A COMPARATIVE EVALUATION OF MICRO LEAKAGE OF A RESIN SEALANT AFTER CONVENTIONAL ACID-ETCH TECHNIQUE, TWO COMPONENT SELF-ETCH AND ONE-COMPONENT TOTAL-ETCH ADHESIVES- AN IN VITRO STUDY

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ABSTRACT

Aims: To compare the micro leakage following conventional acid etching technique, total etch adhesives and self etching adhesives. Materials and Method: In this in vitro study was conducted on, thirty extracted first maxillary permanent premolars. The teeth were randomly technique into three groups of 10 each. Group I (Control): phosphoric acid 37%. Group II : phosphoric acid 37% + two layers total-etch adhesive Group III: self–etch adhesive. Then teeth were sealed by light-curing sealant. After thermocycling (500 cycle between 5-55°C), the samples were immersed in 1% buffered methylene blue solution for 24hrs and sectioned longitudinally in bucco-lingual directions. The sections were evaluated for dye penetration using stereomicroscope 40X. Kruskall-wallis test was used for comparison of micro-leakage among groups with P <0.05 as the limit of significance. Results: The results showed that Group III and Group I had same degree of micro-leakage and there was a significant difference in micro-leakage between these two groups with the Group I. (P<0.05). Conclusion: In conclusion, the single bond adhesive shows significantly less micro-leakage.

Keywords: micro-leakage; self-etch; Sealant; Single Bond; total-etch

Introduction

Anatomic pit and fissures of a tooth have been considered as susceptible sites for initiation of caries in spite of the presence of various prevention methods. These caries are so common world-wide. Application of sealants which could be described as filled or unfilled dental resins to the pits and fissures of teeth, inhibit dental caries. It seems that the mechanism is mechanically prevention of bacterial penetration into vulnerable recesses of the occlusal surfaces of teeth. Appropriately bond of the sealant and enamel is the success key in sealant therapy. This prevents material wash-out and subsequent caries. Micro-leakage is one of the important factors in the sealant therapy failure. In 1992, Figal, introduced the application of an adhesive layer to reduce micro-leakage and enhance the bond strength. Since then, several investigations showed contradictory results.

Application of Self-etch adhesives is a new simple approach, which replaced the acid-etch technique. Simplifying the bonding technique, reducing working time and less probability of saliva contamination are some of its advantages. Acidic primer PH is weaker than acid phosphoric in this system. So there are several questions about its clinical effects that should be answered. Several in vitro studies have compared the micro-leakage of adhesive self-etch system to conventional etching applied to unground enamel. In vitro micro-leakage is essential in predicting marginal seal of the sealant. So the purpose of this study was to compare the effect of conventional acid etching technique, total etch and Self-etch adhesives on micro-leakage of light-curing sealants to unground permanent enamel.

Materials and Method

The present in vitro study was conducted on thirty specimens of maxillary first premolars that were extracted for orthodontic purposes during the last six months. All teeth were cleaned with soft brush and water. Teeth with occlusal and proximal carries, fracture, visible crack and enamel ditching were excluded from the sample. The dental fissures of the selected specimens were polished using fluoride free pumice and brush using low-speed hand piece and were kept in saline. The final prepared specimens were randomly allotted to three groups with 10 specimens each.

Group I (Control group): 37% phosphoric acid gel used for 30 seconds of conventional etching followed by 10 seconds of rinsing and 10 seconds of drying. A pit and fissure sealant was applied on the occlusal surfaces of the teeth that cured for 40 seconds.

Group II (Single Bond -SB): etching process was done similar to that of control group. After rinsing and drying, two layer of SB were applied and cured for 20 seconds followed by the application of pit and fissure sealant, which was cured for 40 seconds.

Group III (Self-etch adhesive): In this group, two liquid components of Self-etch adhesive were applied on the tooth surface. After 15 seconds of drying with mild air flow, adhesive was cured for 20-20 seconds. Finally pit and fissure sealant was applied and cured for 40 seconds.

All samples specimens were kept in distilled water for 24 hours before thermo cycling process. Following thermo cycling with 500 cycles between 5-55°C light-cure glass ionomer was used for sealing the opening in two stages. Two layers of nail polish applied on the total surface of the teeth to 1mm of tooth and sealant conjunction. The samples were immersed in 1% buffered methylene blue solution for 24 hours. After rinsing, they mounted in sectioning appliance by acrylic. Sections were done bucco-lingually and parallel to the long-axis of tooth. Two sections at mesial and distal pits with three cross sections were prepared on each tooth, i.e., 90 samples were prepared. Each cross section observed with 40X magnification using Stereo-microscope. Both buccal and lingual slopes were evaluated for dye and sealant penetration in μm and the ratio of the dye to sealant penetration was calculated. Non-parametric Kruskal-Wallis test was used for comparison of micro-leakage between groups with p<0.05 as the limit of significance.
Results

Standard deviation and mean of micro-leakage of each group is shown in Table 1. According to the table, the minimum and maximum mean of micro-leakage observed in group II and group I respectively. Kruskal-Wallis test showed statistically significant difference in the mean of micro-leakage ratio between the three groups.(p<0.05)

Discussion

Pit and fissure sealant therapy has been approved as an effective treatment in prevention of occlusal caries. Several in-vitro and in-vivo studies have evaluated the sealant bond to enamel. In this experimental study, the effect of conventional acid etching technique, total etch and self etching adhesives on micro-leakage of light-curing sealant to unground permanent enamel were evaluated and compared.

In our study, there was no significant difference in micro-leakage between the control and self-etch adhesive groups (P>0.05), although both had significant difference compared to the group II. The use of single bond plus adhesive, following acid etch technique before the application of the fissure sealant have been shown to increase bond strength and therefore reduce micro-leakage. These effects have been attributed to a combination of moisture-chasing effect and increase flow of the adhesive resin. Our results are consistent to the study done by Gillet et.al who reported that no significant difference exists between self-etch adhesive and conventional acid etch in the mean micro-leakage when used to fill the occlusal fissures of the extracted permanent premolars.

Similarly, Nejad et.al and Asselin et.al reported that no significant difference was noted between self-etch adhesive and phosphoric acid etching and the self-etching adhesive would be an attractive alternative to the acid-etch technique for sealant application in young children where simplifications in the clinical procedure are warranted.

Cehreli et.al evaluated long-term micro-leakage of fissure sealants applied with or without a bonding agent and reported that the use of etch-and-rinse adhesives resulted in significantly less micro-leakage compared to that achieved with self-etching adhesives or acid etching alone. In their study, the sealants placed without a prior bonding agent showed the greatest amount of leakage after four year. Conversely, Castro et.al and Al-Sarheed assessed bond strength of Prompt-L-Pop and showed that the use of bonding agent improves the mean enamel shear bond strength of fissure sealant.

Perry et.al observed that the use of self-etch adhesive in lieu of conventional acid etching (whether cured prior to or subsequent to sealant placement) results in greater incidence of micro-leakage and would not be advocated over traditional etching procedures. This difference may be explained, in part, by the differences in the rate of thermo-cycling and the dye used. The present study had some limitations. The dye material used was a 1% methylene blue. Using other dye solutions (e.g. 0.2% rhodamine, 0.5% solution of basic fuchsin, or 50% silver nitrate) could have produced different results. In addition, other factors must be considered, such as long-term retention, the integrity of the sealant, or the shear strength of the sealant.

Conclusion

In conclusion, the single bond adhesive shows significantly less micro-leakage than the conventional conditioning of enamel with phosphoric acid alone.

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