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RESEARCH ARTICLE

COMPARATIVE EVALUATION OF MICROLEAKAGE AROUND CLASS II CAVITIES RESTORED WITH ZIRCONOMER, TETRIC N CERAM, CENTION-N AND GLASS IONOMER CEMENT- AN IN VITRO STUDY

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ABSTRACT

Esthetic dentistry has shown much advancements in material and technology over time. Microleakageis one of the common factors affecting the integrity of tooth-restoration interface. Hence, the idea of study was to know which of the restorative materials were to be used in clinical practice for deep Class II restorations. Fifty human freshly extracted maxillary premolar teeth were selected and divided into five groups Group1(n=5),:no cavity preparation done, standardized class II cavities were prepared for rest of groups Group2(n=5):left unrestored, Group3(n=10): restored with Zirconomer, Group4(n=10): restored with Tetric N Ceram, Group5(n=10): restored with Cention N,Group6(n=10): restored with Glass Ionomer Cement .The specimens were thermocycled and two layers of nail varnish was applied on all surfaces except for 1mm around the restorative margins and apex was sealed with sticky wax. The samples were immersed in 0.5% methylene blue dye for 24 hrs, washed under running water, sectioned and observed under Stereomicroscope. The statistical analysis was done using kruskal wall is and Mann whitney U tests. All restored samples showed certain amount of microleakage. A statistically significant difference was observed between all the groups except Cention and Tetric N Ceram. Based on the results of this study, it can be concluded that zirconomer showed maximum micro leakage followed by GIC, and Cention-N and Tetric N Ceram showing the least microleakage.

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INTRODUCTION

Aesthetic restorations define the essence of modern esthetic dentistry. The demand for aesthetic and functional restorations have increased not only in anteriors but also in the posterior teeth. The ability of the restorative material to effectively sustain oral conditions depends on the retentive ability of the material to seal the cavity against the ingress of oral fluids and microorganism. Poor marginal seal leads to passage of bacteria, fluids, and molecular penetration which leads to Microleakage[1,2] causing Hypersensitivity of the restored teeth Discoloration, Recurrent caries, Pulpal injury and subsequent Failure of restoration[3,4,5]. Microleakage at the margins of the proximal box specifically at the gingival floor of Class II restorations is a matter of concern to the clinician.

Glass Ionomer Cement

Good color stability, Coefficient of thermal expansion, biocompatibility similar to that of natural tooth excellent marginal seal, Flouride release ability to adhere chemically to enamel and dentin.

Zirconomer

White amalgam, is modified glass ionomer cement with the strength and durability of amalgam. The inclusion of Zirconia fillers reinforces the structural integrity and imparts superior mechanical properties.

CENTION-N

Alkasite restorative material, a subgroup of the composite. Utilizes an alkaline filler, capable of releasing acid-neutralizing hydroxide ions. Self-curing with optional additional light-curing. Full volume (bulk) placement material. Releases calcium and fluoride for remineralization.

TETRIC-N CERAM

Nano-hybrid, medium viscosity type bulk fill. Patented photo-initiator, Ivocerin, which is far more reactive than conventional initiators, ensuring the complete cure of the filling. Suitable for insertion in a 4 mm bulk Special filler technology ensures low shrinkage stress.

Aims and Objectives

To evaluate and compare the microleakage in class II cavity (mesio-occlusal) restored in premolars with:

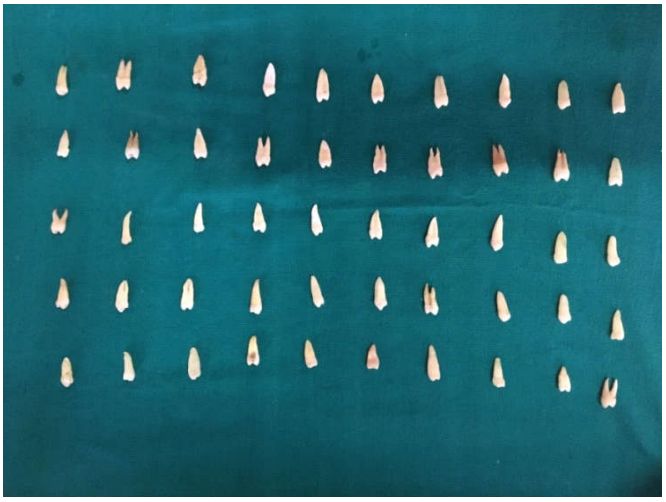
A) ZIRCONOMER (SHOFU Inc., Kyoto, Japan)
B) TETRIC-N CERAM (Ivoclar Vivadent)
C) CENTION-N (Ivoclar Vivadent)
D)GLASS IONOMER CEMENT (GC Universal Restorative), using Stereomicroscope.

