

Research Article**Effect of Multiple Adhesive Coatings of Two Total-Etch Adhesives on the Dentin Bonding Strength of Primary Canines****Reza Razi^{1*} and Hady Ahmadi²**¹D.D.S, Florida, United States (USA).²D.D.S, Tehran, Iran.

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ABSTRACT

Background: Some studies have shown adhesive bond strength to dentin increases following application of successive coatings. Due to problems in the bond to dentine and the importance of achieving an appropriate bond in primary teeth, this study aimed to determine the effect of successive coatings of adhesive (2-coating and 4-coating) on Micro-shear bond strength using two adhesive total-etch (Single bond II, Single bond I) in the primary canine teeth were performed.

Materials and methods: Experimental - laboratory studies on 30 primary canine teeth of healthy human were conducted. The teeth were cut using a thin sectioning its dentin surfaces were exposed. Dentin discs were randomly divided into 2 groups of Single bond II, Single bond I. Dentin surfaces with 35% phosphoric acid H, rinse with water and excess water with a cotton ball was taken. Then, using diamond burs, dentin discs divided into two parts and in a half of each disc, 2 Coating and other half fourth coating of the adhesive used in the other half were used. After agitation the adhesive coating to evaporate the solvent, the flow of air with the same pressure from a distance of 10 cm of the dentin surfaces applied for 10 seconds and this process was repeated in subsequent coatings. After bonding procedures, composite cylinders (100Z) on each half and the hard disk was placed. Micro shear bond strength of the samples by Microtensile tester and MPa was determined. Data analysis by Student t and two-way ANOVA tests were performed.

Findings: In the case of bonded Single bond I, Micro shear bond strength after applying two coatings is 94.2 ± 99.31 and after the application of 4 adhesive coatings is 69.2 ± 25.30 MPa. The samples bonded with adhesive Single bond II, bond strength after applying two coatings is 35.3 ± 18.29 after the use of 4 coatings is 2.07 ± 26.31 MPa. The study results showed that the adhesive type and number of coatings used it microshear bond on the bond strength of the samples was not significant, however, the interaction between the type and number of coatings of adhesive bond strength was reported statistically significant ($P < 0.01$). Compare the two adhesive when applying two coatings of adhesive bond strength of Single bond I showed them significantly higher than the adhesive Single bond II ($p < 0.02$), although the difference 2 adhesive in application of 4 coating was not significant.

Conclusion: Under the terms of this study, microshear bond strength two adhesives total-etch include Single bond I and Single bond II following the application of 2 or 4 coatings of adhesive has no clear difference.

Key words: Multiple coatings of adhesive, Micro shear bond strength, dentin

STATEMENT OF THE PROBLEM

Clinical success of composite restorations depends on an adhesive system that establish acceptable and durable bond composite to enamel and dentin (1). It has been shown to increase the bond

strength of resin to form collagen exposed for etching increased (2). In multiple sources using multiple adhesive coatings to increase the adhesive bond strength on different systems have

been proposed (2, 3).Dentin adhesives manufacturers in order to ensure adequate coverage of at least two coatings of adhesive to etched dentin have recommended. Increasing the thickness of the adhesive coatings by increasing the frequency of its use may reduce polymerization shrinkage and leakage in healing cavities with resin composites (4, 5). However, studies on the application of successive coatings of adhesive limited and few reports about the effects of these methods on the bond strength of primary teeth.Filling material is ideal for children who cannot sit quiet muting should prepare conditions such as cavities, easy placement in the cavity, high adhesion to tooth structure and resistance to displacement are met. This material must have sufficient strength and wear characteristics and insensitive to moisture during hardening. Primary teeth with permanent teeth are large differences in morphology, dimensions, materials, components and composition of the enamel and dentin.The significance of the differences in the treatment of dental and dental restoration, especially in composite restorations according to the microscopic structure of the solid adhesion between restoration and tooth structure (6). Internal stress generated in the mouth could be gone from adhesivebond strength between restoration and tooth make a break. If there is sufficient bond strength, the stress fracture margin to the tooth or composite broken (7).

Results of studies have shown an increase in the number of coatings of adhesive tensile bond strength and reduced micro-leakage. It was argued by increasing the amount of collagen impregnated resin resulting from the use of multiple coatings of adhesive, the remaining water out from between the collagen fibers and infiltration and cross-link monomers adhesive within the hybrid coatings improved.Total-etch adhesives and Single bond adhesive manufactured by the 3M / ESPE. How to use: etched enamel and dentin for 15 seconds and the excess water and rinse for 10 seconds using a cotton pellet is removedtwo separate coatings of adhesive used on surfaces and dry for 2 to 5

seconds, then take the light levels using devices like hard to be cured for 10 seconds.

Adhesive Single bond II: total-etch adhesive filler manufacturing plant of 3M / ESPE. How to use:

The etched enamel and dentin for 15 seconds and rinse for 10 seconds the excess water is removed using a cotton ball then 2-3 separate coating impregnated with adhesive bond on the etched enamel and dentin for 10 sec agitation takes place and the levels of air-dried for 5 seconds and then light-cured for 10 seconds with light becomes difficult.

