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The Effect of Two Bonding Agents Generations On Microleakage Of Composite Resin Using Two Light Curing Systems.

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الخلاصة

الاهداف: تهدف هذه الدراسة المختبرية إلى تقييم تأثير نوعين من المادة اللاصقة ونوعين من أجهزة التصلب الضوئي على التسرب أنجهري لحشوه االراتنج في منطقتي الاتصال الأطباقي واللثي بين السن والحشو الراتنجية. **المواد وطرائق العمل**: في هذه الدراسة تم استخدام (40)عينة أسنان خالية من التسوس من نوع النواجذ تم حفر تجويف على السطح الوجهي والخلفي لكل سن وقسمت الأسنان عشوائيا الى مجموعتين رئيسيتين كل مجموعة 20 سن . 40 تجويف للمجموعة الاولى تم استخدام الجيل السابع من المادة اللاصقة(i-Bond) تم استخدامه طبقا لتعليمات الشركة المصنعة ثم وضع طبقة واحدة من حشوة الراتنج (XRV Herculite) من شركة كيير،في حين ان (20)عينة تم تصليبها بأستخدام جهاز التصلب الضوئي الأعتيادي و(20) الاخرى تم تصليبها بأستخدام الدايود الضوئي. المجموعة الثانية تم استخدام الجيل الخامس من المادة اللاصقة (Exite) حيث تم استخدامة طبقاً لتعليمات الشركة المصنعة ثم وضع طبقة واحدة من حشوة الراتنج من tetric (20) عينة تم تصليبها بأستخدام جهاز التصلب الضوئي الأعتيادي و(20) اخرى تم تصليبها بأستخدام الدايود الضوئي.العينات حفظت داخل حافظة بدرجة حرارة(37م) نصف المجموعة الفرعية الاولى(10) حشوات خزنت يوم واحد والنصف الاخر لاسبوع. ومن ثم عرضت العينات ل(200) دورة حرارية ووضعت بصبغة المثيلين بلو بتركيز(2%) لمدة (24) ساعة وبدرجة حرارة (37م) **النتائج**: اظهرت النتائج لايوجد اختلاف معنوي بين اجهزة التصلب الضوئي وان نوع المادة اللاصقة والحشوة لم يؤثر معنويا على التسرب المجهري، لكن العينات التي خزنت لمدة سبعة ايام اعطت نتائج معنوية عالية للتسرب المجهري بالمقارنة مع العينات التي خزنت ليوم واحد. **الأستنتاجات**: كل العينات في هذة الدراسة اعطت مستويات مختلفة من التسرب المجهري ، التسرب المجهري يزداد مع ازدياد عمر الحشوة. اختلاف اجهزة التصلب الضوئي لم يقلل من التسرب المجهري واختلاف المادة اللاصقة ايضا لم تقلل من التسرب المجهري للحشوة .

ABSTRACT

Aim: To evaluate the effect of two bonding systems and two curing systems on sealing ability of class V composite restorative materials. **Materials and methods:** This study was performed in vitro on 40 caries free upper first premolar teeth. The Standardized class V cavity preparation on buccal and lingual surfaces of each tooth was done. Then the teeth were randomly divided into two major groups each of twenty. 40 cavities were performed on these teeth and the first group7th generation bonding agent (i Bond) were applied according to the manufacturer instructions and single increment of universal composite (XRV Herculite) from kerr were applied and twenty of the cavities were cured with conventional light cure device (astralis-5) and the other twenty cavities were cured with a LED. While the second group 5th generation (Excite bonding agent) applied according to the manufacturer instructions. And filled with universal composite (tetric).Twenty of the cavities light cured with conventional light cure device and the other twenty cavities cured with LED light cured device. Then the teeth were stored in normal physiological saline in an incubator at ($37C^o$) half of each sub group (10 cavities) were stored for one day and the second half stored for one week. Then the teeth were thermo cycled for (200) cycles, after thermo cycling all teeth were immersed in a freshly prepared solution of 2% methylene blue for (24) hours at ($37C^o$). **Results:** The results showed that there was no statistically significant difference between samples cured using conventional light curing system and those cured using LED light curing system. The type of bonding system and composite material used in this study had no significant effect on reducing microleakage. Samples aged for seven days produced significantly higher levels of microleakage than that for one day. **Conclusions:** All samples in this study showed microleakage with different levels. Microleakage increases as the age increases. Neither the types of light curing system nor the types of bonding were able to reduce microleakage.

