



Science

COMPARATIVE EVALUATION OF MICROLEAKAGE IN ALKASITE AND GLASS-HYBRID RESTORATIVE SYSTEM: AN IN-VITRO

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Abstract

Aim: To Compare and evaluate the microleakage of newly introduced Glass Hybrid restorative system(Equia Forte) with alkasite based restorative material(Cention N).

Materials and Methods: 30 premolars free of caries or any other defects and extracted for orthodontic reasons were chosen for the study. Subsequently class I cavities were prepared and teeth were randomly assigned into two experimental groups (n = 15) and restored using EQUIA FORTE and CENTION N respectively. All the specimens were subjected to thermocycling. Specimens were stained with 0.6% RhodamineB dye and evaluated for dye penetration under stereomicroscope.

Results: Equia Forte showed lesser leakage than compared to Cention N.

Conclusion: The study therefore concluded that EQUIA FORTE to have lesser microleakage compared to CENTION N, thereby having better sealing ability.

Keywords: CentionN; Equia Forte; Glass Hybrid System; Microleakage.

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1. Introduction

Over the past years esthetic dentistry has shown considerable progress leading to the development of a number of improved restorative materials. Currently, the main concerns regarding the

performance of these materials refer to their durability and the integrity of marginal sealing. Marginal gap formation contributes to microleakage permitting the passage of oral fluids, ions and bacteria leading to post-operative sensitivity, pulpal inflammation and recurrent caries [1].

Controlling microleakage has always been an important goal of operative dentistry. Various restorative materials have been tried and tested for the same, with each having its own advantages and disadvantages [2].

Cention N (Ivoclar Vivadent; Schaan, Liechtenstein) is a tooth-coloured, basic filling material for bulk placement in retentive preparations with or without the application of an adhesive. It is an “alkasite” a new category of restorative material, like compomer or ormocer and is essentially a subgroup of the composite resin (Samanta, 2017) [2,3].

EQUIA FORTE (GC, America) is a new bulk fill glass hybrid restorative system. It is a combination of a self-adhesive, chemically cured and highly filled resin surface sealant. The manufacturers of EQUIA Forte Fil and EQUIA Forte Coat united they build a stronger, superior posterior bulk fill material. This material has increased fracture toughness, flexural strength, and flexural fatigue resistance. It is a unique restorative system for all age groups will impress you on all levels compared to other restorative options [4].

Thus, the present in-vitro study was done to compare and evaluate the microleakage of alkasite based restorative material (Cention N) with newly introduced glass-hybrid restorative system.

2. Materials and Methods

For the Evaluation of Microleakage

30 premolars free of caries or any other defects and extracted for orthodontic reasons were chosen for the study (Fig 1). All specimens were cleaned and stored in distilled water till use.

Preparation of Class I Cavities

Standardized Class I cavities were prepared, approximately 4 mm in length, 2.5 mm in width and 3 mm in depth. Diamond burs (#837 Komet Gebr, Brasseler, Lemgo, Germany) were used in a high speed handpiece to prepare the cavities, under constant water irrigation [5]. A William's graduated periodontal probe (Hu-friedy, Chicago, IL, USA) was used to measure the dimensions of the prepared cavity. The teeth were then placed in distilled water at room temperature until use. All prepared samples were then randomly divided into two groups.



Figure 1: 30 premolar samples



Figure 2: standardized class I cavity preparation

Restorative Procedures

Group1 (CENTION-N): All samples in **group 1** were etched using Scotchbond multi-purpose etchant (3M ESPE), washed with water jet and dried with gentle stream of air leaving a moistened surface. A layer of Tetric N Bond (Ivoclar Vivadent) was then applied using a disposable microbrush, and light cured for 10s and samples were restored using Cention-N (Ivoclar, Vivadent). Dosing, mixing and restoration of the cavity were strictly according to manufacturer instructions.

Group2 (EQUIA FORTE): For all the samples in **group 2**, conditioning was done with GC Cavity conditioner (10% polyacrylic acid) for 10s and washed with water jet and dried with gentle stream of air. The capsule plunger of equia forte was tapped for activation and kept on an amalgamator for mixing. The capsule was inserted into specially designed applicator and clicked twice to prime capsule after which they were immediately dispensed into prepared cavity. Finishing of the restoration was done by applying the EQUIA forte coat, which was light cured for 20s.

Preparation for Assessment of Microleakage

After restoration, the samples were stored in distilled water at 37°C for 24 hours, following which, they were subjected to a thermocycling regimen of 500 cycles between 5°C and 55°C, with a dwell time of 30 seconds in each bath [6]. The samples were dried after thermocycling and then sealed with 2 coats of nail varnish 1 mm away from the restoration margin. The samples were then immersed in Rhodamine B dye for 24 hours [7]. The teeth were washed under running water after dye exposure following which they were sectioned longitudinally in bucco-lingual direction using a water cooled struers low speed diamond saw.

