A COMPARATIVE EVALUATION OF MICROLEAKAGE OF SINGLE STEP SELF ETCH AND TOTAL ETCH ONE BOTTLE ADHESIVE SYSTEMS IN PRIMARY TEETH – AN IN VITRO STUDY

ABSTRACT

Single step self etch adhesives are the most recent entrant in the field of adhesive dentistry. These adhesives can be of immense use in pediatric dentistry as they decrease the chair side time considerably. The present study was carried out in vitro to compare the microleakage of single step self etch adhesives and total etch one bottle adhesives in both permanent and primary teeth.

Keywords: Single step self etch, Total etch, Microleakage.

INTRODUCTION

The acid etching technique introduced by Buonocore (1955) has given a new dimension to adhesive dentistry. Strong durable bonds between dental biomaterials and tooth substrates are essential from a mechanical, biologic and esthetic perspective. Good marginal adaptation of restorative material reduces microleakage, staining, pulpal irritation and recurrent caries (Nakahayashi, 1992). Studies conducted by Barkmeier et al. (1986) and by Gippatrick et al. (1991) have documented the reliability and predictability of enamel bonding. Dentin is physiologically and morphologically different from enamel. Whereas enamel is 92% inorganic hydroxyapatite by volume dentin is only 45% inorganic. Another complicating factor is the layer of debris (smear layer) which covers the surface of cut dentin. Simple acid etching and application of conventional hydrophobic resins, therefore, can not provide bond to dentin as they do to enamel. To overcome this problem dentin bonding agents were designed to mediate an adhesive bond to the inorganic and/or organic constituent of dentin. Dentin bonding agents have come a long way since their inception. Now a days, simplified adhesive systems have been introduced also referred to as ‘Single step self etch’ adhesive systems. These systems enable dentist to etch, prime and bond simultaneously. While the numbers of steps are being reduced with every advancement, the point, which needs to be considered, is that, whether it is affecting the physical characteristics of composite resins. The major disadvantage of composite resins has been polymerization shrinkage, which might lead to microleakage and recurrent caries.

While lot of studies have been conducted comparing the shear bond strength and microleakage of various adhesive systems in permanent teeth, much less is known about the performance of dentin adhesives in primary teeth. The ultra structure of primary dentin presents challenges that go beyond those encountered in permanent teeth. Primary dentin has been reported to have greater regional variation than permanent dentin and, in some case more and large dentinal tubules have been reported. De Araujo FB et al. conducted a study using earlier generations of adhesive systems and reported lower bond strength to dentin of primary teeth. Single step self etch adhesives can be of great use in pediatric dentistry as they are convenient for both operator and patient but the performance of these materials still needs to be evaluated in primary teeth.

Aims and Objectives

1. To evaluate and compare the marginal sealing ability of total etch one bottle adhesive and single step self etch adhesives on primary teeth.

MATERIAL AND METHODOLOGY

Method of collection of samples – Sixty non carious primary molars which were over retained were selected for this study. The teeth were cleaned and placed in normal saline.

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Experimental design – Primary teeth were divided into two groups as follows –

PB II - 30 primary teeth to be restored using Prime and Bond NT Total etch one bottle adhesive.
Xe II - 30 primary teeth to be restored using Xeoni III Single step Self etch adhesive.

Standardized Class V cavities were made on buccal surfaces of all teeth in both groups. The dimensions of the prepared cavity were 4 x 2 x 1.5 mm.

For group PB II - The Class V cavity was cleaned thoroughly with water. After cleaning the water was blown off gently. 34% phosphoric acid was applied as conditioner for 15 sec and then rinsed off. Cavity was dried gently with air spray. Prime and Bond NT was applied to teeth in both groups with the help of an applicator tip. Surfaces of the cavity were kept wet for 20 sec.

Solvent was removed by blowing gently with air from a dental syringe and then light cured for 10 sec. Immediately after application of bonding agent cavity was restored using Z 100 restorative hybrid composite with the help of Teflon coated instrument.

For Xe II – Class V cavity was cleaned thoroughly with water and water was blown off gently. Xeoni III (single step self etch) adhesive was used in this group. Xeoni III comes in 2 bottles Liq A and Liq B which were mixed in a clean mixing well for 5 sec. With the applicator tip, generous amount of Xeoni III was applied to thoroughly wet all cavity surfaces. It was left undisturbed for 20 sec and then cured with light curing unit for at least 10 sec. After that cavity was restored using Z 100 hybrid composite.

After restorations all the teeth were mounted in three inch long cylindrical moulds using self cure resin.

2. Thermocycling – All the specimens were stored in distilled water for 48 hours prior to thermocycling. Each specimen was thermocycled 500 times. Each cycle consisted of 34 sec in water baths held at 5 and 55 with an exchange time of 13 sec between the baths.

