

MICROLEAKAGE AND SHEAR BOND STRENGTH EVALUATION OF ZIRCONIA REINFORCED GLASS IONOMER RESTORATIVE IN PRIMARY MOLARS (IN VITRO STUDY)

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INTRODUCTION

There has been continuous interest by researchers to improve the biomechanical properties of glass ionomer cements (GICs). The inclusion of zirconia fillers in the glass component of GICs developed a high strength restorative material known as Zirconomer Improved (ZI).⁽¹⁾ The success of this new restorative material depends on its marginal seal and good adhesion with tooth dentinal surfaces.⁽²⁾ The study aimed to evaluate in vitro, the microleakage and dentin shear bond strength (SBS) of zirconia reinforced glass ionomer restorative ZI compared to resin modified glass ionomer cement (RMGIC) (Fuji II LC) in restoration of primary molars.

METHODOLOGY

A total of twenty-eight primary molars were included in the study. The teeth were allocated randomly into four equal groups (n=7) according to the evaluation method and type of applied GIC. For microleakage test, standardized class v cavities were prepared on the buccal surfaces of each molar. In group I (test) ZI was applied, while in group II (control) RMGIC was applied. Specimens were thermocycled for 500 cycles, immersed into methylene blue dye for 24 hours, sectioned and examined under a stereomicroscope.⁽³⁾ Quantitative assessment was done by recording the distance of stain penetration at gingival and occlusal margins. It was assessed as percentage based on the following formula:

Microleakage percentage % = depth of dye penetration (mm) / cavity depth (mm) x 100.⁽⁴⁾

For SBS test, specimens with 3 mm diameter in group III and group IV were mounted on a Universal Testing machine to assess SBS by measuring the force required to cause debonding. After debonding, each specimen was examined using a stereomicroscope to determine the failure modes.⁽⁵⁾

RESULTS AND DISCUSSION

Using Mann Whitney U test, the difference in microleakage scores was not statistically significant (p=0.06). Using independent t test, there was statistically significant difference between both group (P=0.01) with the test group ZI showing higher dye penetration percentage.

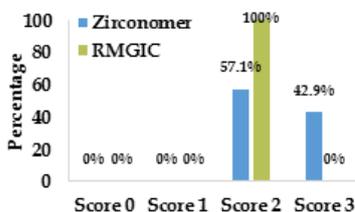


Fig (1): Microleakage scores

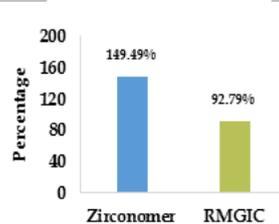
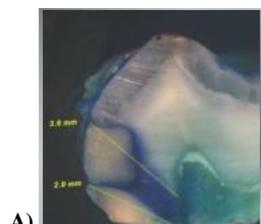


Fig (2): Microleakage percentage



A) Score 3 in group I (test group)



B) Score 2 in group II (control group)

Fig (3): Microleakage scores.

Using independent t test, there was a significant difference (P=0.04) with the control group RMGIC showing higher SBS. Regarding the mode of failure, there was no significant difference between the two groups according to chi square test (PMC=0.59).

Table 1: Shear bond strength and mode of failure in the two study groups.

	Group III (ZI)	Group IV (RMGIC)	
	Mean ± SD		
Shear bond strength	1.47 ± 0.13	2.10 ± 1.06	T- test p value P= 0.04*
Mode of failure	N (%)		Chi-square (X ²) P value
Adhesive	5 (71.4%)	3 (42.9%)	X ² = 1.17 P _{MC} = 0.59
Cohesive	0 (0%)	0 (0%)	
Mixed	2 (28.6%)	4 (57.1%)	

*Statistically significant at p value <0.05

X²: Chi-square test

PMC: Monte Carlo corrected p value

The high dye penetration percentage in test group ZI was related to the presence of zirconia fillers in the structure of Zirconomer which resulted in poor adaptation of the restorative material to the tooth surface. It was believed that the ceramic particles present in the chemical composition of Zirconomer would interfere in the chelating reaction that takes place between the carboxylic group (-COOH) in polyacrylic acid structure and the calcium ions (Ca²⁺) present in tooth structure.⁽⁶⁾ The high values of SBS of RMGIC was explained by the dual mechanism of adhesion including, dynamic ion exchange and micromechanical bonding. Other explanation is the presence of hydroxyethyl methacrylate (HEMA) in composition of RMGIC which is characterized by its higher wetting ability to penetrate the exposed collagen network causing micromechanical retention.⁽⁷⁾

CONCLUSION

Zirconia reinforced glass ionomer restorative demonstrated higher leaking and less retention than resin modified glass ionomer cement in restoration of primary molars.

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