Stereomicroscopic evaluation of the sectioned samples in each group was done and the degree of dye penetration was assessed according to the following scoring criteria [6].

Score 0	No dye penetration
Score 1	Dye penetration up to 1/4th buccal and lingual wall
Score 2	Dye penetration up to 1/2 of buccal and lingual wall
Score 3	Dye penetration along the entire buccal/lingual wall
Score 4	Dye penetration up to 1/4 th of pulpal wall.
Score 5	Dye penetration up to 1/2 of pulpal wall.
Score 6	Dye penetration along entire pulpal wall.

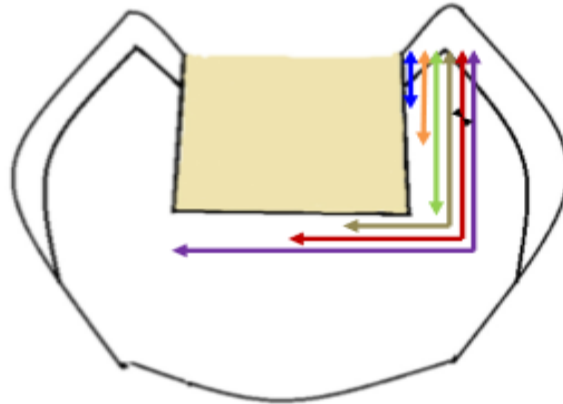


Figure 2 Schematic diagram depicting levels of microleakage. 
score 1;  score 2;  score 3;  score 4;  score 5;  score 6.

Figure 3: Scoring criteria for dye penetration [6].

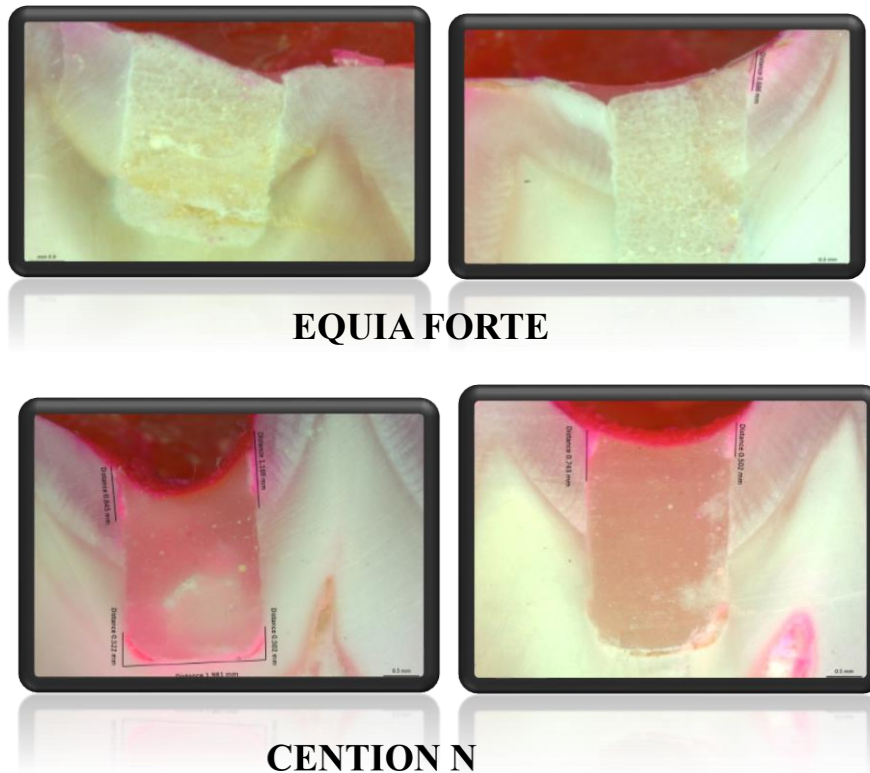


Figure 4: Stereomicroscope [30X] images showing microleakage

3. Statistical Analysis

The data were collected, tabulated, and statistically analysed using **Mann whitney U test**.