B. Microleakage testing – Each specimen was coated with nail varnish except for the buccal Class V restoration and 1 mm of tooth structure surrounding the restoration.

The specimens were then suspended in 5% aqueous solution of methylene blue at 37°C. After 48 hours teeth were taken out, washed and sectioned longitudinally through the center of restoration in bucco lingual direction with a diamond disc mounted on a straight handpiece. Sections were examined under stereo microscope at 40 x magnification for linear penetration of dye and scored as follows –

SCORING DATA
- Score 0 : No Dye penetration
- Score 1 : Dye penetration between the restoration and tooth into enamel only.
- Score 2 : Dye penetration between the restoration and tooth into enamel and dentin.
- Score 3 : Dye penetration between the restoration and tooth into the pulp chamber.

RESULTS
A total of 60 extracted non carious retained primary molars were selected and divided into two groups as follows:

Group PB II – 30 teeth to be restored using Total etch one bottle adhesive (Prime and Bond NT).
Group Xe II – 30 teeth to be restored using Single step self etch adhesive (Xeoni III).

MICROLEAKAGE SCORES

For Group Xe II the minimum value obtained was 2.00 and maximum value obtained was 3.00. The range for this group was 2.00 with Co efficient of range CR = 20%.

COMPARATIVE STATISTICS

Comparison between group PB II and Xe II – Table No. 3

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<td>Median</td>
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<td>Standard deviation</td>
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T values – Table No. 4

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** - Highly significant.
The difference between performance of Prime and Bond NT and Xeoni III in primary teeth in terms of microleakage is statistically highly significant. Prime and Bond NT performed much better than Xeoni III in primary teeth.

Graphic representation of results for Microleakage Assessment – Graph No. 1

Comparison between Mean Microleakage scores achieved for both the groups

MICROLEAKAGE SCORES

Illustration No.1 Mounted Specimens (Primary Teeth)
DISCUSSION
In the last two decades, the traditional methods of retaining restorative materials by mechanical means have been replaced, to a large extent, by the tooth conserving adhesive methods. Dentin bonding systems are available as three-step, two-step and one-step systems, depending on how the three steps—etching, priming and bonding to tooth substrates are accomplished or simplified. The simplicity of self etch systems, with fewer number of steps, makes them appealing for use in pediatric dentistry. Since, last few years use of composite restorations is on rise in pediatric dentistry, the dentin of primary and permanent teeth is different in composition and structure. The concentration of calcium and phosphate in peritubular and intertubular dentin is lower in primary teeth than it is in the permanent teeth. In addition, the tubule density of dentin in primary teeth is lower than that of dentin in the permanent teeth. Microleakage is the diffusion of substances within the cracks that contains fluids or within gap between restorative material and dentinal substrates. Microleakage develops between cavity walls and filling materials when materials are poorly adapted to the cavity, when they pull away from a wall during polymerization, when liners or smear layer dissolve or when recurrent caries occur in gap between materials and tooth structure (Prati et al., 1992). Gaps between restoration and tooth are responsible for bacterial and fluid penetration, marginal discoloration and consequently clinical failure (Triadan, 1987).

If we compare the performance of both the bonding agents, Prime and Bond NT performed much better than Xeno III. Kaaden et al. investigated the morphological characterization of resin dentin interface in primary teeth and showed that Prime and Bond NT formed a clearly visible adhesive layer whereas for Self etch adhesive system (Prompt L Pop) this layer was not continuously observable. The absence of adhesive layer could be one of the reasons for poor microleakage shown by Self etch adhesives. Silva Telles et al. reported similar results when they investigated interfacial micromorphometry of composites in primary and permanent teeth using Prompt L pop (Self etch) and Single bond (Total etch). They failed to observe hybrid layers in most of the samples restored with Prompt L Pop. According to Silva Telles et al. the low pH of Self etch adhesives impairs the polymerization of the resin monomers and therefore does not allow the formation of a strong and stable hybrid layer. The other explanation for difference in performance of Prime and Bond NT and Xeno III might be their different mechanisms of bonding to tooth structure. Prime and Bond NT removes the smear layer, seals the resin dentin interface thus preventing the exposure of pulp and dentin complex to bacteria. Xeno III modifies the smear layer instead of removing it completely and as already demonstrated by Tay et al. that Self etch adhesives might have residual water with in the adhesive dentin interface, which might effect the polymerization.

CONCLUSION
1. Prime and Bond NT and Xeno III failed to eliminate microleakage completely. But Prime and Bond NT showed less microleakage as compared to Xeno III in primary teeth. 2. Prime and Bond NT showed significantly less microleakage in primary teeth.

BIBLIOGRAPHY