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Original Research

COMPARATIVE EVALUATION OF MICROLEAKAGE IN CLASS V CAVITY OF VARIOUS TOOTH - COLOURED RESTORATIVE MATERIALS IN HUMAN PERMANENT PREMOLAR TEETH: *AN IN VITRO STUDY.*

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Abstract:

Aim- To compare and evaluate microleakage of various tooth-colored restorative materials in human permanent premolar teeth.

Materials and Methodology-Class V cavities were prepared in 60 freshly extracted teeth. Teeth were randomly assigned into four experimental groups (n = 15). Group 1 -Restored with Equia Forte (GC America), Group 2-Restored with Cention N (Ivoclar Vivadent). Group 3- Restored with Ceram X (Dentsply). Group IV restored with GIC. All the specimens were subjected to thermocycling. Specimens were stained with Methylene Blue Dye and evaluated for dye penetration under stereomicroscope.

Results- According to the results, Group 4 (GIC) exhibited the highest micro leakage followed by Group 3(Ceram X) and then Group 1 (Equia Forte). Least microleakage was shown by Group 2 (Cention N).

Conclusion-All materials showed some microleakage at margin of restoration. However, Group 2 (Cention N) exhibited lowest microleakage.

Keywords-premolars, microleakage, Equia Forte, Cention N.

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Introduction

Over centuries, microleakage between restoration and cavity wall is probably recognized as dentistry's greatest hazard. Microleakage is the chief reason for tooth sensitivity and recurrent caries beneath the restoration, and, therefore, it is the main reason for the failure of treatment and replacement of restorations [1]. Most tooth cavities which are encountered are the result of caries. Pathogenesis of the Class V cavities may occur because of caries, from attack by erosive substances; and/ or by excessive toothbrushing with a hard toothbrush.

Sensitivity, in the presence of a carious lesion or poor aesthetics may result in a patient's request for treatment of a Class V lesion, but the dental practitioner may also consider restoration of such a lesion under the following circumstances:

- To arrest the progress of the lesion.
- To prevent plaque accumulation and the potential onset of caries or periodontal disease.
- As the class V lesion is unaesthetic.
- Where pulpal exposure is likely to happen if the lesion increases in depth.

In class V cavities due to the difficulty of access, selection of a suitable restorative material is a controversial issue.[2] The primary problem associated with the restoration of this kind of cavity is leakage at the gingival margin located in dentin.

Several restorative materials may be used for the restoration of Class V carious cavities or non-carious lesions. Ideal properties of a material for restoration of Class V cavities include:

- Satisfactory resistance to wear caused by tooth brushing.
- Low modulus of elasticity, given that teeth have been considered to flex around their cervical area.
- Good aesthetics.
- Small filler particles for polishability.

GIC offers remarkable advantage of being the only restorative material with a true chemical bond to tooth structure. Unlike adhesive resins (eg Composites) that bond micromechanically to partially demineralized enamel and dentin, GIC bond chemically to mineralized tooth structure through Ion-Exchange mechanism[3].

The new era is the era of nanotechnology, which is being used extensively to produce restorative materials with improved aesthetics, adhesion, and mechanical properties. One of the recent advancements is the Ceram-x, the nanocomposite, which is radiopaque, light curable restorative material being used for restoration of both permanent and primary teeth[4]. But these modern resin composites undergo 2.6 to 7.1% volumetric contraction during polymerization.

Cention N (CN) is an "alkasite" restorative material. CN thus has a chemical bonding to tooth structure[14].Equia Forte is a tooth coloured restorative material that chemically bonds to tooth structure.

Hence, this present study was conducted to evaluate the microleakage in Class V cavity of four different tooth coloured restorative materials i.e. conventional glass ionomer cement [Fuji II GIC (GC Corp., Japan], nanohybrid composite Ceram X (Dentsply),an "alkasite" restorative material [Cention N (Ivoclar Vivadent)] and a glass hybrid restorative system Equia Forte (GC America).