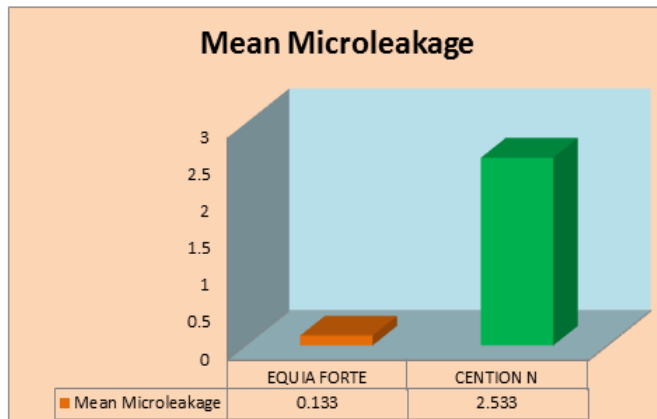
4. Results

Table 1: Descriptive statistics and multiple comparisons

Descriptive Statistics				
Microleakage * Group		Group		
		EQUIA FORTE	CENTION N	
Micro Leakage	SCORE 0 = NO LEAKAGE	Count	13	1
		%	43.3%	3.3%
	SCORE 1 = DYE PENETRATION UPTO ¼ TH BUCCAL/LINGUAL WALL	Count	2	8
		%	6.7%	26.7%
	SCORE 2 = DYE PENETRATION UPTO ½ OF BUCCAL/LINGUAL WALL	Count	0	0
		%	0.0%	0.0%
	SCORE 3 = DYE PENETRATION ALONG THE ENTIRE BUCCAL/LINGUAL WALL	Count	0	0
		%	0.0%	0.0%
	SCORE 4 = "DYE PENETRATION UPTO 1/4TH PULPAL FLOOR"	Count	0	2
		%	0.0%	6.7%
	SCORE 5 = "DYE PENETRATION UPTO 1/2TH PULPAL FLOOR"	Count	0	2
		%	0.0%	6.7%
	SCORE 6 = "DYE PENETRATION ALONG PULPAL FLOOR"	Count	0	2
		%	0.0%	6.7%
Total	Count	15	15	
	%	50.0%	50.0%	

Table 3: Mannwhitney U test

Mann-Whitney U					
	Group	N	Mean	Std. Deviation	p
Mean Microleakage	EQUIA FORTE	15	0.133	0.351	<0.001
	CENTION N	15	2.533	2.166	



On evaluation, the mean microleakage between two groups was seen to be highest with Cention-N restorations. Equia Forte showed lesser microleakage.

5. Discussion

Restorative dentistry has come a long way from Dr. GV Black’s ‘extension for prevention’ approach and preparation of the retention form for dental amalgam fillings, to the minimally

invasive micro-retention of adhesive composite fillings and chemically bonded restorations such as glass ionomers. In this process, restorative treatment has become more and more patient friendly, while tooth restorations require now less and less removal of healthy tooth structure and are therefore comparatively smaller with a subsequently longer survival time or at least longer re-restoration cycle.

One of the major factors influencing the longevity of any dental restoration is microleakage. Microleakage is defined as the clinically undetectable passage of bacteria, fluids, molecules, or ions between a cavity wall and the restorative material applied to it. Microleakage causes staining at the margins of the restoration, hypersensitivity of the restored teeth, recurrent caries at the tooth/restoration interface, and the development of pulpal pathology [8,9]. Hence, this study was conducted to compare and evaluate the microleakage of alkasite based restorative material with a glass hybrid restorative system.

The present study indicated that there was significant difference in microleakage between two groups i.e. EQUIA forte showed lesser leakage. The advantage of GC EQUIA Forte is an innovative restorative system based on a new glass hybrid technology, which has more voluminous glass fillers of EQUIA Forte Fil were supplemented by smaller, highly reactive fillers that strengthen the restoration. In combination with the EQUIA Forte coat, a composite coating the flexural strength increases by 17% and flexural energy by almost 30%. EQUIA Forte Coat penetrates the surface porosities, thus increasing the strength of the overall EQUIA filling and reduces the microleakage around the restoration [4].

The smaller microleakage scores of EQUIA forte as compared to Cention N can also be attributed to the fact that EQUIA forte is a single component material whereas Cention N requires mixing of the two components. The smaller microleakage scores of EQUIA forte as compared to Cention N might have been due to premeasured capsule of EQUIA forte, which obviated the uncertainties in powder/liquid proportion and allowed the consistent mix of the restorative material.

Cention N includes special patented filler (Isofiller). Isofiller acts as a shrinkage stress reliever minimizing shrinkage forces during polymerization. According to the manufacturer, the shrinkage stress reliever within Cention N acts 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-allowing bulk filling of Cention N. Only minimum literature is available regarding polymerization shrinkage and marginal leakage of Cention N [2,3].

6. Conclusion

Within the limitations of this study, it can be concluded that Glass hybrid restorative system showed lesser microleakage than alkasite based restorative material, thereby having better sealing ability. However, clinical acceptability of glass hybrid restorative systems has to be verified with larger sample size and with in-vivo studies.

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