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Comparative Evaluation Of Microleakage In Three Different Glass Ionomer Based Cements: An Invitro Study.

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ABSTRACT

The aim and objective of this study was to evaluate and compare the sealing ability of three different glass ionomer based cement in class I restorations by evaluating dye penetration under stereomicroscope. All teeth in Group I(Type II glass ionomer cement),Group II(Type IX glass ionomer cement),Group III (Cention),Group IV(Cention with Light Cure) were restored with respective restorative materials and clear varnish was applied on all the samples except for the area with restoration. The samples were further immersed in 2% methylene blue dye for 48 hrs. After 48 hrs, the samples were further cleaned under running water to clear the methylene blue dye. Teeth was dried and all teeth were sectioned buccopalatally using diamond disc. The sectioned tooth were further examined under stereomicroscope with X10 magnification for dye penetration. The images were captured and observed for dye penetration. Restoration with Type IX Glass Ionomer Cement ,Cention (Ivoclar) restoration followed by etching ,bonding and light cured showed better results and lesser micro leakage in Class I restorations.

Keywords: Microleakage, Class I restoration, Glass ionomer cement

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INTRODUCTION

One of the most common case of failure in restorative materials is microleakage which contributes for secondary caries, pulpal irritation and failure of treatment[1].Microleakage can be defined has a clinically undetectable passage of fluids, molecules, bacteria ,ions in between the restoration and the cavity wall. This can be clearly attributed to change in temperature, dimensional changes, mechanical stress, improper adaptation of restorative material. Therefore a good seal at the restoration tooth interface is essential to minimize microleakge[2].

Various materials in the market have sought to improve the quality, longetivity and durability of these restorative materials[3,4]. Wilson and Kent introduced Glass Ionomer Cement and since then these materials are widely used in dentistry as base, liner and restorative materials. They are water based tooth coloured materials consisting of glass component and polyalkeoic acid which sets through a aid based reaction[5].Glass ionomer cements have certain drawbacks like difficulty in manipulation, water senstivity and poor wear resistance[6].

The variation physical properties of traditional glass ionomer cements i.e. by introduction of high powder liquid ration has helped in improving early moisture sensitivity and faster hardening is achieved by variation of particle size, particle distribution .These variations facilitates its use in posterior teeth[7,8]. Glass ionomer cement is classifies based on its use as luting cement, anterior restorative material, pit and fissure sealants, core buildup, ART technique and posterior restorative material with high filler content and streength[9,10.]

An "alkasite" material Cention N (Ivoclar Vivadent) is a recently introduced materials with basic composition of UDMA. Liquid comprises of dimethacrylate and initaitors and powder contains glass fillers, initiators and pigments. The sole cross linkage is methacrylate monomers in association with a stable initiators, hence exhibits high density of polymer network which decreases micro leakage[11].

Thus, the purpose of this study is to compare and evaluate the microleakage variation in Glass ionomer cement (Ketac Type IX,GC Corp),Glass ionomer cement (Type II,GC corp) and Cention N .

MATERIALS AND METHODS

Objective: To evaluate the sealing ability of Type II, IX glass ionomer cement and Cention N restorations in class I cavity preparation.

Tooth selection: The study was conducted on 80 extracted human premolars collected from department of oral and maxillofacial surgery.

Inclusion criteria:

- Non-carious or minimal carious premolars with two roots

Exclusion Criteria:

- Teeth with extensive caries
- Teeth with cracks

80 freshly extracted human extracted maxillary pre-molars were collected, stored and disinfected according to OSHA regulations.

