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A Comparative Evaluation of EQUIA Forte Microleakage Versus Resin-Modified Glass Ionomer

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ABSTRACT

Purpose: The purpose of this invitro study was to compare between micoleakage of EQUIA Forte and resin modified glass ionomer cement in primary and permanent teeth. **Materials and methods:** Class V cavity preparation was done on the labial surface of 45 primary anterior teeth and 45 premolars. Teeth were then grouped and restored with EQUIA Forte, Fuji II LC, or Riva light cure. The microleakage at tooth restoration interface was done using dye penetration test with methylene blue. The score of dye penetration depth at the occlual and cervical margins was recorded using stereomicroscope. **Results:** Occlusal and cervical segments of primary and permanent teeth showed that the highest scores were recorded in Fugi II LC, followed by Riva light cure, while the lowest scores were recorded in EQUIA Forte. Chi square test revealed a significant difference between restorative materials (p=0.00). **Conclusion:** Among the three restorative materials, EQUIA Forte can be considered as the best material in the term of microleakage. Periodic evaluation is advised when any of the three materials are used in clinical practice.

KEYWORDS

EQUIA Forte, Fuji II LC, methylene blue, microleakage, Riva light cure.

INTRODUCTION

Carious deciduous teeth demand restorative materials which will remain functional in the oral cavity until teeth exfoliation. The search for restorative materials that need less procedural steps, faster setting time and less cost is very important while dealing with children. As glass ionomer cements require less steps and setting time, so they are the most common used restorations for primary teeth [(1)]. Marginal leakage at the tooth/restoration interface is considered a major factor affecting the durability of dental restorations. It may cause discoloration, recurrent

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caries at the tooth/restoration interface, breakdown of the restorations margins, hypersensitivity of restored teeth and subsequent pulpal lesions. For many years, it was clearly known that conventional restorations and techniques resulting in restorations without complete marginal seal, and numerous studies approved that leakage of fluid would occur at tooth/restoration interface. This marginal leakage has been considered as an important factor in the etiology of dental pulp inflammation after the insertion of dental restorations [(2)].

The newly introduced highly viscous glass ionomer cement (EQUIA Forte [GC America]) relied on success of the previous version of this system. The improvements of this new system allow its use unrestrictedly for Class I and II stress-bearing cavities.

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EQUIA Forte also provides better physical and mechanical properties as high flexural strength, high fluoride release, and high acid and wear resistances.

The upgraded EQUIA Forte Fil has added micron sized fluoroaluminosilicate fillers to the standard one. The addition of these highly reactive fillers leads to release more fluoride and metal ions and improves the physical properties of the set material. Another modification includes a light-cured, nano-filled resin coating (EQUIA Forte Coat). This updated coat have a new very reactive multifunctional monomer that has more wear resistance, thinner film layer and adds lustrous smooth surface to the final restoration[(3)].

MATERIALS AND METHODS

In this study, three restorative materials were used:

EQUIA Forte fil and coat, Fuji II LC, And Riva light cure.

1- Teeth selection:

Forty five exfoliated or extracted primary anterior teeth and forty five extracted premolars (were extracted for orthodontic reason age range (14-25years) were collected for this experiment, with consent from the patient's parents and approved by Ethical and Research Committee of Al-Azhar University. The teeth were washed with water to remove blood and scaled with scaler to remove attached periodontal tissue, plaque and calculus, then stored in thymol at room temperature and used within one month.

Inclusive criteria: Non carious teeth without any visible cracks and fractures on the surface.

Exclusive criteria: Any tooth that has any surface defects, caries, restoration, or enamel cracks was discarded.

