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RESEARCH ARTICLE

COMPARATIVE EVALUATION OF MICROLEAKAGE IN DIFFERENT RESTORATIVE MATERIALS AN INVITRO STUDY

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Abstract

Introduction: Microleakage is one of the most frequent cause behind a restoration failure. Numerous advancements in restorative materials and placement techniques have been made to overcome this problem.

Aim And Objectives: The purpose of this study is to evaluate the microleakage of three different restorative materials with different chemical structure and to determine which among the three has more sealing ability.

Materials And Methods: Thirty extracted mandibular 3rd molars were stored in distilled water and standardized class 1 cavity preparation was done. All the 30 samples were divided into 3 experimental groups GROUP I (GIC), GROUP II (ORMOCER), GROUP III (CENTION N) 10 sample in each group. Teeth were buccolingually sectioned in two halves and immersed in 2% basic fuchsin dye and micro leakage was assessed under stereomicroscope.

Results: IN our invitro study the highest microleakage was observed in GIC (1.5 ± 0.849) followed by Cention n (0.7 ± 0.6749) and Ormocer (0.3 ± 0.483) respectively. Significant difference was observed in group I and group II with p value of 0.0005.

Conclusion: Better sealing ability were observed in Ormocer > Cention-n > GIC.

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Introduction:-

One of the most common factor involved in loss of tooth structure is dental caries that impairs shape, function and aesthetics of the affected tooth¹. Tooth damaged with dental caries can be corrected with restorative materials¹. To choose the most reliable restorative material the clinician has to take in consideration many factors like biological, optical, mechanical and manipulative properties². Despite newer innovations and advances in various restorative materials micro leakage is still a concern for a clinician as it determine longevity of a restorative material in oral cavity.^{2,3} Eccentric mechanical loading and axial loading induce more tensile stress at tooth restoration interface and can also lead to increase in microleakage. Ist molar have to bear more mechanical loading. Also, type of restorative material also affects the micro leakage⁴. Newer Restorative materials have proven to decrease the micro leakage and increase the marginal integrity at the tooth restoration interface. GIC bonds to tooth structure chemically and has thermal properties similar to tooth structure⁵. Cention is a new tooth colored aesthetic material. It belongs to a subgroup of composite material class. It has properties of amalgam and GIC¹. Ormocer—the acronym of organically

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modified non-metallic inorganic composite material. This new class of material combines the surface properties of the silicones, the toughness of the organic polymers and the hardness and thermal stability of ceramics⁶. Our present invitro study aims to compare the marginal leakage of GIC,Ormocers and Cention Cement in Class I restoration of permanent molars.

Aim:-

To evaluate the micro leakage of three different materials having different physical and chemical properties GIC,Ormocers and Cention.

Objectives:-

1. To evaluate the die penetration depth for GIC,Ormocer and Cention in class 1 cavity in permanent molars.
2. Comparative evaluation of microleakage in GIC,Ormocer and Cention in class cavity in permanent molars.

Materials And Armamentarium:-

1. 30 MANDIBULAR SOUND 3RD MOLARS WITH NO CARIES OR RESTORATIONS
2. GLASS IONOMER CEMENT (FUJIFILM 2 GIC)
3. CENTION - N (IVOCLAR VIVADENT)
4. ORMOCER (ADMIRA FLOW, VOCO, Cuxhaven, Germany).
5. 2% BASIC FUSCHIN DYE
6. DISTILLED WATER
7. STEREOMICROSCOPE

Methodology:-

1. Freshly extracted teeth were immersed in 2.6 % of sodium hypochlorite solution and rinsed with running water for 10 minutes.
2. A standardized class 1 cavity preparation was made involving occlusal surfaces using 245 carbide tungsten bur in a high speed air-rotor hand piece.
3. All the prepared samples are divided into 3 experimental groups with 10 teeth in each group according to the restorative material used.
1. GROUP I-TYPE II GIC (FUJIFILM 2 GIC) was placed in prepared cavity with the help of plastic filling instrument.
2. GROUP II- ORMOCER (ADMIRA FLOW, VOCO, Cuxhaven, Germany) was placed in prepared cavity with the help of composite filling instruments and according to manufacturer's instructions.
3. GROUP III- CENTION - N (IVOCLAR VIVADENT) was placed in cavity and condensed with the help of condenser.
4. Teeth were stored in distilled water for 24 hrs.
5. The specimens were then prepared for dye exposure.
6. Each tooth was covered in nail polish excluding an area approximately within 1mm of periphery of the restoration.
7. Apices of the teeth are covered with modelling wax to prevent die extrusion through the root apices.
8. The dye was removed and samples were thoroughly cleaned and rinsed under tap water until all the dye was removed from the surface.
9. After that samples were mounted in self-curing acrylic blocks and sectioned buccolingually through the center of the restoration with a low-speed diamond saw.
10. The teeth were then examined under stereomicroscope (16X magnification) to measure the depth of the dye penetration at the two surfaces of the cavity.
11. The score which was higher was given as a score to the particular tooth.

