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Assessment of Microleakage for Conventional GIC, Ormocer and Cention N restorative materials

Running title: Microleakage of GIC, Ormocer and Cention N restorative materials

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Abstract

***Objectives*:** Assessment of micro leakage for conventional GIC, ormocer and cention N restorative materials

***Materials and method*:** In this research, class I cavities were prepared on 48 human premolars. Samples were divided into 3 groups of 12 samples in each group as; Group 1- Conventional GIC, Group 2- Cention N, and Group 3-ormocer restorative materials. Samples were then dried and thermocycled. 2% Methylene blue was used to colour the teeth. After being longitudinally sectioned, every tooth was microscopic examined.

***Result*:** The mean micrleakage score for conventional GIC, cention N and ormocer was 2.24±1.349, 3.45±0.675 and 1.12±0.357 respectively. Mircoleakage was found least in ormocer group and maximum in Cention N group ($p<0.001$).

***Conclusion*:** We found highest microleakage with Cention N followed by conventional GIC and least with Ormocer.

Keywords Cention N, Ormocer, microleakage, restorative materials

Introduction

The most prevalent dental condition is still dental caries. It can be repaired using a variety of repair materials. Recent developments in restorative dentistry have limited the extent of cavities to those that are only minimally invasive. Even though restorative materials are constantly improving, problems like marginal microleakage still exist. Microleakage is the clinically untraceable movement of particles, liquids, molecules, or ions between the surface of a cavity wall and the restorative material that has been applied to it.[1] For the longevity of restorative material, a good marginal seal and better bond strength are crucial.[2]

Due to its simplicity of use and acceptable aesthetics, conventional glass ionomer cement (GIC) is frequently used for tooth restoration. With time, GIC has undergone significant development. GIC's use is nevertheless constrained in some clinical settings due to their low physical properties and reduced wear resistance. [1]

Initially, it was believed that traditional restorative materials were both biocompatible and biologically inert. Ormocers, Cention N, and bioactive materials were developed in the search for a better restorative material. The term "organically modified ceramics" is abbreviated as "Ormocers." Silicones, organic polymers, and ceramic glasses are some of the

basic components of this substance. The universal nanohybrid ORMOCER® restorative material Admira Fusion x-tra by Voco, Germany, represents a recent development in the field of ormocers. [1]

Microleakage is still a significant contributor to restoration failure. It is the starting point for secondary caries, pulpal pathology, postoperative sensitivity, staining of restorations, and tooth discoloration.[1] In order to evaluate the microleakage of conventional GIC, ormocer, and Cention N restorative materials, this in vitro study was conducted.

Materials and method

This in vitro experiment was carried out between February 2019 and November 2020. A high-speed airotor hand piece was used to prepare Class I Cavities after cleaning the chosen nonpathologic teeth.

The teeth were then divided into 3 categaries based on the restorative material, Group A-Conventional GIC, Group B-cention N, and Group C-Ormocer, using a straightforward randomization technique. All repairs were done in accordance with the manufacturer's instructions. All samples were color-coded by the operator. Then, thermicycling in a water bath was performed on all of the repaired teeth. The samples were then placed in 2% Methylene blue dye for 24 hours to prepare them for evaluation of microleakage of restorative materials.[1,3] They spent the next five minutes submerged in water. The samples were longitudinally sectioned in the mesio-distal direction, parallel to the centre of the restoration, using a slow-speed, water-cooled diamond disc. With the aid of a microscope, the dye penetration was assessed. The acquired information was statistically assessed.

Result

The mean micrleakage score for conventional GIC, cention and ormocer was, 2.24±1.349, 3.45±0.675 and 1.12±0.357respectively. Mircoleakage was found least in ormocer group and maximum in Cention N group ($p<0.001$) (Table 1).

Discussion

The microleakage at the interface of tooth-restoration is the most typical issue with restorations. Marginal gaps between the cavity wall and the restoration are caused by a number of factors, including inadequate adhesion, inadequate moisture control, polymerization shrinkage, and incomplete removal of the smear layer. [1]

The goal of the present research was to assess and contrast the microleakage of conventional GIC restorative materials, ormocer, and Cention N. In this study, Class I restorations were used to assess microleakage. We discovered that conventional GIC had the maximum microleakage, followed by Cention N, and Ormocer had the lowest.

Jain et al. compared the microleakage of bioactive, ormocer, and traditional glass ionomer cement (GIC) restorative materials. They discovered that bioactive restorative materials had the lowest microleakage. [1]

A brand-new hybrid dental composite called Ormocer is made up of organic, inorganic, and polysiloxane components. When compared to traditional composite resins, this material exhibits the least amount of polymerization shrinkage (1.25% by volume) and extremely low shrinkage stress. [1]

In premolar teeth treated with nano-composites using Cention N and Hydroxyapatite reinforced Glass ionomer cement as a base, Albadah and Khan evaluated microleakage in class one cavities. They came to the conclusion that Nanocomposite was the base material that showed the most microleakage, followed by Cention N. The least amount of microleakage was seen in GIC with hydroxyapatite as the base material. [4]

El Halim measured the shear bond strength of the nano-composite and adhesive versions of the activa bioactive restorative. Bioactive composite with adhesive came in second to nanocomposite in terms of shear bond strength, while bioactive composite without adhesive displayed the lowest shear bond strength value.[5]

The bilayered restorative technique continues to have issues with polymerization shrinkage and the resulting microleakage. A problem with the bonding between the restorative material and the substrate is what causes shrinkage. [6]

Panchal et al. analyse the impact of two self-adhesive composite resins on shear bond strength and microleakage. They came to the conclusion that there were significant differences between the Prime fill flow and Dyad flow in terms of in vitro microleakage and shear bond strength. [3]

Raju et al. assess and compare the shear bond strength and microleakage of glass ionomer cement (Fuji IX GP) and tricalcium silicate-based restorative material (Biodentine) in primary and permanent teeth. They came to the conclusion that tricalcium silicate-based restorative material (Biodentine) displayed less microleakage than the glass ionomer cement (Fuji IX GP).[2]

Alkhudhairy and Ahmad determined that flowable and fiber-reinforced composites have better shear bond strength and microleakage properties than other bulk-fill restorative materials such as Surefil (SDR), Biodentine, and Ever X posterior. [7]

However, the Cention N restorative material showed higher microleakage in the current study. This could be caused by a number of things, including insufficient fusion of the restorative material with the tooth tissue, polymerization shrinkage, and air entrapment during placement. To confirm the findings, additional research is required.

Conclusion

Ormocerfound to be good restorative materials with lowest microleakge compared to cention N and conventional GIC.

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Tables

Table 1: Mean Microleakage score

Groups	**Mean±SD**	**p**	**F Anova**
Group I- conventional GIC	2.24±1.349	0.001	22.915
Group-II- Cention N	3.45±0.675		
Group III- Ormocer	1.12±0.357		