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Microleakage of Dyract AP compomers in class V preprations of deciduous teeth after air-dried versus not dried salivary contamination at the occlusal wall (in vitro study)

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Abstract

This in vitro study was conducted to asses the affect of salivary contamination in case of air dried or not dried (kept moist) before the application of the bonding agent (prime and bond NT) on the microleakage of Dyract AP compomers (advance performance) in primary molars at the occlusal wall of class V preparations and compare it to the standardized technique of application.

Sixty class V cavities were prepared in 30 teeth (exfoliated primary molars), the cavities were prepared in the middle third of the buccal and lingual surface of each crown and randomly divided into three groups (each group consists of 20 cavities) Group (I): air-dried after salivary contamination, Group (II): not dried after salivary contamination (kept moist), Group (III): with out salivary contamination. After the teeth were filled, stored in distilled water for 24 hours, thermocycled, stained with basic fuchsin dye, sectioned to record the extend of dye penetration under stereomicroscope. Results revealed that there is no difference in the linear microleakage among groups at the occlusl wall. Although the differences were not statistically significant, greater microleakage was found in group (I) indicating that if salivary contamination occur, it is better to leave the preparation moist rather than complete air dryness.

Keywords: Compomers, Air dried salivary contamination, Microleakage, Deciduous teeth.

Introduction

Compomers are a new generation of a restorative material developed with the intend of trying to blend the favorable characteristics of glass ionomers (fluoride release, chemical bond to dentin) with the advantages of composite resins to increase toughness, wear resistance, esthetic and polishability, thus becoming increasingly popular as alternatives to glass ionomers cements and composite resin in primary posterior teeth (without phosphoric acid etching) allowing a simplified and fast application technique, in addition to fluoride release [1,2].

Contamination by saliva has always been a problem and can be especially difficult to control in the pediatric patient. Copious amounts of saliva, behaviors management issues, very young patients and rampant caries extending into cervical areas make isolation for placement of suitable

restorations difficult. Research data clearly state that saliva contamination of newly etched enamel and dentin requires that the surface be re-etched [3]. Dry enamel has been thought as necessary for good adhesion since it had been shown that an acid-conditioned enamel surfaces readily absorbs salivary constituents, reducing surface energy and rendering the surface less favorable for bonding, these changes had been shown to occur with an exposure period as short as one second and even if an air-water wash was used after the exposure [4]. Marginal microleakage may be caused by several factors, such as dissolution of liners or smear layers, degradation of the bonding or restorative material used, extend of marginal gap, polymerization shrinkage of material used and varying coefficients of thermal expansion for restoration. All of these factors may lead to marginal staining, post operative sensitivity, recurrent caries and pulpal problems [5]. Many studies [6,7] had been done on microleakage of class V of posterior permanent teeth restorations and the findings obtained had been assumed to apply to primary teeth, but some evidences suggest significant chemical and morphological differences between them [8]. Furthermore, information regarding microleakage of primary human posterior teeth restorations is limited. For these reasons this study was conducted to estimate microleakage in primary human posterior teeth.

Materials and method

Thirty exfoliated sound human primary molar teeth were collected and initially stored in distilled water containing thymol. After cutting the remaining resorbed roots at the level below cementoenamel junction, the crowns were cleaned with hand scaler and polished by pumice and rubber cup with contra angle handpiece at low speed to remove plaque and debris washed under running water then the pulp chambers were filled with amalgam.

Fresh unstimulated human saliva was collected from group of ten healthy volunteers who had not eaten or consumed any liquids for thirty minutes and pooled for immediate use [4].

Standardized class V cavity was prepared with butt-joint margins in the middle thirds of buccal and lingual surfaces of each tooth. A tungsten carbide fissure bur No.330 in a turbine handpiece was used with proper water cooling to prepare the cavities, one bur was used for every five cavities as shown in figure 1.

The cavity walls were finished with a stainless steel fissure bur No.53 in a low-speed handpiece to remove any unsupported enamel. A vernier caliber was utilized to standardize the cavities dimensions to be approximately 3mm width (mesio-distally), 2mm height (occluso-gingivally) and 2mm depth (bucco-lingually) [6]. The teeth were randomly divided into three groups; each group consists of ten teeth (twenty cavities) filled with compomer (Dyract AP).

Group (I): was restored after completely air dried salivary contamination. Group (II): was restored after salivary contamination but kept moist.

Group (III): was restored without salivary contamination and according to the manufacture instructions.