All the scoring was carried out by a single person and the scoring criteria used for the study is as follows:

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 into enamel and dentin.

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

Results:-

According to statistical analysis, lower micro leakage score were observed in group II ormocer and group III cention N. Higher microleakage scores were observed in group I GIC.

1. The mean micro leakage score of group I is higher compared to other groups, and the mean microleakage score of group II is lowest compared to other groups (TABLE 2).
2. As per the scores the mean microleakage score of group I is significantly higher than group II ($P=0.0005$). ($p < 0.05$). TABLE 3
3. There is no significant difference in the mean microleakage scores of group I and III ($P = 0.0792$) which is in the confidence interval of ($p > 0.05$) (TABLE 3).
4. There is no significant difference in the mean microleakage score of group II and III ($P=0.3809$) which is in the confidence interval of ($p > 0.05$) (TABLE 3).

Table No.1:- Experimental groups.

GROUP I(GIC)	GROUP II(ORMOCER)	GROUP III(CENTION-N)
2	0	1
1	1	0
1	0	2
3	0	1
2	1	0
0	0	1
1	0	1
2	0	0
1	1	1
2	0	0
14	3	7

Table 2:-

Groups	Mean	SD
Group I	1.5	0.849
Group II	0.3	0.483
Group III	0.7	0.6749

SD; standard deviation.

Table 3:- Comparison Of Mean Value Of Microleakage.

Test	Group I VS II	Group I VS III	Group II VS III
t-score	3.67	2.058	1.309
p-value	0.0005	0.0792	0.3809

$P < 0.05$; test used: student t test.

Discussion:-

Microleakage is still a big concern for clinicians as it results in pulp alterations, sensitivity and secondary caries which are the most common causes of restoration failure (Manhart et al, 2004). There are various methods to assess microleakage of different restorative materials, dye leakage method is very common and widely accepted due to its low cost and simplicity⁷.

In our present in-vitro study we evaluated the microleakage of three different restorative materials (GIC, ORMOCERS, CENTION –N) with different bonding mechanism with the tooth structure using dye penetration method. Our results showed highest microleakage and less sealing ability with GIC followed by Cention –N and least with ORMOCERS with the significant difference in microleakage between Group I (GIC) and Group II (Ormocer) p-value (0.0005).

Our study demonstrate less microleakage of Cention-N as compared to GIC which is in accordance with the study conducted by Mazumder et al where he found minimal microleakage with the cention-n when compared with GIC and composite.

Similarly another study done by George et.al also reported lower microleakage with Cention-n as compared to GIC which is in accordance with our findings.⁸ Higher microleakage with GIC could be attributed to its higher viscosity whereas the lower microleakage of cention –N could be related to its structure. Cention-N exhibits a high polymer network density and degree of polymerization over the complete depth of the restoration due to the use of cross-linking methacrylate monomers in combination with a stable, efficient self-cure initiator. It also includes special filler (Isofiller) which acts as a shrinkage stress reliever minimizing the shrinkage force which is responsible for the low volumetric shrinkage leading to less microleakage.¹

In our study the least microleakage was observed in ormocer which may be possibly due to three –dimensional structure and low modulus of elasticity exhibited by Ormocers that are responsible for the reduced polymerization shrinkage. Our findings are in agreement with the study done by Gunjunyadav et.al who reported least microleakage with ormocers and highest with respect to Giomer.⁶

There is no significant difference in microleakage of ormocer and Cention N as both are the subgroup of composite.⁹

Limitations of the present in-vitro study are:

1. The results obtained in our study is not correlated to actual clinical scenario such as mechanical loading that can lead to variations in microleakage.
2. The results obtained from the microleakage evaluation of ormocer and cention n could not be compared with the other studies owing to lack of literature comparing these two.
3. Operator skill can be the other factor that can lead to variation in the actual values.

Conclusion:-

Following conclusion are obtained from the study:

1. Ormocer can be considered as a good restorative material having good sealing ability.
2. The microleakage scores of GIC, Cention N and Ormocers can be summarized as :GIC >Cention n >Ormocer.

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