microleakage at a dentin-restoration junction in Group I (10.1) &Group II(18) and Group I & Group III (22) and between Group II (18) & Group III (22) were insignificant ($p>0.05$). The comparison is given Table no. 2.

DISCUSSION

One of the prime factors for the success of a restoration is the marginal adaptability of the restorative material. Adaptability of Cention N and two different flowable composite resins in Class V cavities is checked in this study. Clinically, cervical lesions extend to different tooth substrates like enamel at the occlusal and dentin at the gingival margins. Flowable composite resins are widely used to restore Class V cavities as they are easy to handle and have a low modulus of elasticity and good aesthetic results. It becomes a challenge as bonding of composite resin to dentin is more difficult and less predictable than bonding to enamel (Craig, 2012). For a restoration to be successful, it should adapt properly or intimately to the walls of the cavity to prevent micro leakage. Micro leakage is the clinically invisible passage of bacteria, fluid, ions or molecules in micro gaps (10^{-6}µm) between a restorative material and cavity wall. This results in post-restoration sensitivity because of interfacial hydrodynamics. Addition to this staining of the tooth, secondary caries formation, defective restoration and pulpal involvement may also occur. To evaluate microleakage, methylene blue dye was used in this study. The diameter of dye molecules is 0.80nm that is less than the diameter of dentinal tubules (1-4µm) (Bayne and Thompson, 1998). Thermal changes were simulated as that observed in the oral cavity by thermocycling. It is an in-vitro process of subjecting a tooth and restoration to temperature extremes that conform to those found in the oral cavity (Thomazatti and Alexandra, 2002). Class V cavities restored with flowable composite resin Group II (13.5) showed the least leakage at enamel-restoration junction followed by cavities restored with Cention N Group I (16.5) and Gaenial Universal Flo Group III (16.5).

At the dentin-restoration junction, least microleakage was observed with Cention N Group I (10.1) followed by flowable composite resin Group II (18) and Gaenial Flow Group III (22.0). Restorations with flowable composite resin demonstrated least microleakage at enamel-restoration junction than Cention N and Gaenial Universal Flo. However, dye leakage at dentin-restoration interface was more than Cention N and less than Gaenial Flow. Our findings are in accordance with Yazici AR *et al.* (2003), Sadeghi Mostofa (2012), Attar *et al.* (2003) who found less leakage at enamel-restoration interface. Reason for this could be less filler content of composite resin that results in low viscosity, high flowability, and coefficient of thermal expansion close to that of the tooth structure. Modulus of elasticity is low and this allows for plastic deformation and absorption of polymerization shrinkage stresses. Cavities restored with Cention N show the least leakage at the dentin-restoration junction. Reason for this could be the tooth-restoration interface is largely sealed with an acid resistant, resin-dentin interdiffusion zone i.e. hybrid layer. Our findings are in accordance with that of the study conducted by Manuel Lopes (Manuela Lopes, 2015). The powder of Cention N contains Isofiller that acts as shrinkage stress reliever. The liquid consists of four different dimethacrylates, initiators and other additives. A combination of Urethane dimethacrylate (UDMA), an aromatic-aliphatic – UDMA, Tricyclodecan-dimethanol dimethacrylate (DCP) and PEG-400DMA cross-links during polymerization to form strong mechanical properties and good long-term stability. The main component of monomer matrix is UDMA that provides moderate viscosity and strong mechanical properties.

Aromatic-aliphatic-UDMA combines a favorable property of aliphatic that is low tendency to discolor and aromatic diisocyanates provide stiffness. DCP is a low viscosity, a difunctional monomer that enables hand manipulation. Polyethylene glycol 400 dimethacrylate (PGE 400 DMA) is a liquid monomer that improves the flow and adapts well to the smear layer (Manuela Lopes, 2015; Prati and Nucci, 1991). Cention N shows a high polymer network density and degree of polymerization over the depth of the restoration as it uses sole crosslinking methacrylate monomer in combination with stable, efficient self-cure initiator (Manuela Lopes, 2015).

When restorative materials are used along with dentin bonding agents, they improve the marginal seal of restorative material and tooth interface. They have proven to be effective at reducing but not eliminating microleakage (Peutzfeldt and Asmussen, 2002). Group III showed more leakage at both enamel-restoration and dentin –restoration junction than Group I and Group II. Our findings are in accordance with JH Jang *et al*. (2015). This could be due to more polymerization shrinkage of Gaenial Universal flo, Similar leakage values were shown by group I and group II at enamel restoration junction indicate that they perform equally well in terms of microleakage. Our findings are based on the in-vitro study. Further research to evaluate the clinical performance of the alkasite material is required.

Conclusion

Within the limitation of this in-vitro study following conclusions can be drawn

Microleakage at enamel-restoration interface was less than microleakage at dentin –restoration interface of each group, but the difference was statistically not significant. At enamel-restoration interface least leakage was seen with flowable composite resin restoration followed by Cention N with adhesive then Gaenial universal flo. At dentin-restoration interface Cention N with adhesive shows better marginal adaptability followed by flowable resin composite and Gaenial universal flo.

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REFERENCES

Alani, AH. and Toh, CG. 1997. Detection of microleakage in dental restoration: A review. *Oper Dent.,* 22: 173-185.

Attar, N., Tam, LE. and Mc Comb, D. 2003. Flow, strength, Stiffness and Radiopacity of flowable composites. *Journal of Canadian Dental Association,* 69(8):516-21.

Bayne, SC. and Thompson, JY. 1998. A characterization of the first-generation flowable composite. *J Am Dent Association*, 129 (5): 567-577.

Craig RG. Craig's Restorative Dental Materials. 13th ed. St Louis Mosby; 2012.

Jang, JH., Park, SH. and Hwang, IN. 2015. Polymerization shrinkage and depth of cure of bulk-fill resin composites and highly filled flowable resin. *J of Operative Dentistry,* 40-2,172-180

John Burgess, 2015. Microleakage of Cention N compared to dental amalgam. Final report. Scientific documentation – Cention-N. pg no. 26-27.

Manuela Lopes, 2015. Ultramorphological study of the interface: dentin-Cention N as a function of saliva contamination and the usage of an adhesive system. Scientific documentation of Cention N. 2015, Pg No. 24-25.

Peutzfeldt, A. and Asmussen, E. 2002. Composite restorations: influence of flowable and self-curing resin composite lining on microleakage in vitro. *Oper Dent.,* 27(6):569-75

Prati, MD. and Nucci, MD. 1991. Shear bond strength and microleakage of Dentin Bonding Systems. *J Prosthet Dent.,* 65 (3): 401-407

Sadeghi Mostafa, 2012. An in vitro microleakage study of class V cavities restored with a new self-adhesive flowable composite resin versus different flowable materials. *Dent Res J.,* (Isfahan) 9(4):460-465.

Thomazatti, D. and Alexandra, M. 2002. Pereira. In vitro evaluation of microleakage of the flowable composite in Class V restorations. *Braz Dent J.,* 13(3): 184-187.

Yazici, AR., Baseren, M. and Dayangac, B. 2003. The effect of flowable resin composite on microleakage in Class V cavities. *Oper Dent*., 28:42-46.

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