Materials and method:

Sixty exfoliated or extracted permanent premolars were collected. The tooth were cleaned with the help of ultrasonics and were placed in distilled water at room temperature. Tooth have cracks, caries and previous restorations were discarded from the study. Standarized Class V cavity was made on the buccal surfaces of premolars. The dimensions of the preparations were marked with periodontal probe 5 mm length (mesiodistally),2 mm in width (occluso gingivally) and 2 mm in depth.

Fig 1:Dimensions of cavity preparation

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The cavity preparation was done using diamond burs (Mani). Randomly, samples were grouped in 4 experimental groups. **Equia Forte** was used to restore the cavities of Group I.(n = 15) (GC America).The prepared cavities of Group II were then restored with **Cention N** (n = 15) (Ivoclar Vivadent, India). The prepared cavities of Group III were restored with **Ceram X** (n = 15).The prepared cavities of Group IV were restored with **GIC** (n = 15).Then all the restored teeth were subjected to a thermocycling unit of 500 cycles.Dye penetration method was used to assess the microleakage.2% methylene blue dye was used to assess the microleakage.The specimens waere immersed in it for 24 hrs.Microleakage evaluation was assessed with the help of stereomicroscope (20X).

Indication

Scores

No dye penetration score was depicted as 0.
Dye penetration in enamel was depicted as 1.
Dye penetration in dentin was depicted as 2.
Dye penetration extending till pulpal space was depicted as 3.

Results:

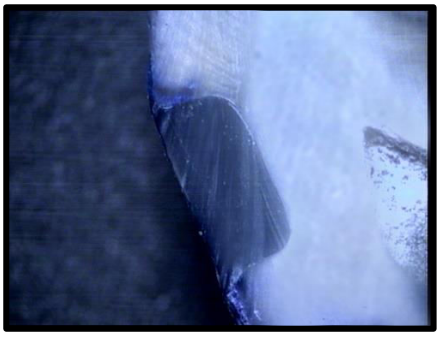

Fig 2-
Score "1": Microleakage in enamel seen in Group I

Fig 3-
Score "0": No Microleakage seen in Group II

Fig 4-
Score "2": Microleakage in dentin seen in Group III

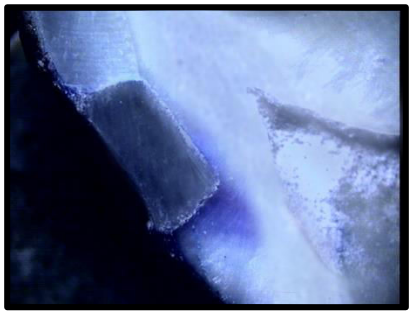

Fig 5-
Score "3": Microleakage extending pulp seen in Group IV

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Under descriptive statistics means with corresponding standard deviations (s.d.) were calculated. Also One Way Analysis of variance (ANOVA) followed by post hoc Tukes Test was performed with the help of Critical Difference (CD) or Least Significant Difference (LSD) at 5% and 1% level of significance to compare the mean values. To compare the means t-test was used. $p \leq 0.05$ was considered statistically significant.

ıltiple Comparisons: Dependent Variable: Microleakage Tukey HSD						
Group	Group	ean Differ-ence J)	l. Error	g. Value	% Confidence Interval	
					wer Bound	per Bound
Group I (Equia	oup II (Cention N)	3	7	9	1	8
Group I (Equia Forte)	oup III (Ceram X)	00*	7	2*	35	5
Group I (Equia Forte)	oup IV (GIC)	533*	7	.001*	08	9
Group II (Cention N)	oup III (Ceram X)	333*	7	<0.001*	88	9
Group II (Cention N)	oup IV (GIC)	067*	7	<0.001*	61	52
Group III (Ceram X)	oup IV (GIC)	33*	7	4*	28	9

*. The mean difference is significant at the 0.05 level.

Discussion

Most tooth cavities which are encountered are the result of caries. While caries does present on the buccal and lingual aspects of teeth, many such defects are not related to bacterial action and have been attributed to erosion, abrasion or abfraction. Performance of restorative material can be evaluated with microleakage. Shrinkage or poor adaptation of restorative material to cavity wall led to the microleakage. Recurrent caries and pulpal diseases are the results of microleakage. A proper marginal sealing is essential to improve the longevity of restorations.