Key words:Composite, Microleakage, Class V, Bonding agent, curing systems.

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INTRODUCTION

The foundation of modern adhesive dentistry was laid in 1955, when buonocore reported that acids could be used to alter the surface of enamel to render it more receptive to adhesion.(1)

Since that time evolved through several generations with changes in chemistries, mechanisms, number of bottles, application techniques and clinical effectiveness.(1)

The total etch technique using the fifth generation adhesive system proved its clinical effectiveness with reduction in number of application into two steps. It consisted of a separate etching procedure on dentinal surface before application of single bottle adhesive containing both primer and bonding agent.(1-3)

A recent development involved the use of acidic or self-etching adhesives which combine acid conditioning with the priming and bonding procedure known as the seventh generation /self-etching adhesive system or all in one system. Apart from simplification of single step application, the rational behind this system is to superficially demineralize dentin and simultaneously penetrate it with monomers, which can be polymerized in situ.(1-3)

Halogen lamps are the most frequently used sources of polymerization of resin-based dental materials. Their benefits include low cost technology while their drawbacks involve the production of high temperatures and decline of irradiance over time due to bulb and filter ageing. (1, 2)

Different technologies of light curing composite resins like plasma arc lamps, laser and LED (light emitting diode) have been developed and investigated. (2,3)

LED technology seems to be the most promising. The visible light of a LED is produced by quantum-mechanical effects differently from halogen lamps that need heating of metal filaments. Basically, LED is a combination of two different semiconductors, When a voltage is applied, the electrons from one semiconductor and the lack of electrons from the other are connected, resulting in light emission. Its benefits include microelectronics (that allow manufacturing of smaller devices) and a narrow emission spectrum that falls closely within the absorption range of camphoroquinone, which is, in turn, the most commonly used initiator of cure of resin monomers. As a consequence, the light emitted by LED lamps is much more efficient.(4-8)

Microleakage may be defined as the passage of bacterial fluids, chemical substances, molecules and ions between the tooth and the restoration , It is an intrinsic problem of direct filling and is clinically undetectable.(1,9)

Microleakage often results in two specific clinical manifestations. These are the post-operative patient hypersensitivity as well as the potential route for penetration of oral and bacterial irritant to the pulp.10

Microleakage is used as a measure by which clinicians and researchers can predict the performance of the restorative materials in the oral environment.(10)

The aim of this in vitro study was to evaluate the effect of different bonding systems and different curing systems on the sealing ability of class V composite restorative materials.

MATERIALS AND METHODS

This study was performed in vitro on 40 caries free upper first premolar teeth, They were stored in normal saline before cavity preparation, then standardized class V cavity preparation on buccal and lingual surfaces of each tooth was done.

The cavities were 5mm in length, 3mm in width and 2mm in depth (Figure 1).(2)

Figure (1) : show class V cavity in the buccal surface of premolar

Group 1: 40 cavities were cleaned with distilled water and dried then 7th generation bonding agent (i Bond) were

applied according to the manufacturer instructions (Applying three consecutive layers of iBond (generously) on the entire cavity. Leave adhesive on for 30 seconds. Simultaneous, gently massage promotes de-mineralization and diffusion processes (Figure 2).

Figure(2): show the i bond 7th generation bonding.

Blowing - distribute iBond gently in oil-free air stream, until no more liquid movements are visible. Finally Continue drying for five seconds then light cured for 20 seconds, then a single increment of universal composite (XRV Herculite) from kerr were applied and twenty samples (A1,B1) were cured with conventional light cure device (astralis-5) from vivadent of power density 500 mW/cm2 and the second half(C1,D1) were cured with a LED from (Ultraled; Dabi Atlante, Ribeirão Preto, SP, Brazil) with power density of 430 mW/cm2 .

