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A Comparative analysis of the microleakage of three different direct restorative materials amalgam (AA), glass ionomer cements (GIC), and Cention N(CN) in Class II restorations using stereomicroscope

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ABSTRACT

Background: The present study was conducted to compare the microleakage of three different direct restorative materials amalgam (AA), glass ionomer cements (GIC), and Cention N (CN) in Class II restorations using stereomicroscope. Class V cavities were made in thirty intact caries free premolars and restored with restorative materials to be tested respectively. The restored teeth were stored for 24 h in distilled water and thermocycled for 500 cycles between 5°C and 55°C with a dwell time of 30 s in each bath. Samples were immersed in 0.5% basic fuchsin dye for 24 h. The teeth were sectioned along the buccolingual direction. Microleakage was evaluated under a stereomicroscope and data subjected to statistical analysis. The study concluded that out of all the restorative materials, CN a newer restorative material displayed minimum microleakage compared to AA and GICs.

Keywords: Microleakage, glass ionomer cements, restorative materials.

INTRODUCTION

There have been more changes and developments in dentistry over the past decade than in the previous hundred years combined, and the pace is accelerating! In the current age of adhesive dentistry or microdentistry, conservation of tooth structure is paramount. Rather than using extension for prevention as a treatment guideline, emphasis now is placed on restriction with conviction.[1] Microleakage is defined as the clinically detectable passage of bacteria, fluids, molecules or ions between a cavity wall and the restorative materials applied to it and is the major problem in clinical dentistry. Achieving a micromechanical and biomechanical bond between the restoration and tooth is considered effective and a standard procedure in clinical practice.[2]

Numerous direct filling materials are available in the modern dental practice from amalgam (AA) to modern tooth color restorative material. AA materials were first introduced in western dentistry in the 19th century, glass ionomer cements (GICs) were introduced around the 1970s, composites became standard during the 1980s, resin-modified glass ionomers and compomers were introduced in the 1990s and the current decade saw the launch of several new restorative materials.[3]

Cention N (CN) is an “alkasite” restorative material. Alkasite refers to a new category of filling material, which is like compomer or ormocer materials and is essentially a subgroup of the composite material class. This new category utilizes an alkaline filler, capable of releasing acid-neutralizing ions.[4]

The advent of new restorative materials, together with new adhesives has brought enormous benefits notably in terms of esthetics and strides toward

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minimally invasive dentistry. They may, however, be perceived as expensive, time-consuming, and technique-sensitive. Their existence has not eliminated the need of traditional "basic" dental materials.[5] This in vitro study compared marginal microleakage in Class V cavities restored with AA, GIC, and CN. Microleakage of occlusal and gingival margins of Class V cavities were evaluated using stereo microscope.

Materials and Methods: Thirty caries free premolars extracted for orthodontic purposes were selected for the study to evaluate the microleakage. The teeth were examined by transillumination to exclude teeth exhibiting enamel fractures as these might allow dye penetration. Then, the teeth were immersed in 2.6% sodium hypochlorite solution and rinsed with running water for 10 min. Each steps were evaluated by a calibrated evaluator.

Cavity preparation: Standard Class V cavities were prepared with an ISO size (No.014) inverted cone and straight fissure (No.010) bur 1.5 mm oclusally from the cemento-enamel junction. The bur was changed after every five specimens. Cavity size was standardized to a size of 3x2x2 mm dimensions. All preparations were carried out with high speed air rotar with water spray coolant by the same operator. Following cavity preparation, All the prepared samples were divided into 3 experimental groups, with 10 teeth in each group according to the restorative material used: Group I-silver AA; Group II-Type II GIC; and Group III-CN.

MATERIALS AND METHODS

The restored teeth were stored for 24 h in distilled water and thermocycled for 500 cycles between 5°C and 55°C with a dwell time of 30 s in each bath. All tooth surfaces were covered with two coats of clear nail polish with the exception of 1 mm around the tooth-restoration margins and allowed to air dry. Samples were immersed in 0.5% basic fuchsin dye for 24 h. The teeth were sectioned along the buccolingual direction, coincident with the center of the restoration mesiodistally, with a sectioning diamond disc under water spray from chip syringe. The dye penetration of the occlusal and gingival margins of each section was evaluated independently by the observer using a stereo-microscope (Olympus, F. No. 19-34/2008-RE) at a magnification of 22.5× The leakage number was taken from the following ratio:

Leakage Number =Distance evidenced for dye/ Overall distance determined for margin

The leakage distance from the margins to the determined limit was recorded in mm, and the leakage number was a result of the proportion of dye leakage as shown in table1:

Table 1: Score criteria of microleakage

SCORE	Tooth-restoration interface	Score criteria (proportions)
1	no dye penetration	0.00
2	dye penetration up to the first-third of the prepared cavity wall	0.25
3	dye penetration up to the second-third of the prepared cavity wall	0.50
4	dye penetration into the entire prepared cavity wall	0.75
5	dye penetration into the entire prepared cavity wall and the pulpal wall	1.0

Descriptive statistical analysis was performed to calculate the means with corresponding standard deviation. Furthermore, one-way analysis of variance followed by post hoc Tukey's test was performed with the help of critical difference (CD) or least significant difference at 5% and 1% level of significance to compare the mean values. $P < 0.05$ was taken to be statistically significant.