Zetas Olmez (2005) examine the quality of distance between restoration and morphology of the hybrid coating bonded composite restorations using one or two coatings of Prompt-L-Pop system in primary teeth dentin in this study, the results revealed the best distance and morphology in primary dentin was seen in the Single bond system. The primary teeth primary following the application of two coatings of prompt-L-Pop was better than the application of coating (8).

Nakaoki et al (2005)examined the effect of two adhesive coatings all-in-one on the strength of the bond's microshear.In this study, three commercial systems include Ader Prompt L-Pop, Reactmer Bond and Xeno III with other bonding system (OBF-2) was compared.Based on the results of this study showed microshear bond strength of adhesives all-in-one following the application of monocoating and two coating together had no significant difference however, differences of fracture morphology was observed (9).

Hashimoto et al (2004) examined the effect of successive coatings of adhesive bond strength to dentin microtensile.The study concluded that the use of four successive coating of resin in total-etch adhesive bond strength between the resin and the best quality in terms of improving the dentin. Pre and postcalving continuous coating of adhesive bonded samples could leakage due to increased infiltration reduce hybrid resin coating (2).Given the importance of achieving optimal bond strength of composite restorations and the lack of study on the effect of successive coatings

of adhesive in primary teeth, this study aimed to determine the effect of successive coatings of adhesive (multiple adhesive coating) microshear bond strength following the application of the total-etch adhesives in primary teeth was done.

MATERIALS AND METHODS:

Experimental - laboratory studies on 50 primary canine teeth of healthy human were conducted and soft tissue caused by periodontal components and dental calculus on it using the stylus mass was separated from the dentin and root. The teeth were stored in a solution of Chloramine 5.0% for a week, and among them 30 teeth have no filling cavities, fractures or cracks for use in the study were selected. Selected teeth out of 5.0% chloramine solution until used in the study of temperature (4° C) were kept in distilled water. Every week distilled water containing teeth were replaced. In the teeth, the enamel occlusal them by thin sectioning (Bonwill, USA) under the stream of water was removed vertically. After cutting 2 Mm teeth with thin sectioning of the surface coating of dentin discs were obtained. The discs with 400, 600 and 800 grit sandpaper size and below water flow with rotational motion were sandblasted to the same smear coating uniform levels in all samples be created. The dentin disks were randomly divided into two groups and each group was used an adhesive. For this purpose, each disc in widescreen with diamond cutting discs was divided into two halves. In both episodes, dentin was etched with 35% phosphoric acid for 10 seconds, 10 seconds was washed under the stream of water. In two groups, respectively, the adhesives Single bond I and single bond II were used. In the second half of a half of a hard coating of the adhesive coating 4 and the other half went to work. For this purpose, after agitation by the brush each coating of adhesive to evaporate the solvent Puar using the same air flow pressure air from a distance of 10 cm of the dentin applied for 10 seconds and the same process was repeated in subsequent coatings of adhesive. Examples of light used to harden by light curing device were

used. Then, using Tygon tube to a height of 1 mm diameter 0.7 mm composite Z100 was placed on the disk. Disc two is attached to Tygon tube and 40 seconds LED light curing device was irradiated to harden. The samples in distilled water for 24 hours in an incubator at a temperature of 37 ° C and humidity 80%.

After 24 hours, cylindrical plastic heart with a razor cut and removed. Dentine discs using a drop of glue on the plate were fixed Microtensile tester device. Then, using the measuring device Micro shear bond strength, strength of the samples was measured and recorded. Micro shear bond strength of the applied force divided at the time of fracture in Newton on the cross-section in square millimeters and the unit MPa was obtained. To analyze the data, spss software version 15, and Kolmogorov-Smirnov test and ANOVA were used. The significance level was set at 0.05.

RESULT

In this study, in vitro Experiential a total of 30 dentin disk in the Single bond I and 30 dentin disks in the Single bond II were examined. In the half of the disks in each group of two coatings and in the other half of the fourth adhesive coating was used. The results showed that the samples bonded with adhesive system Single bond I, Micro shear bond strength of the adhesive samples following the application of 2 coatings 99.31 ± 94.2 Mpa and following the application of the adhesive coating 4 is 25.30 ± 69.2 MPa. The samples bonded with adhesive system and Single bond II Micro shear bond strength of the adhesive coating after the application of 2 coatings 18.29 ± 35.3 Mpa and after the use of 4 coatings 26.31 ± 2.07 MPa. The results showed the system by increasing the number of coatings of adhesive Single bond I micro-shear strength slightly lower but increasing the number of coatings of adhesive Single bond II system to increase the scope of the micro shear bond strength of samples. The study compared the effects of variable adhesive system type and number of coatings used it, the results showed no significant difference existed in this

area, although the interaction of adhesive type and the number of coatings used on the micro shear bond strength of the samples has been effective ($p < 0.01$)