2- Teeth preparation:

Preparation of standardized rounded class V cavities was done on the buccal surface of the selected teeth. The occlusal margins of the cavities were placed in enamel while the cervical margin was located in dentin/cementum with high speed hand piece (W&H, Austria) under coolant and was prepared just by inserting the entire head of the bur. An endodontic file stopper was placed at the termination of the bur head to control the depth. The bur was replaced every 10 preparations. For primary teeth: round bur #5 was used and the depth of the cavity was 1.5mm. For premolars: round bur #7 was used and the depth of the cavity was 2mm. No bevel was made at any of the enamel margins of the prepared cavities. The prepared teeth were stored at room temperature in distilled water until being used within one month.

3- Teeth grouping:

Samples were divided into: (n=45)
G1: primary teeth.
G2: permanent teeth.

Each group was further subdivided into three subgroups according to the material used into: (n=15)

R1: teeth restored with EQUIA Forte.
R2: teeth restored with Fuji II LC.
R3: teeth restored with Riva light cure.

4- Application of restorative materials:

Materials were supplied in capsules, mixed using amalgamator (ADM 9002, Germany) as recommended by the manufacturer and immediately applied in the cavities as a single layer using the Aplicap Applier (3M ESPE dental products, USA). In all cavities, the capsule nozzle started extrusion of restoration at the deepest part of the cavity to avoid incorporation of air bubbles.

A. Application of EQUIA Forte:

The material was applied to the prepared cavities of groups G1R1 and G2R1, allowed to set freely for 5 minutes, a plastic instrument was used to remove the excess immediately after restoration insertion, finishing was done using super fine finishing diamond then a layer of coat was applied to the restoration surface. Light curing for the coat for 20 sec. was done using a light-emitting diode (LED) curing unit (woodpicker).

B. Applicaton of RMGICs:

The material was applied to the prepared cavities of groups G1 (R2&3) and G2 (R2&R3) contoured, light cured for 20 sec., and then finishing was done.

5- Thermocycling:

After 24 hours storage of teeth in distilled water, thermocycling was done at 5°C and 55°C for 500 cycles with a dwell time of 25 s and 10 s transfer time between baths.

6- Immersion in dye:

The marginal sealing of the restored teeth was assessed using dye penetration method. Sealing of the root apices was done using wax after thermocycling, and two layers of nail polish were coated on teeth 1 mm away from the restoration margin. Teeth were then dipped in 2% methylene blue dye. After 24 hours of immersion at room temperature, teeth were removed, washed under copious water for 10 minute to remove excess dye then left to dry for 6 hours until dye fixation.

7- Microleakage assessment:

Each tooth was sectioned vertically in a buccolingual direction through the center of the restoration into two halves using a diamond disc (Brown Alumina Oxide, Henan Tianze Imp. And Exp.) with a low speed straight hand piece (Allowable max. speed 40,000 rpm weight 48g. NSK, Japan) under coolant water spray. One section of each tooth was carefully cleaned with alcohol to remove the cutting debris to be examined under stereomicroscope.

8- Stereomicroscope evaluation:

The extent of the leakage was assessed using stereomicroscope at 40X magnification; a photographic record for each specimen was obtained and the degree of dye penetration was scored. The following Scoring criteria were used to assess the microleakage at the interface between the tooth and restoration.

Scores

Indication

0 No dye penetration.
1 Dye penetration reaching the enamel .
2 Dye penetration reaching the dentin.
3 Dye penetration reaching the floor.

Statistical analysis:

Statistical analysis was performed using SPSS program. As data related to microleakage score was expressed as number and percent. Chi square test was used for comparisons.

The level of significance was set at $P < 0.05$.

RESULTS

In Occlusal segment of primary and permanent teeth, the highest scores were recorded in Fugi II LC, followed by Riva light cure, while the lowest scores were in EQUIA Forte. Chi square test revealed a significant difference between restorative materials (p=0.00).