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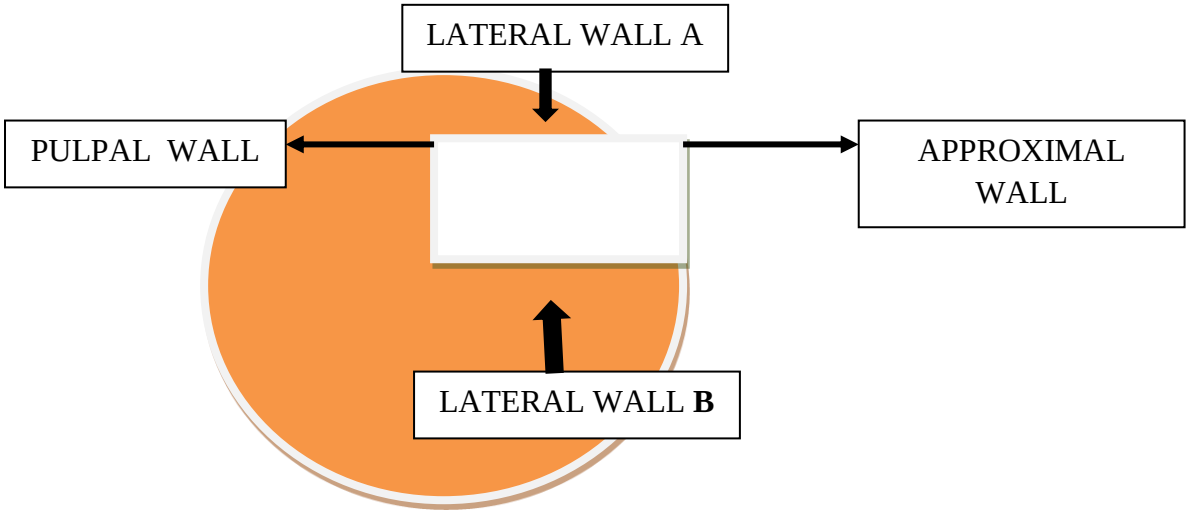
Table 1: Materials Used In Study

GLASS IONOMER CEMENT	MANUFACTURER	SAMPLES
TYPE II GLASS IONOMER CEMENT	GC INDIA CORP	20
TYPE IX GLASS IONOMER CEMENT		20
CENTION	IVOCLAR	20
CENTION-LIGHT CURED		20

Class I cavity preparation was done with Round bur,245 bur[Mani Bur].The tooth were randomly categorized into four groups further:
Group I: Class I restoration with Type II Glass Ionomer cement (GC Corp)
Group II: Class I restoration with Type IX Glass Ionomer Cement (Ketac, GC Corp)
Group III: Class I restoration with Cention N (Ivoclar Vivadent)
Group IV: Class I restoration with Cention N (Ivoclar Vivadent) and Light Cured.

All teeth in Group 1,2,3,4 were restored with respective restorative materials and clear varnish was applied on all the samples except for the area with restoration. The samples were further immersed in 2% methylene blue dye for 48 hrs. After 48 hrs, the samples were further cleaned under running water to clear the methylene blue dye. Teeth was dried and all teeth were sectioned buccopalatally using diamond disc .The sectioned tooth were further examined under stereomicroscope with X10 magnification for dye penetration.The images were captured and observed for dye penetration.

Graphic Model of microleakage assessment in transverse section:



Dye penetration was analyzed based on five grade scale [12]

0-no dye penetration into the filling material or along the filling-tooth interface,
1-dye penetration into the filling material or along the filling-tooth interface up to half of the lateral wall A or B,
2-dye penetration into the filling material or along the filling-tooth interface along all lateral wall A or B (till bottom of the cavity, pulpal wall),
3-dye penetration into the filling material or along the filling-tooth interface up to half of both lateral walls A and B

4- dye penetration into the filling material or along the filling-tooth interface along both lateral walls A and B (till bottom of the cavity, pulpal wall).

Statistical Analysis

All data were statistically analyzed and differences were considered statistically significant for $P<0.05$. The difference in dye penetration depth and percentage of dye penetration by the groups were statistically analyzed using Kruskal–Wallis test, and Tukey's Post Hoc was used for pairwise comparison between groups because of significant results of Kruskal–Wallis test.

RESULTS

The condition of restorations made were expressed, as dye penetration, ranged from 0 till 4 and a detailed dye leakage analysis revealed differences in discoloration around the tested restorations.

The percentage of dye penetration along full length in Group I (Type II Glass ionomer cement) is 2.5%,Group II(Type IX Glass ionomer cement) is Nil,Group III (Cention) is 1 (1.25%) and Group(Cention LC) is Nil.[Table 2]

Table 2: Dye Leakage Around Examined Restoration.