Comparing microshear bond strength of the samples bonded with Single bond II system showed bond strength by increasing the number of coatings used (from two coatings to four coatings) had increased somewhat, so that the samples showed an average increase in the 2.09 MPa. In the Single bond I, increasing the number of coatings of adhesive from 2 to 4 were led to a slight reduction in the strength (mean reduction = 1.74). There is not significant differences between the micro shear bond strength based on the number of coatings of adhesive was applied (system Single bond II: $p = -0.6$, System Single bond I: $p = 0.14$). They found that when using a two-coating system of Single bond I and Single bond II there were significant differences between the two systems and use of two coatings of adhesive Single bond I average 2.82 units greater than Single bond II system the number of coatings micro shear bond strength had shown ($p < 0.02$). However, the use of 4 coatings of Single bond I and Single bond II significant differences were observed between the two systems. The adhesive system Single bond II to a limited extent with higher bond strength of adhesives Single bond I (average 1.01) showed that significant differences were not met ($P = 0.26$).

DISCUSSION AND CONCLUSION

This study aimed to evaluate the effect of multiple adhesive coating on Micro shear bond strength in both total-etch adhesives include Single bond I and Single bond II was conducted in primary canine teeth. The results overall showed adhesive type and the number of coatings applied to it (2 or 4 coatings) has not a significant effect on the strength of microshear bond dentin discs, however, interaction between these two variables significantly bond strength of samples were under the influence. These results collectively indicate a limited reduction in adhesive bond strength of

Single bond I and a limited increase in adhesive Single bond II seeks to increase the number of coatings of adhesive was used. Hashimoto et al. (2005) showed that by increasing the number of coatings to 4 coatings of adhesive bond strength was increased and leakage reduction and nano coating 4 and more almost no leak was observed (10). Also Ito et al (2004) reported an increase in the number of coatings of adhesive can be improved bonding strength and quality (11). Adhesive with filler used in this study include Single bond II that spherical silica nano-sized fillers, who was 10% wt. However, the findings showed that when applying two coatings of adhesive Single bond I and Single bond II Micro shear bond strength of Single bond I was significantly higher than that of Single bond II. However, the use of 4 coatings of two adhesive significant differences was observed between the two adhesive systems. The adhesive Single bond II had a limited extent with higher bond strength of adhesives Single bond I, accordingly; there is no filler in adhesives significant effect on bond strength. Adhesive examined in this study were both based Ethanol and has copolymer poly Alkanoic Acides with high viscosity adhesive that for better stability against moisture is added to it. This copolymer is due to the high molecular weight in the adhesive solution of unsolved and the creation of a separate phase in the polymer adhesive is to produce blood cells. The method multiple coatings of adhesive application, remove the remaining solvent with the air flow is important to create a bond. Due to the presence of ethanol solvent in the Single bond I and Single bond II and as solvents in the adhesive resin to prevent polymerization of the monomers. (12). These factors can affect increase or decrease in the bond strength of adhesives of study. There are other factors copolymer poly Alkanoic Acides in adhesives Single bond I and Single bond II which can prevent the dye methacrylate in Dentin and make them stay on top of the surface area to be hybrid coating, so that even with the use of multi-

coating adhesive full penetration does not take place in dentin (13).

Tam et al (2001) show SEM images adhesives containing 10% by weight broke the filler, filler completely to the surface of demineralized dentin resin has not penetrated deeper into the dentinal tubules were less filler. Accordingly, capillaries effect on a liquid adhesive created and parts of filler in the resin penetration into the dentinal surface of filter demineralized dentin tubules (14). Also, Kim et al (2004) showed, with the addition of more than 3% wt nano-filler to adhesive bond strength Microtensile reduced (15). Because of the adhesives Single bond II containing 10% by weight is Nanofiller, this factor can also be associated with the failure to increase the bond strength of the adhesive.

In this study, we tested the same substrate, dentin discs obtained from each tooth is divided into two halves and in a half second coating of the adhesive coating 4 and the other half went to work. Total-etch adhesives evaluated included two types of adhesives Single bond I and Single bond II Adper were selected that is widely used in restorative procedures and have been studied in many studies to evaluate the bond strength. These adhesive properties were considered in this study as well. Sadr et al (2007) showed that by applying airflow for 10 seconds to evaporate solvents in 2 and 5 seconds maximum bond strength is obtained (16). In this Balkenhol et al (2007) also took 10 seconds to evaporate the solvent adhesive compared with 2-3 seconds to complete evaporation of the solvent in the adhesive (17).

Although laboratory studies quick and relatively cheap way of getting information about features such as leakage and bond strength of their bond, however, its results cannot be generalized in all aspects of clinical conditions. Large clinical variables such as experience of clinicians and clinical conditions are host all of which affect the success of restorative treatment. Although laboratory studies have shown that rarely flood a full restorative materials, however, most of them show good performance. Therefore, the results of

laboratory studies to clinical conditions are applied with caution. However, in laboratory studies, attempts are made on the same conditions, however, it should be noted that the final evaluation of restorative materials including adhesives must be done through the clinical long-term studies.

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