Group 2 : 40 cavities cleaned with distilled water and dried then the cavities (enamel and dentine) were acid etched with 37% phosphoric acid for 15 seconds then washed with water spray for five seconds and dried with cotton leaving moist dentin (according to manufacturer instructions) then single bond 5th generation (excite bonding agent) applied according to the manufacturer instructions, and filled with universal composite (Tetric).

Twenty cavities (A2, B2) light cured with conventional light cure device and the other half (C2, D2) cured with LED light cured device.[9-14]

Then the teeth were stored in normal physiological saline in an incubator at 37 Co sub groups(A1,C1,A2,C2) were stored for one day and the second half (B1,B2,D1,D2) stored for one week.

After storage the apices of teeth were blocked with cold cure acrylic and the teeth were coated with two layers of nail varnish except the restorations and 1mm around the restorations.

Then the teeth were thermo cycled for 200 cycles. 2 Thermocycling was done manually between two water baths the temperature of one bath was maintained at 5oC ± 2oC and the other bath at 55oC ± 2oC. The immersion time was for 30 seconds in each bath and 15 seconds intervals between baths. [11, 12]

After thermocycling all teeth were immersed in a freshly prepared solution of 2% methylene blue for 24 hours at 37Co and then washed with water and allowed to dry then they were embedded in blocks of cold cure acrylic and with a sectioning device they were sectioned longitudinally buccolingually through the centre of the restoration. [9, 10]

The depth of dye penetration was measured for each occlusal and gingival tooth restoration interface using stereomicroscope and the scoring criterion for the amount of dye penetration was accordingly: [11]

Score 0: no dye penetration.

1: dye penetrates 0.5 mm.(from cavo surface margin).

2: dye penetrates 1mm.

3: dye penetrates1.5mm.

4: dye reaches the pulpal floor.

RESULT

Statistical analysis of data by using the analysis of variance “ANOVA” revealed that there was highly significant difference among the different subgroups for each group (Table 1,2).

Table (1) ANOVA test for group I.

s.o.v	d.f	s.s	m.s	F	p-valu
Between groups	3	8.675	2.892	6.01	0.002
Within groups	36	17.300	0.481		
total	39	25.975			

d.f:degree of freedom, ss: sum of squares, ms: mean squares.

Table(2) ANOVA test for group II.

s.o.v	d.f	s.s	m.s	F	p-valu
Between groups	3	12.200	4.067	7.55	0.000
Within groups	36	19.400	0.539		
total	39	31.600			

d.f:degree of freedom, ss: sum of squares, ms: mean squares.

Bar chart shows the mean of dye penetration (in millimeters) of the different subgroups (Figure 3).

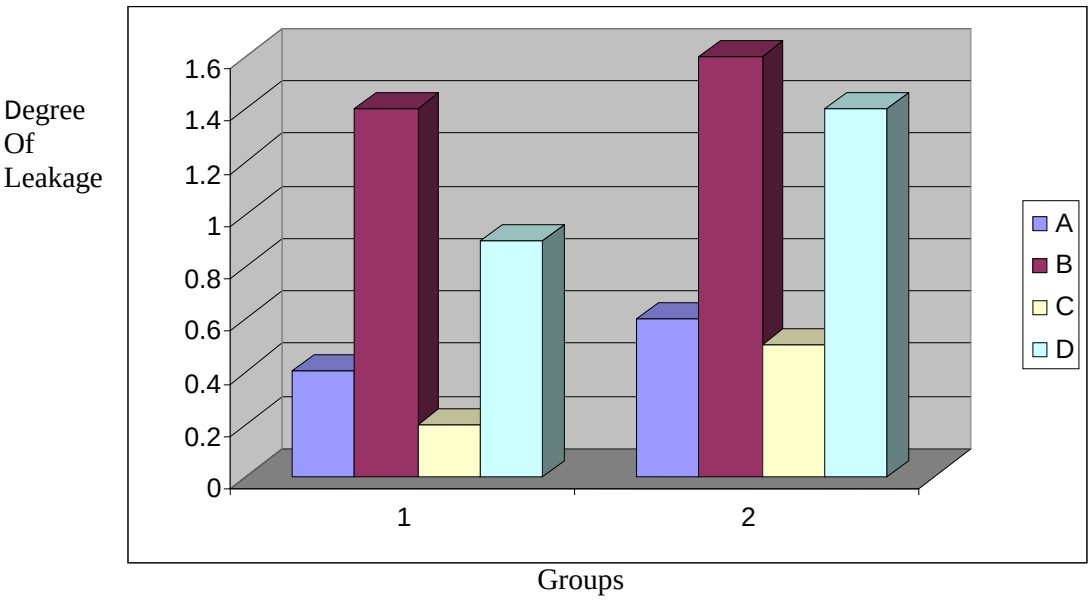

Figure (3) show the Bar chart and the differences between means of each sub groups.