Restorative materials	No Dye Penetration	Dye penetration to half-depth of one wall	Dye penetration along one full wall
Group I	3 (3.75%)	15 (18.75%)	2 (2.5%)
Group II	15 (18.75%)	5 (6.25%)	0 (0.0%)
Group III	11 (13.75%)	8 (10%)	1 (1.25%)
Group IV	17 (21.25%)	3 (3.75%)	0 (0.0%)

	N	Mean	Std Dev	Std Error	95% CI		Mean Square	F	P Value
					Lower	Upper			
Group I	20	0.95	0.51	0.114	0.71	1.19	0.2546	10.6	0.000*
Group II	20	0.25	0.44	0.099	0.04	0.46			
Group III	20	0.5	0.61	0.136	0.22	0.78			
Group IV	20	0.15	0.37	0.082	-0.02	0.32			

Kruskal Wallis Test
*Statistically Significant

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Table 3: Comparision Of Microleakage Between Groups

Variables		Mean Difference	Std Error	P value	95% CI	
					Lower	Upper
Group I	Group II	0.7	0.155	0.000*	0.29	1.11
	Group III	0.45	0.155	0.024*	0.04	0.86
	Group IV	0.8	0.155	0.000*	0.39	1.21
Group II	Group I	-0.7	0.155	0.000*	-1.11	-0.29
	Group III	-0.25	0.155	0.377	-0.66	0.16
	Group IV	0.1	0.155	0.917	-0.31	0.51
Group III	Group I	-0.450	0.155	0.024*	-0.86	-0.04
	Group II	0.250	0.155	0.377	-0.16	0.66
	Group IV	0.350	0.155	0.117	-0.06	0.76
Group IV	Group I	-0.800	0.155	0.000*	-1.21	-0.39
	Group II	-0.100	0.155	0.917	-0.51	0.31
	Group III	-0.350	0.155	0.117	-0.76	0.06

Tukeys Post Hoc
*Statistically Significant

Results showed that in comparison between Group I(Glass ionomer Type II) with other groups showed significant dye leakage in Group I. Glass ionomer cement Type IX,Cention and Cention with light cure showed significant less dye penetration in comparison with Group I(Glass ionomer Type II) .[Table 3]