In cervical segment of primary and permanent teeth, the highest scores were recorded in Fugi II LC, followed by Riva light cure, while the lowest scores were in EQUIA Forte. Chi square test revealed a significant difference between restorative materials (p=0.00), (Table 1, Fig.1&2)

Table (1): *Comparison of Microleakage score in different restorative materials in primary and permanent teeth.*

Tooth segment	Restorative material	Score 0	Score 1	Score 2	Score3	X^2	P
Occlusal Primary	EQUIA Forte	15 (100%)	0	0	0	53.8	0.00*
	Fuji II LC	0 (0%)	5(33.3%)	3(20%)	7(46.7%)		
	Riva light cure	3 (20%)	12(80%)	0	0		
Cervical Primary	EQUIA Forte	15(100%)	0	0	0	60	0.00*
	Fuji II LC	3 (20%)	3(20%)	9(60%)	0		
	Riva light cure	0	15(100%)	0	0		
Occlusal Permanent	EQUIA Forte	15 (100%)	0	0	0	38.87	0.00*
	Fuji II LC	7(46.7%)	5(33.3%)	3(20%)	0		
	Riva light cure	0	15(100%)	0	0		
Cervical permanent	EQUIA Forte	15 (100%)	0	0	0	38.9	0.00*
	Fuji II LC	0	8 (53.3%)	0	7(46.7%)		
	Riva light cure	6 (40%)	9 (60%)	0	0		

*Significance level P<0.05, *significant*

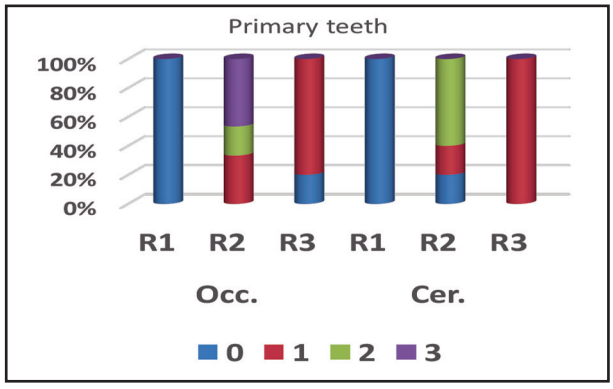

Figure (1) Column chart showing percentage of microleakage score in different restorative materials in primary teeth.

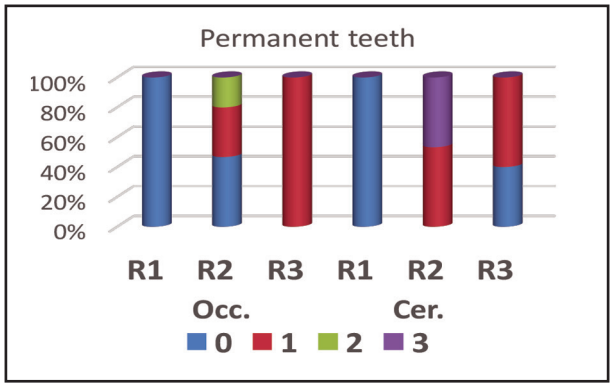

Figure (2) Column chart showing percentage of microleakage score in different restorative materials in permanent teeth.

DISCUSSION

The results of this study showed that EQUIA Forte was the only restoration that inhibited microleakage at both occlusal and cervical margins, while in both Fuji II LC and Riva light cure higher leakage was detected .This was in agreement with another study [4] who found that EQUIA showed less microleakage than RMGICs. This might be due to that the coefficient of thermal expansion of EQUIA is similar to that of adjacent tooth structure, which could be a reason for less microleakage observed in EQUIA as compared to Fuji II LC , while the coefficient of thermal expansion being quite high as compared to tooth structure for the latter [5].While in another study [6] the EQUIA system showed results very similar to resin modified glass ionomer, and this might be due to the fact that it compared other types of RMGICs (Ketac Molar and Photac Fil) with EQUIA system in class I cavities and without thermocycling.

By comparing the occlusal margin scores of both teeth, significant differences among the three tested restorations were found. The lowest scores were in EQUIA Forte, followed by Riva light cure, while the highest scores were in Fuji II LC. This could be resulted from polymerization shrinkage that occurs in light cured resin modified glass ionomer cements. Polymerization shrinkage develops within 5 minutes after curing and continues for the next 24 hours .This shrinkage resulted in contraction stress which can break the adhesive interface and create marginal gaps [7].