Group (I): The cavity surface was contaminated with fresh, unstimulated human saliva, left undisturbed for twenty seconds, excess saliva was air dried for 10

second to leave dry surface, Prime and Bond NT (bonding agent) was dispensed onto a fresh Applicator tip and directly applied to the cavity surfaces, undisturbed for 20 seconds. After that, solvent was removed by blowing air gently for 5 seconds and cured for 20 seconds, the compomer material (Dyract AP) was directly applied onto the cavity utilizing the applicator gun, then the material was dispensed using slow steady pressure, adapted with a plastic instrument (Ash No.6) and celluloid strip then light-cured for 30 seconds [4].

Group (II): Steps were similar to Group (I) except that the surface was contaminated with fresh, unstimulated human saliva, left undisturbed for twenty seconds, excess saliva was gently removed to leave a visibly moist surface, the adhesive applied, and the compomer placed.

Group (III): Steps were similar to Group (I) except that the surface was washed with air/water spray, remove the rinsing water by blowing gently for 5 seconds, avoiding complete dryness of the dentin, the adhesive applied, and the compomer placed (according to manufacture instructions).

After restoration, the teeth were stored for twenty four hours in distilled water, then thermocycled for 300 thermal cycles manually between 5°C ± 2 and 55°C ± 2 water baths with a dwell time of 30 seconds [7,9,10].

After that all the teeth were sealed with two layers of nail varnish to within approximately 1mm of the restoration margins to prevent dye penetration in areas other than the exposed margins [11,12]. All the teeth were immersed in 0.5% basic fuchsin dye solution at 37°C in an incubator for 24 hours then sectioned into two halves and two samples were prepared from each half by sectioning through the center of each restoration utilizing diamond wheel with proper water cooling.

An independent examiner who was blinded to the identity of the samples analyzed the walls by viewing under a binocular stereo microscope with x20 magnification. The degree of microleakage was determined by the degree of dye penetration from the margins of the restoration towards the axial wall. Dye penetration was scored according to the criteria described in table 1 [13]. Both sections of each restoration were read for microleakage at the occlussal wall and the section of each wall which had the greatest amount of microleakage was recorded as the score for that restoration [4,14].

Statistical analysis

To determine significant differences between the groups, data were analyzed using the Kruskal-Wallis non-parametric analysis of variance test.

Results

The mean and standard deviation for each group are shown in table 2 and figure 2.The percentage of microleakage score are shown in table 3. Application of Kruskal-Wallis non-parametric ANOVA test showed no significant differences concerning microleakage among the different groups at the occlusl wall as shown in table 4 and 5.

Discussion

The reason behind not using the phosphoric acid etching with most compomers when used as permanent filling for primary teeth is that the acidity of the bonding agent provide

some etching to the lower mineralized enamel and dentin of the primary teeth compared with permanent teeth [15], also the superficial demineralization of dentin will keep residual hydroxyapatite attached to collagen which will serve as a receptor for additional chemical bonding [16]. Although laboratory studies [17,18] had shown phosphoric acid etching reduce microleakage and improve bond strength of compomer restorations, most manufactures do not prescribe enamel and dentin etching. This finding is explain why the percentage of score one was the most predominant score in all the three groups which is located at the enamel part of the occlusal wall, this finding is in agreement with the results of Irie et al. [19], who found low bond strength because of low micro-mechanical interlocking of compomer with enamel. The results of this study indicate that when compomers used for restorations primary posterior teeth, salivary contamination does not adversely affect enamel microleakage. Therefore, no alteration in the technique is necessary, as in group (II) in which salivary contamination left moist prior to the application of the bonding agent and the water present in the saliva facilitated the infiltration of the prime and bond NT which is a hydrophilic bonding agents into the enamel and dentin [4], furthermore compomer differ from composites fillings in that it is a hydrophilic restorative materials, they are adapted well in moist preparations [20], while when the preparations is completely air dried, it will effect on the depth of dye penetration, that is why the percentage of dye penetration of score two and three (mostly located at dentin) was the most predominant score in group (I), which can be explained that the dried film of salivary protein inhibits penetration of the bonding agent in to the collagen fibril of the dentin [4].

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Table 1: scoring criteria of dye penetration.

