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An Sem Analysis of Microleakage and Marginal Adaptation of All in one Single Bottle Self Etch Adhesive with An Extra Hydrophobic Layer

KEYWORDS: SINGLE BOTTLE SELF ETCH ADHESIVE, HYDROPHOBIC LAYER, MICROLEAKAGE, SCANNING ELECTRON MICROSCOPY.

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ABSTRACT *The aim of this in vitro study was to evaluate and compare Microleakage and Marginal Adaptation of three All in one single bottle self etch adhesive system with and without applying an extra Hydrophobic layer. Marginal adaptation at the Resin Dentine interface can be increased and microleakage can be decreased by using a single bottle self etch adhesive system along with an extra hydrophobic layer so that we can improve the quality and longevity of composite Restoration.Three single bottle self etch adhesives were used in this study which included Adper easy one,Xeno V and G-bond in the Experimental Group and One two step self etch adhesive in the control group which was Clearfill SE. Statistical Analysis was done by one way Anova and Tukey's HSD test.Result of the present study showed that an extra Hydrophobic layer application significantly reduced the microleakage and improved the marginal adaptation in All in one single bottle self etch adhesives.*

The classic concept of three step bonding to dental tissues has developed rapidly to more user friendly, simplified adhesive systems. These comprise the two step etch and rinse and the self etch systems .The self etch systems were initially available in two steps and was further reduced to a one step procedure for simpler and faster application.

Despite the user friendly features of this category of adhesives, they are composed of high concentrations of hydrophilic and / or ionic resin monomers and this fact associated with the lack of non solvented resin coating turned them into permeable membranes that permit rapid dentinal fluid transudation across the polymerized adhesives.

Moreover, this one step adhesive solutions contain high amount of water which is required to dissociate the weak acidic methacrylate monomers into ionized forms for permeation into the smear layer and underlying mineralized dentin.This excess water may prevent the optimal polymerization of the adhesive monomers and leads to phase separation.

Initially, self-etch adhesives were introduced for use in a two step procedure. After application of an acidic primer, a relatively hydrophobic bonding resin was to be applied on top of the primed surface. Later All in One self etch systems were developed. This was found to have more microleakage due to their phase separation due to both hydrophilic and hydrophobic contents in the same bottle.

Hence, there was a need to study to evaluate and compare the microleakage and marginal adaptation of single bottle self etch adhesive system with and without an extra hydrophobic layer.

MATERIALS AND METHODS

Class V cavities with Dimension of 3mm mesiodistally and 1.5mm depth were prepared on the buccal and lingual sides of thirty five freshly extracted caries free premolars .Teeth were divided into control group and experimental group . In the control group, two bottle adhesive clearfill SE (kuraray medical inc-1621 sakazu, kurashlki, okayama 710-0801, japan) was used.In the experimental groups 3 single bottle self etch adhesives were used -Adper easy-one (3M EspeD-82229,seefield ,Germany), Xeno V (GC Corporation, Tokyo, Japan) and G-bond (Densply DeTrey GmbH 78467, Konstanz, GERMANY) which was applied according to manufacturer's direction on buccal side and with an extra hydrophobic layer on the lingual side respectively (N=10)

(Table 1-showing the method of application in control and experimental group).

Table 1-Adhesive systems and Method of Application

Adhesive systems	Application according to Manufacturers direction	With an extra Hydrophobic layer application
Clearfil SE(2 bottle) (CONTROL)	1.Apply 2 coats of primer under pressure(20 sec) 2.Air stream(10 sec at 20cm) after application of each coat 3.Apply one coat of adhesive(15 sec) 4.Air stream to make the bond film uniform(5 sec at 20cm) 5.Light activation(10 sec-600 Mw/cm^2)	
Adper easyone(single bottle) (EXPERIMENTAL)	1.Apply one coat of adhesive under pressure (20 sec) 2.Gentle air stream for 5 sec 3.Apply a second coat of adhesive under pressure(20 sec) 4.Gentle air stream 5.Light activation(10 sec-600 mW/cm^2)	1.Step 1-5 from Manufacturer's Direction 2.Apply one coat of adhesive from clearfil SE Light activation (10 sec-600mW/cm^2)
Xeno V(single bottle) (EXPERIMENTAL)	1.Apply xeno V sufficiently wetting all the cavity surfaces uniformly. 2.Agitate the adhesive for 20 sec. 3.Evaporate the solvent thoroughly by airblowing for 5 sec until there is no movement of the adhesive . 4.Cure for 20 sec	1.steps 1-5 from Manufacturer's direction. 2.Add the adhesive from clearfil SE.Airstream to make the film uniform 3.cure for 20 sec
G-bond(single bottle) (EXPERIMENTAL)	1.Apply one coat of adhesive and scrub for 5 sec. 2.Adhesive was left undisturbed for 5-10 sec. 3.Air dry under maximum pressure for 5 sec 4.Light curing for 10 sec at 600 Mw/cm^2	1.steps 1-4 from manufacturer"s direction. 2.Apply one coat of adhesive from Clearfil SE. 3.Airstream to make the bond film uniform(3sec at 20 cm) 4.Light activation (10 sec-600mW/cm^2)