In cervical segment of both primary and permanent teeth there was a significant difference between restorative materials. The lowest scores were in EQUIA Forte, higher scores were recorded in Riva light cure while the highest scores were in Fuji II LC. RMGIC's showed higher leakage scores at the cervical margin than the occlusal margin which was significant in Fuji II LC and non significant in Riva light cure. This was in agreement with a previous study [5].

These higher leakage scores was detected in cervical margin which is located at dentin-cementum, compared to occlusal margins located at enamel that could be related to the difference in components of enamel and dentin-cementum. Bonding to enamel differs than bonding to dentin as enamel is composed of about 90% inorganic components, while dentin contains a considerable amount of collagen fibers and water, therefore dentin has lower bonding strength than enamel [8]. It was also shown that significant polymerization shrinkage and surface hardening could occur after initial photo curing of the resin and more contraction continues for the first 24 hours as the material finally set. Hence, microleakage at dentinal margin was greater than (with significant difference) at enamel margins of Fuji II LC in both primary and permanent teeth [5].

In Fuji II LC, deciduous teeth showed more microleakage occlusaly than permanent teeth that was statistically significant. This might be due to the compositional difference between deciduous and permanent teeth. As the permanent teeth contain more inorganic content than primary teeth, and the boding strength of cement to tooth structure depends on the calcium amount present in enamel and dentin, thus permanent teeth showed less microleakage [9].

CONCLUSION

Under the conditions of this study, the following could be derived; EQUIA Forte system has no microleakage which suggests that it can be used as a permanent restoration for primary and permanent teeth while RMGICs have lower microleakage resistance compared with EQUIA. Fuji II LC restorations should be followed up for any leakage, marginal stains or recurrent caries.

REFERENCES

1. Gaintantzopoulou MD., Gopinath VK., Zinelis S. Evaluation of cavity wall adaptation of bulk esthetic materials to restore class II cavities in primary molars. Clin Oral Invest. 2017; 21:1063-70

2. Kidd EAM. Microleakage: a review J Dent. 1976; 4:199-206.

3. Basso M, Brambilla E, Benites MG, Giovannardi M, Ionescu AC. Glass ionomer cement for permanent dental restorations: a 48-months, multi-centre, prospective clinical trial. *Stoma Edu J*. 2015; 2: 25-35.

4. Gopinath VK. Comparative evaluation of microleakage between bulk esthetic materials versus resin-modified glass ionomer to restore Class II cavities in primary molars. J Indian Soc Pedod Prev Dent. 2017; 35: 238-43.

5. Amaral I, Gameiro A, Lopes L and Ventura. *In Vitro* Study of Micro Leakage and Micro Hardness of High Viscosity Glass Ionomer Cement and Resin Modified Glass Ionomer Cement. *Oral Health and Dentistry*. 2017; 1 : 283-90

6. Siddiqui F, Karkare S. Sealing Ability of Nano-ionomer in Primary Teeth: An ex vivo Study. Int J Clin Pediatr Dent. 2016;9:209-13.

7. Masih S, Thomas AM, Koshy G, Joshi JL. Comparative evaluation of the microleakage of two modified glass ionomer cements on primary molars. An in vivo study. J Indian Soc Pedod Prev Dent. 2011; 29:135-9.

8. De Munk J, Van Landuyt K, Peumans M, Poitevin A, Lanbrechts P, Braem M, et al. A critical review of the durability of adhesion to tooth tissue: Methods and results. J Dent Res. 2005; 84:118-32.

9. Singla T, Pandit IK, Srivastava N, Gugnani N, Gupta M. An evaluation of microleakage of various glass ionomer based restorative materials in deciduous and permanent teeth: An in vitro study. Saudi Dent J. 2012; 24:35-42.