Figure 1: Comparison Of Significant Differences Between Groups

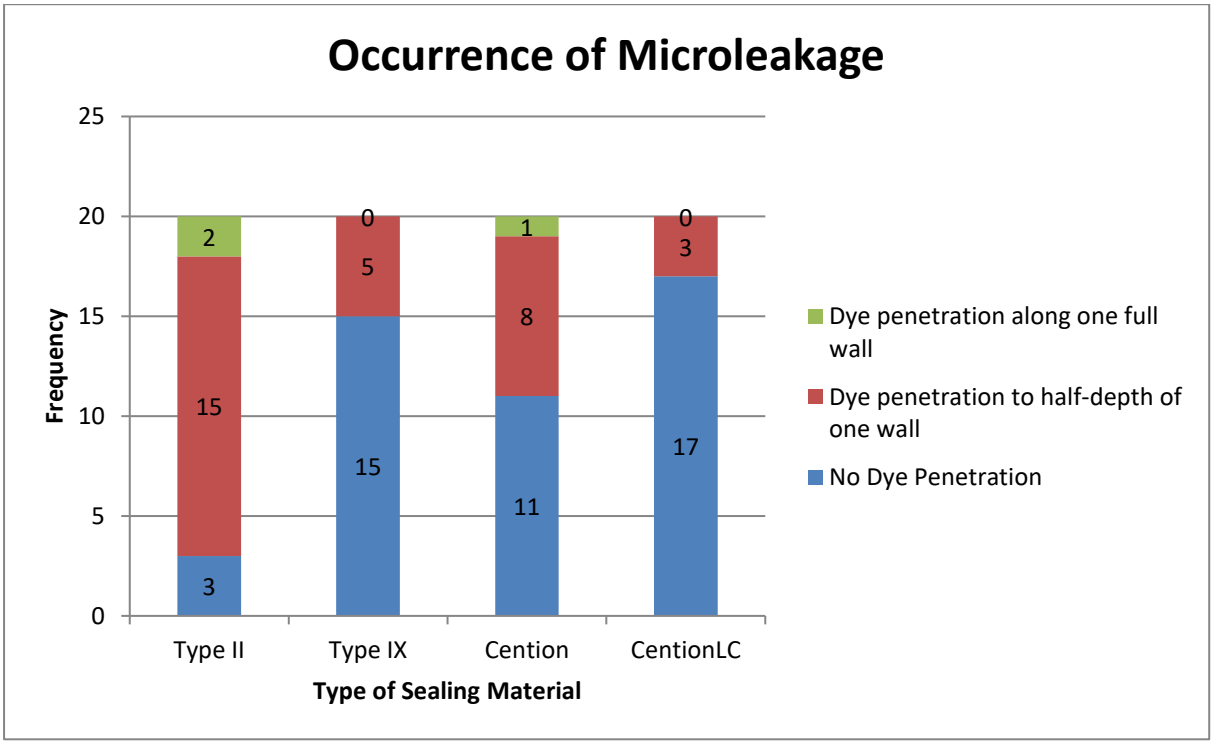

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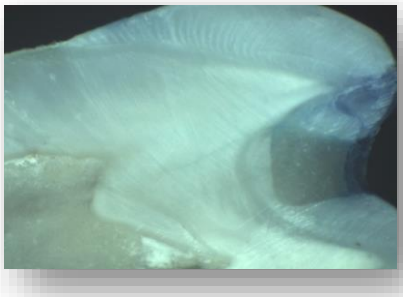
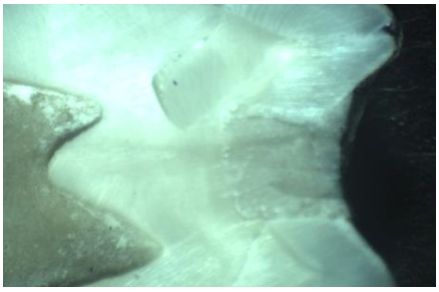
Figure 2: Dye Penetration Among The Groups

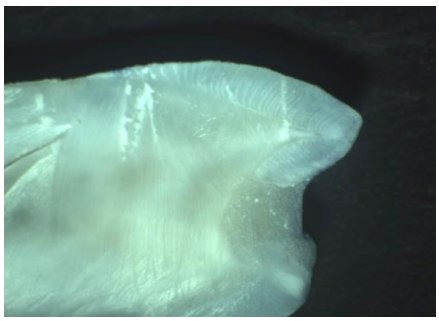
Type II Glass ionomer cement



Type IX Glass ionomer cement



Cention -Ivoclar



Cention +Light cure

DISCUSSION

Microleakage is defined as the "diffusion of the bacteria, oral fluids, ions and molecules into the tooth and the filling material interface" OR "defined as the clinically undetectable passage of bacteria, fluids, molecules or ions between tooth and the restorative or filling material" [13].Various restorative materials are used to restore carious and non-carious lesions. In class I cavities Silver amalgam, Glassionomer cement and composites are common options. Wilson and Kent introduced Glass ionomer cement which an efficient liner, base, restorative materials and luting cement[14].

Reaction between carboxylic groups of polyalkenoic acid with calcium ions of hydroxyapatite (HAP) at tooth interfaces results in ionic bond between GIC and dental hard tissues. Various studies conducted have shown that none of these materials have complete sealing ability[15, 16].In the present study Type II Glass ionomer cement showed maximum dye penetration in comparison with Cention, Type IX glass ionomer cement and Cention with Light Cure this may be attributed to the increased penetration in Cention post etching and bonding prior to restoration[17].Dye penetration studies remain best method for evaluating the sealing ability of the materials. Thus, the present study was conducted based on dye penetration methodology using methylene blue[18].

Thus within the limitations of the study following conclusion can be made , that restoration with Type IX Glass Ionomer Cement ,Cention (Ivoclar) restoration followed by etching ,bonding and light cured showed better results and lesser micro leakage in Class I restorations.

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