Score	Criteria
0	no dye penetration
1	dye penetration within 1/3 of cavity wall
2	dye penetration within 2/3 of cavity wall
3	dye penetration within last 1/3 of cavity wall but not contacting the axial wall
4	dye penetration along the axial wall

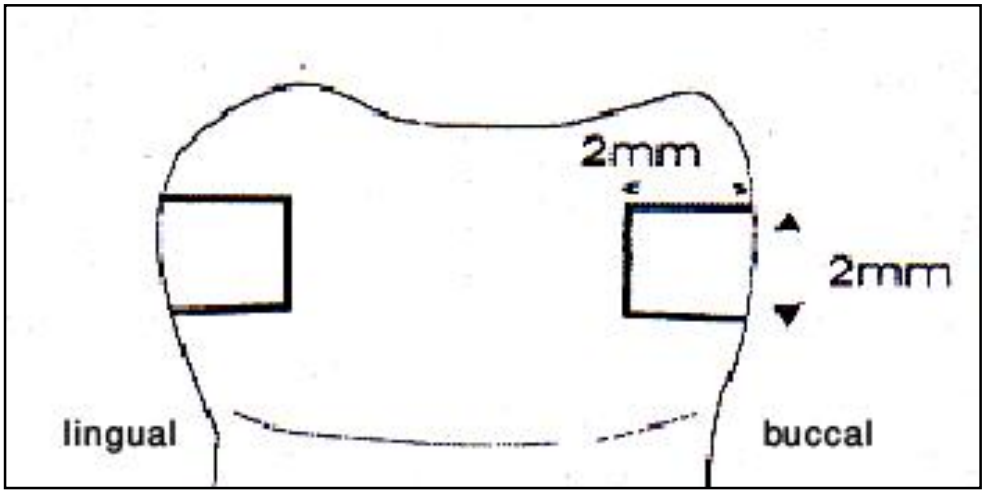

Figure 1:diagram showing the cavity location.

Table 2 :mean and standard deviation of microleakage scores.

Group	No	Score(0)	Score(1)	Score(2)	Score(3)	Score(4)
I	20	5	50	30	10	5
II	20	15	55	25	5	0
III	20	20	55	20	5	0

Table 3 :percentage of dye penetration scores.

Group	Occlusal wall	
	Mean	S.D
I	1.6	0.94
II	1.2	0.77
III	1.1	0.79

Table 4 :Kruskal-Wallis test at the occlusal walls.

Group	No	Median	Std. of mean	D.F	Sig.
I	20	1	0.2	2	*N.S
II	20	1	0.17		
III	20	1	0.18		

* Where N.S = non significant.

Table 5 :multiple comparisms between groups.

Pair comparisons	P value	Sig.
Between Group I and II	0.14	*N.S
Between Group I and III	0.06	*N.S
Between Group II and III	0.70	*N.S

*Where N.S = not significant

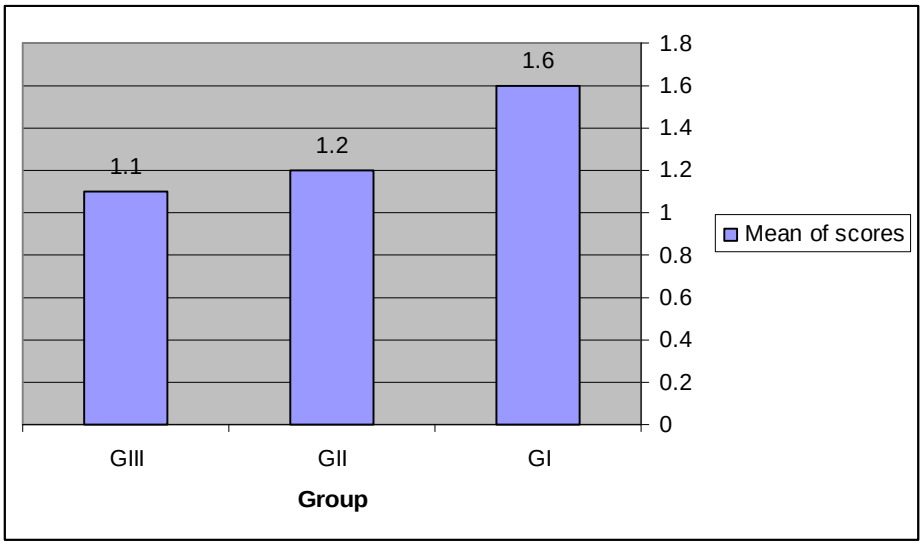

Figure 2 :bar chart showing the mean of scores of microleakage of the different groups at the occlusal wall.