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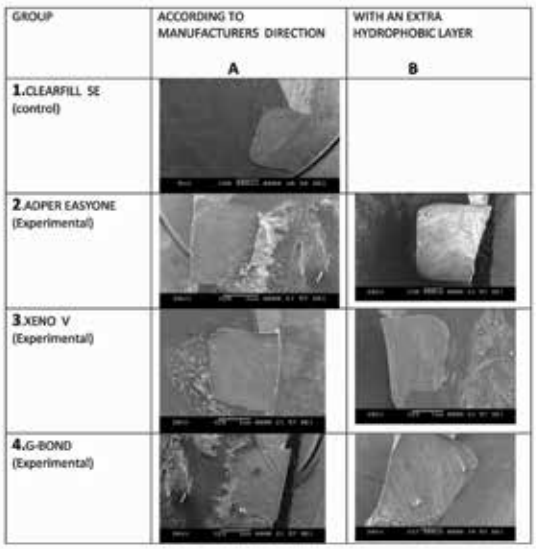
Resin composite (Filtek Z 350 composite restorative (A2 shade,3M Espe dental products.St.paul MN 55144-1000 USA) was applied in incremental layers and cured as per the manufacturers instructions. Restored teeth were stored in distilled water for 10 days and then subjected to thermocycling (500 cycles,5 to 55 C, 30 seconds dwell time). All specimens were immersed in 50% weight by volume silver nitrate solution (Qualigens fine chemicals. A division of Maxosmithkline pharmaceuticals) for 24 hours. After 24 hours, specimens were removed from silver nitrate solution and washed under running water for 5 minutes and placed in the photodeveloping solution for 8 hours while exposing to fluorescent light. After 8 hours, the teeth were removed from the developing solution, and sectioned buccolingually using diamond disc .

Samples were demineralised using 6N HCl for 30 seconds and deproteinized with 2.5 % Naocl for 10 minutes to enable examination of the interface and left to dry for 24 hours. Samples were Gold sputtered (JEOL, JFC-1600 Auto fine Coater, Tokyo, Japan) and viewed using scanning Electron microscopy (JEOL, JS M-6380LA, Tokyo, Japan) under various magnifications

(Figure 2 –showing SEM picture of microleakage in Control an Experimental Groups)

Figure-2 -SEM picture of microleakage in control an experimental Groups)



Leakage was calculated by the Global leakage formula

Overall leakage = P/L x 100

(P = Length of silver nitrate penetration along the resin dentine interface, L=Total length of the dentinal cavity wall on the cut surface). Statistical analysis was done using One way Anova and tukey's HSD test.

RESULT AND DISCUSSION

In one way Anova test which compared the control group and the experimental Group ,Microleakage was found to be statistically significant ($p<0.001$). Tukey's HSD test was used for inter group comparison. There was statistically significant difference in microleakage when clearfill SE (GROUP 1) was compared to Xeno V with an extra hydrophobic layer (GROUP 3B) ($p=0.042$). Microleakage was reduced in Adper easyone when Hydrophobic layer was applied (GROUP 2B) ($p=0.001$) compared to that applied according to manufacturer's Direction. (Group 2A). Xeno V (GROUP 3A) had lesser microleakage than Adper easyone (GROUP 2A) (p value=0.011) and G-bond (GROUP 4A)(p value=0.011) when applied according to manufacturer's direction. Xeno V(GROUP 3B) had significantly lesser microleakage than G-bond (GROUP 4B)($p=0.002$) when applied with an extra hydrophobic layer.Extra Hydrophobic layer significantly reduced microleakage and improved marginal Adaptation in All the three All in one single bottle Adhesives.

(Table-3 ,4 indicates statistical analysis indicating microleakages between control and experimental groups)

Table 3:- shows ONE WAY ANOVA comparing all the 7 Groups

MEASUREMENT IN MM

	N	Mean	Std. Deviation	Mean Square	F	Sig.
CLEARFILL SE	10	27.71	5.093144	375.798	9.527	<0.001
ADPER EASYONE MD	10	35.007	5.117719			
ADPER EASYONE HL	10	22.674	9.264685			
XENO V MD	10	24.892	7.147909			
XENO V HL	10	18.959	3.404913			
G-BOND MD	10	34.999	6.868444			
G-BOND HL	10	30.772	5.319304			
Total	70	27.859	8.288183			

N=No of specimens in each Group

Table 4 -Inter comparison between Clearfill SE,Adper Easyone, Xeno V and G-bond using POSTHOC tukey's test

Tukey HSD

(I) GROUP	(J) GROUP	Mean Difference (I-J)	Std. Error	Sig.	P VALUE
CLEARFILL SE	ADPER EASYONE MD	-7.297	2.808772	0.144	0.144
	ADPER EASYONE HL	5.036	2.808772	0.558	0.558
	XENO V MD	2.818	2.808772	0.951	0.951
	XENO V HL	8.751	2.808772	0.042	0.042
	G-BOND MD	-7.289	2.808772	0.145	0.145
	G-BOND HL	-3.062	2.808772	0.929	0.929
ADPER EASYONE MD	ADPER EASYONE HL	12.333	2.808772	0.001	0.001
	XENO V MD	10.115	2.808772	0.011	0.011
	G-BOND MD	0.008	2.808772	1	1
ADPER EASYONE HL	XENO V HL	3.715	2.808772	0.839	0.839
	G-BOND HL	-8.098	2.808772	0.075	0.075
XENO V MD	XENO V HL	5.933	2.808772	0.358	0.358
	G-BOND MD	-10.107	2.808772	0.011	0.011
XENO V HL	G-BOND HL	-11.813	2.808772	0.002	0.002
G-BOND MD	G-BOND HL	4.227	2.808772	0.741	0.741

According to the present study, it was observed that Phase separation was seen in ' All in one single bottle self etch adhesives' when it was used according to manufacturer's direction because it contains both hydrophilic and hydrophobic components in a single bottle. This lead to microleakage which was traced using silver nitrate. Application of Hydrophobic layer from two bottle self etch adhesive increased the adaptation of composite to dentine, decreased microleakage and increased the longevity of composite Restoration.

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