Further investigation Using student t-test, no significant differences were found between the subgroups light cured using conventional light curing device and their corresponding subgroups light cured using LED curing device , Also no significant differences were found between the subgroups restored using 7th generation bonding agent and their corresponding subgroups restored using 5th generation bonding agent. Further investigation using student t-test showed highly significant differences between subgroups aged for 7 days and their corresponding subgroups aged for 1 day (Table3).

Table 3 the T-Test between subgroups

Sub groups	Mean		t-value	P-value	Level of significance
	First	second			
A1&B1	0.400	1.400	-2.89	0.009	H.S
C1&D1	1.4	0.9	1.3	0.021	.S
A1&C1	0.400	0.200	0.95	0.36	N.S
B1&D1	1.4	0.9	1.3	0.21	N.S
A2&B2	0.6	1.6	-3.2	0.006	H.S
C2&D2	0.5	1.4	2.59	0.023	S
A2&C2	0.6	0.5	0.43	0.67	N.S
B2&D2	1.6	1.4	0.49	0.63	N.S
A!&A2	0.4	0.6	-0.87	0.4	N.S
B1&B2	1.4	1.6	0.49	0.63	N.S
C1&C2	0.2	0.5	-1.41	0.81	N.S
D1&D2	0.9	1.4	-1.3	0.21	N.S

DISCUSSION

Effect of Light Curing Technique:

The results of this study showed that there were no significant differences in microleakege between subgroups cured using conventional light curing device and their corresponding subgroups light cured using LED curing device.

This may be due to that the initial intensity of LED device used in this study is 430 mW/cm2, which is probably not significantly different from that of the conventional light curing device which is 500 mW/cm2. [14]

This is agree with Nomoto et al; who found that LED curing unit create curing depth equal to that produced by the tungsten halogen light.[14]

This study agrees with the findings of Tay et al; who show that there is no significant difference in curing depth between LED and tungsten halogen light. [13]

Effect of age and thermocycling:

Results of this study showed that subgroups aged for 7 days produced more leakage than those aged for 1 day. This increase in microleakage with aging could be related to the disintegration of the bonding agent and gap formation. [2]

Gap formation and microleakage are the results of thermally induced stresses caused by a sharp difference in the coeffi-

cients of thermal expansion of the tooth and the restorative material.[2]

These results agree with Hakimeh et al.[15]; Majeed [16] they found that increase in age and thermocycling significantly affects microleakage of Class V composite restoration; However these results disagree with that of Marroquin et al.[17] who concluded that microleakage of composite showed reduction in leakage with aging due to water sorption.

Effect of Type of Bonding System:

The results of this study revealed that there were no significant differences in microleakege between subgroups filled using 7th generation bonding agent and those filled using 5th generation bonding agent. This may be due to that both bonding are alcoholic base.

This result agree with Araujo et al they found that the bond strength of 7th generation to enamel is typically stronger and more stable than that obtained with dentin, and leakage along the enamel/restoration interface is less than that of dentin. [18]

For this phenomenon according to Sano et al [19] and Li et al [20] leakage could happen through a porous zone at the hybrid layer ─ adhesive interface without gap formation. Furthermore, they indicated adhesive systems do not completely permeate the demineralized dentin but left ahybrid layer with large amount of porosity that allowed oral fluid to diffuse

CONCLUSIONS

Within the limits of this study , the following conclusions were drawn:

1- All samples in this study showed microleakage with different levels.
2- Microleakage increases as the age increases.
3- Neither the types of light curing systems nor the types of bonding were able to reduce microleakag**e.**

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