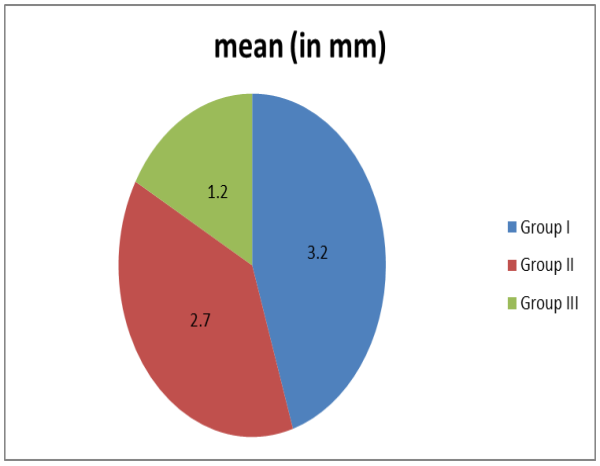

Fig 1: Mean of three groups.

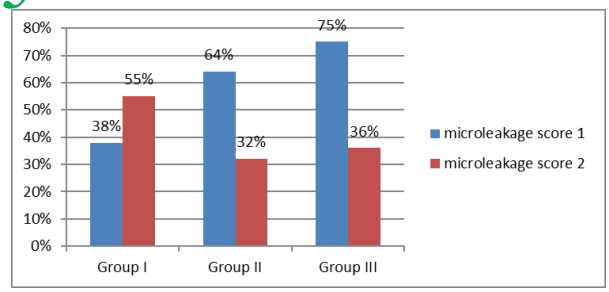

Fig 2: Distribution of microleakage score of different restorative materials.

RESULTS

According to the Statistical Analysis, lower microleakage scores were observed in CN and GIC. Higher microleakage scores were observed in silver amalgam.

1. The mean microleakage score of Group I is higher compared to other groups, and the mean microleakage score of Group III is lowest compared to other groups.

2. As per the CDs, the mean microleakage score of Group III is significantly lower than Group I and Group II (P = 0.05). The P value is not falling into the confidence interval [Figure 7]

3. At an individual level, there is no significant difference in the mean microleakage scores of Group I and Group II. The P = 0.17 which is in the confidence interval of (P > 0.05)

4. At an individual level, there is a significant difference in the mean microleakage scores of Group II and Group III. The P = 0.02 which is not in the confidence interval of (P > 0.05)

At an individual level, there is a significant difference in the mean microleakage scores of Group I and Group III. The P = 0.005 which is not in the confidence interval of (P > 0.05).

Microleakage is still a concern in restorative dentistry, as it has been related to pulp alterations, sensitivity, and secondary caries, which are the most common causes of restoration failure. Currently, no outstanding method is available to determine microleakage. Despite the limitations, dye leakage methodology remains a popular tool to investigate the sealing ability of restorative materials, due to its low cost and the technique being very simple.[4]

Microleakage refers to the leakage of tiny amounts of fluids and debris in the space between a dental restoration (cement or adhesive) and the tooth (cavity wall) at the surface. Linked to poorly fitting restorations, it may or may not be clinically detectable and is one of the most important reasons for recurrent caries and pulpitis. Marginal microleakage should be considered in the evaluation of a restorative material because it has been directly related to the success or failure of the restorations.[6]

GICs exhibited the lowest leakage in cementum/dentin margins; similar to findings previously reported. The better performance could be attributed to the high dimensional stability of the material lower thermal conductibility and chemical adhesion to dentin.[7]

CN is a tooth-colored, basic filling material for direct restorations. It is self-curing with optional additional light-curing. It is commercially available and consists of a separately packaged powder and liquid that are mixed by hand directly before use.[8] Only disadvantage is that it is available in only one shade. Minimizing shrinkage stress is particularly important in a full volume replacement material that is applied in bulk. CN, therefore, contains a shrinkage stress reliever with a low modulus of elasticity.[9]

CONCLUSION

All the restorative materials used in the study were unable to prevent the microleakage completely. Out of all the restorative materials, CN a newer restorative material displayed minimum microleakage compared to AA and GICs.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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