Glass ionomer cement (GIC) is the only tooth-coloured bulk placement, intrinsically adhesive [7]restorative material with several other favourable properties including biocompatibility luoride release, anti-cariogenic property.

Ceram X has Sphere Tec filler technology. But these restorations can still lead to polymerization shrinkage which leads to poor marginal seal, secondary caries, marginal staining, postoperative sensitivity and partial or total loss of restoration[8]. Today, the interest is directed toward the development of new restorative materials that provide minimal microleakage. Cention N and Equia Forte are the new innovative materials.

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The manufactures of these restorative materials claim that they provide adequate seal between the cavity wall and restoration.

It can be hypothesized that Cention N may clinically inhibit caries at restoration margin[10]. Adhesion of Equia has been proposed by two mechanisms. First, bonding with the formation of an ion-exchange layer as seen with conventional GICs and second, bonding with the formation of a modified hybrid zone with the tooth structure. No study was yet conducted to compare the microleakage of two newer restorative materials i.e., EQUIA Forte and Cention N. Hence, this present study was conducted to evaluate and compare the microleakage in Class V cavity of four different tooth-coloured restorative materials i.e. conventional glass ionomer cement [Fuji II GIC (GC Corp., Japan], nanohybrid composite Ceram X (Dentsply), an "alkasite" restorative material[11] [Cention N (Ivoclar Vivadent)] and a glass hybrid restorative system Equia Forte (GC America).

Microleakage testing was done by measuring the degree of dye penetration in restorative margins of Class V cavities using stereomicroscope. The dimensions of the cavity preparations were marked with periodontal probe 5 mm length (mesiodistally),2 mm in width (occluso gingivally) and 2 mm in depth. Then the samples were restored with the four experimental materials according to manufactures instructions.

The most commonly used technique for microleakage is dye penetration. It is better than isotopes due to its better penetrability due to lower molecular weight. Methylene blue dye was used to detect microleakage as its molecular weight is 1nm so it can penetrate easily within the dentinal tubules[12]. Stereomicroscope was used in the study as it is a versatile instrument, and it can reproduce unprecedented depth and sharp images which can be used to detect microleakage of restorative materials.

Stereomicroscope was used to assess the microleakage at 20 x.

0: No dye penetration.

1: Dye penetration between the restoration and the tooth into enamel only.

2: Dye penetration between the restoration and the tooth limited to enamel and dentin.

3: Dye penetration between the restoration and the tooth extending into the pulp chamber.

From this study, it was seen that the mean microleakage was least for Cention N i.e. (0.53),followed by Equia Forte (1.07) and Ceram X (1.87).The mean microleakage was highest for GIC (2.60)

Multiple intergroup comparison by Tukey's post hoc test shows that, there is statistically significant difference between all the groups except for Group I and Group II.

Results show that Group IV (GIC) showed highest microleakage as compared to other 3 materials as moisture is integral to the setting of Glass Ionomer cement.

Hydration or water uptake during setting may compensate for setting shrinkage but causes wash out of calcium and aluminium ions retarding setting and decreasing surface integrity. This leads to the formation of microgaps between the tooth restoration interface leading to microleakage[13].

Ceram X shows less microleakage than GIC but more microleakage when compared to Cention N and Equia Forte. The reasons responsible for microleakage were, modern composite resins undergo volumetric contractions ranging between 2.6% to 4.8 %.

Conventional GIC and Ceram X showed more microleakage than Equia Forte. The mean microleakage between Equia Forte and Cention N was statistically insignificant. Presence of special patented isofiller was responsible for less microleakage.From the above results Cention N, can be considered as an alternative to other restorative material due to its good sealing property, better esthetic compared to the GIC and having good fluoride releasing property.

Conclusion:

From the above result it can be concluded that, Cention N has shown least microleakage followed by Equia Forte, Ceram X and GIC.

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