MATERIALS AND METHODS

Inclusion criterion -Non-carious teeth without any visible stains and cracks.

Exclusion Criteria: Grossly decayed tooth, teeth with facets, Fractured teeth, Teeth with aberrant anatomy and previous restoration.

Sample size- 50 maxillary premolar teeth

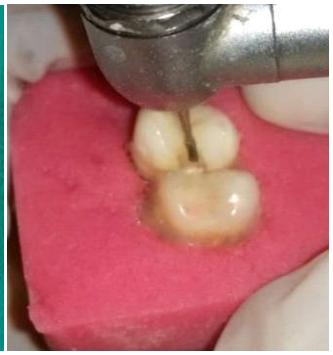


Sample Size=50

Control group (n) =10, Experimental group-Restored (n)=40
Group I-Negative control n) =5, Group II-Positive control (n)=5
Group III-ZIRCONOMER (n)=10, Group IV-TETRIC N CERAM(n)=10

Group V-CENTION-N(n)=10, Group VI-GLASS IONOMER CEMENT(n)=10

Each specimen was mounted with adjacent teeth for placement of Tofflemirematrix which allowed building up of the proximal wall.



Class II preparations were made on mesial surfaceby using a carbide bur (number245) in a water cooled high speed air turbine hand piece. For every five preparations a new bur was used.

A conservative Class II preparation with dimensions as follows:

Bucco-Lingual Extension:4mmMesio-Distal Depth:2mThe gingival margin 1mm coronal to Cemento enamel junction.All the prepared surfaces (group IV & V, i.eTetric N ceram and Cention N) were dried with oil free compressed air, etched with 37% phosphoric acid for 10 s and then rinsed for 30 seconds, and dried gently. Two consecutive layers of Tetric N Bond bonding agent was applied to the etched surface, gently dried, and light cured for 20 seconds.

The teeth were then randomly divided into: Two control groups of 5 each and four experimental group of 10 teeth each. The specimens in each group were restored with the respective materials according to manufacturer's instructions and finishing and polishing was done using finishing kits. The specimens were stored at 100% relative humidity at 37°C for 24 h and were then submitted to 1000 thermal cycles at 5°C and 55°C with a dwell time of 30 sec at each temperature and 10 seconds was the transferring time between the two temperature baths. The specimens apex were sealed with sticky wax and were then covered with two layers of nail varnish, except the resin restoration and 1 mm area around it. Immersed in 0.5% aqueous Methylene blue dye for 48 h. The specimens were rinsed and sectioned mesiodistally using diamond disks.

The microleakage was measured using stereomicroscope at ×20 magnification

*Microleakage analysis*All specimens were examined under magnification to measure the extent of dye penetration according to Radhika *et al*:

Five-point scale:

Score 0 = No dye penetration

Score 1 = Dye penetration less than half of the gingival wall

Score 2 = Dye penetration along the gingival wall

Score 3 = Dye penetration along the gingival wall and less than half of the axial wall

Score 4 = Dye penetration along the gingival and axial wall. All the data was collected and statistically analysed.

RESULTS

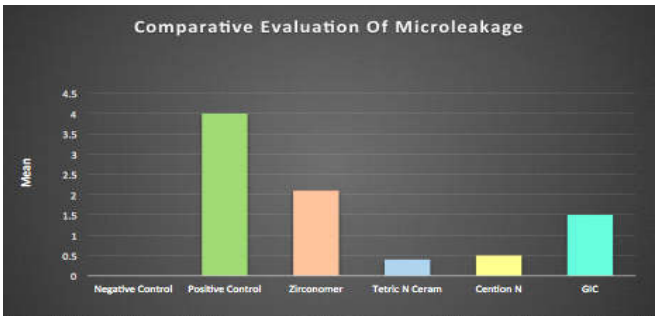
Scoring for microleakage

		Microleakage					Total
		0	1	2	3	4	
Groups	• Negative	5	0	0	0	0	5
	• Positive	0	0	0	0	5	5
	• Zirconomer	3	0	2	3	2	10
	• TetricNCeram	6	4	0	0	0	10
	• Cention N	5	5	0	0	0	10
	• GIC	3	1	4	2	0	10

Comparison of Microleakage in Different Groups Using Kruskal Wallis Test

Groups	N	Mean	Mean rank	Kruskal Wallis	P value
Negative	5	0	11.50	Chi square = 24.949	.000 (Significant)
Positive	5	4	47.00	df=5	
Zirconomer	10	2.1	32.25		
Tetric N ceram	10	0.4	17.90		
Cention N	10	0.5	19.50		
GIC	10	1.5	28.60		

Mann Whitney U Test was undertaken which revealed that zirconomer has significant difference (more microleakage scores) with Tetric N ceram, cention-N while no significant difference with GIC. Tetric N Ceram has significant difference (less microleakage score) with zirconomer and GIC while no significant difference with Cention-N. Cention-N has significant difference (less microleakage score) with zirconomer and GIC while no significant difference with Tetric N Ceram. GIC has significant difference (more microleakage scores) with Tetric N Ceram and Cention-N while no significant difference with zirconomer



DISCUSSION

Major factor influencing the longevity of any dental restoration is microleakage.[6,7] Maxillary first premolars were selected for this study and standardized class 2 cavities were prepared to simulate clinical situation. Cavities were prepared and restored strictly according to manufacturer instructions. Thermo cycling was done to mimic intra-oral temperature variations.[8] Two layers of nail varnish were applied all around leaving 1 mm from the restoration margins, and the apex was sealed with sticky wax, to avoid any dye penetration from invisible cracks, areas devoid of enamel or cementum etc. Dye leakage studies are amongst the most frequently used methods for detecting microleakage.[9] Methylene blue dye was used in this study since its molecular size is as low as 1 nm which is smaller than the diameter of dentinal tubule and can thus penetrate through the smallest of gaps between the restoration and tooth interfaces. Zirconomer presented the higher microleakage. Addition of zirconia fillers to the glass component of Zirconomer improved its mechanical properties but not its marginal integrity.[10] Shameera et al conducted a comparative study of microleakage among GC Fuji IX, Amalgam, and Zirconomer, result that GC Fuji IX Extra was much better than zirconomer. [11] Patel et al conducted a study and results were similar to the present study. They showed that zirconomer exhibited the highest microleakage as compared with composite and amalgam.[12] Glass Ionomer cements bond chemically to tooth structure, achieved via an exchange of ions leading to formation of calcium-polyacrylate bond, are highly technique sensitive and the most critical aspect is isolation from moisture for the first 30 minutes after placement. On exposure to water the matrix forming ions are easily leached out during the initial set. Also excessive dehydration can result in a chalky, crazed or a cracked surface leading to considerable marginal leakage.[13] Cention-N includes a special patented filler (Isofiller), acts as a shrinkage stress reliever minimizing shrinkage, like a spring expanding slightly as the forces between the fillers grow during polymerization. Moreover, the organic/inorganic ratio and the monomer composition of the material, accounts for its low volumetric shrinkage-leading to lowest microleakage, allowing bulk filling of Cention –N.[14] Tetric N Ceram Bulk fill composite with patented Ivocerin inclusion within the core matrix. It involves advanced composite filler technology, a pre-polymer shrinkage stress reliever, a light initiator/polymerisation booster and a light sensitivity filter which leads to reduced marginal gaps, and hence microleakage.

Conclusion

Within the limitations of the study, it can be concluded that all the restored groups showed microleakage. Tetric N Ceram and Cention N showed the least microleakage showing statistically significant differences with Glass Ionomer Cement and Zirconomer showing highest microleakage.

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