P- ISSN 1991-8941 E-ISSN 2706-6703 *Journal of University of Anbar for Pure Science (JUAPS)* Open Access
2015, 9 (2) :56-61

STUDYING THE EFFECT OF LASER ON MICROLEAKAGE OF LIGHT CURE FILLING FOR ANTERIOR TEETH.

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ARTICLE INFO

Received: 19 / 5 /2022
Accepted: 28 / 5 /2022
Available online: 3/5/2017
DOI: 10.37652/juaps.2015.124469

Keywords:
laser,
fillings ,
microleakage,
anterior teeth.

ABSTRACT

To assess of the microleakage of anterior fillings after the application of laser dental treatment, eight samples of each group were taken .The first group samples are taken to examine the filling with the acid and bonding are used; while the second group samples, the laser and bonding are used; then the third group samples were taken where the laser, acid and bonding were in use.The adhesion resulted for the first group samples was not good because the depth of leakage was high which indicated dye penetration approximating the tooth cavity floor portion.It was noted that the adhesion quality of fillings measured of second group samples was good because the depth of leakage was medium in touching the enamel layer.Adhesion checked for the third group samples shows fillings of high strength since no leakage, penetration of dye.

Introduction

Laser is one of the most important inventions of the twentieth century. Since the first report on laser radiation by (1), many potential fields for its application have been investigated (2). The use of lasers like high power diode laser and neodymium-doped yttrium aluminum garnet (Nd:YAG) in endodontics is an innovative approach for disinfection, providing access to formerly unreachable parts of the tubular network, due to their ability to penetrate dental tissues better than irrigant solutions. Laser etching has become available as an alternative to acid etching of enamel and dentin. Laser etching is painless and do not involve either vibration or heat. laser etching of enamel or dentin has been reported to yield an anfractuous surface and open dentin tubules, however Nd:YAG laser is not well-absorbed by dental hard tissue(3).The dental morphology provides information on the diet of fossil primates. Each tooth can be divided into the following three parts: crown, neck, and root. most primates have the following four kinds of teeth (from front to back): incisors, canines, premolars, and molars (4).

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Adhesion is the "phenomenon of the sticking of two surfaces together due to molecular attraction for each other" (5) In other words, adhesion is any attraction process between dissimilar molecular species(6) Microleakage can be described as the movement of bacteria, fluids, molecules, ions or air between the wall of the tooth cavity and the restorative material (7), leading to discoloration, recurrent caries and pulpal pathology, affecting longevity of composite resin restorations(8).

Materials & Methods

Technique & Procedure

Group A

i. Tooth Preparation

The cavity was prepared on labial surface of the tooth using turbine hand piece by fissure bur with 2mm depth and 5mm diameter according to standardized dental procedures of cavity preparation.

ii. Acid Itching

The cavity was itched with acid for 35 seconds and then washed thoroughly to remove access acid with normal saline and dried by air using air syringe.

iii. Bonding Agent

The bonding agent was applied to the cavity by fine brush to the alL surfaces and light cured for 10 second.

iv. Composite Light Cure

The composite filling was introduced to the cavity the adapted to the surfaces. The access material was removed by carver and the fine brush was used to smoothen the external surface. A celloid transparent strip was put over the filling and light cure was applied for 60 seconds.

Group B

i. Tooth Preparation

The Cavity was prepared on labial surface of the tooth using turbine hand piece by fissure bur with 2mm depth and 5mm diameter according to standardized dental procedures of cavity preparation.

ii. Laser Itching

The cavity was radiated with pulsed laser beam at 10 mJ by three pulses.

iii. Bonding Agent

The bonding agent was applied to the cavity by fine brush to the all surfaces and light cured for 10 second.

iv. Composite Light Cure

The composite filling was introduced to the cavity the adapted to the surfaces , the access material was removed by carver and the fine brush was used to smoothen the external surface .A celloid transparent strip was put over the filling and light cure was applied for 60 seconds.

Group C

i. Tooth Preparation

The Cavity was prepared on labial surface of the tooth using turbine hand piece by fissure bur with 2mm depth and 5mm diameter according to standardized dental procedures of cavity preparation.

ii. Laser Itching

The cavity was radiated with pulsed laser beam at 10 mJ by three pulses.

iii. Acid Itching

The cavity was itched with acid for 35 seconds and then washed thoroughly to remove access acid with normal saline and dried by air using air syringe.

iv. Bonding Agent

The bonding agent was applied to the cavity by fine brush to the all surfaces and light cured for 10 second.

iiv. Composite Light Cure

The composite filling was introduced to the cavity the adapted to the surfaces , the access material was removed by carver and the fine brush was used to smoothen the external surface. A celloid transparent strip was put over the filling and light cure was applied for 60 seconds.

Fgure(1) Tooth Preparation

Figure (2) Acid Itching Preparation

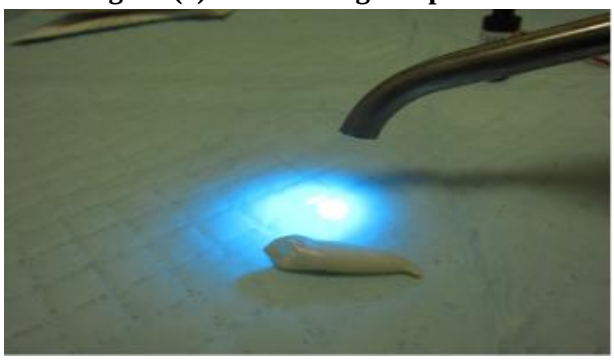


Figure (3) Tooth

Light Curing

Result & Discussions

The Results of the Microleakage Tests

Criteria for the Microleakage Degree

The degree of microleakage using dye penetration was scored in a blinded manner based on a 4-grade scale as shown in (Table.1).

Table(1): Criteria for Microleakage

Score	Contents
0	No dye penetration
1	Dye penetration through the cavity margin reaching the enamel tissue
2	Dye penetration through the cavity margin reaching the dentine tissue
3	Dye penetration through the cavity margin reaching the cavity floor portion

The Results of Acid Itching and Bonding (First Group)

When using the (acid itching + Bonding) for a first sample group through examination by cutting teeth longitudinally after it has been immersion all teeth in a freshly prepared solution of 2% methylene blue for 14 days at (37°C). The depth of dye penetration was measured by using stereomicroscope and the scoring criteria. The result, as following (A, B, C, E, G, the result appear 62.5% score 2) while (D, F the result appear 25% score 1 and H the result appear 12.5% score 3). This means the penetration of the dye arrived in dentine layer. The adhesion between the filling and the tooth was not good because of the presence of gaps led to the penetration of the dye and reach down to dentine layer. These gaps formed from polymerization shrinkage and cavity configuration factor. Polymerization reaction and subsequent interaction with the aqueous environment may result in a series of physical changes in the composite like water sorption may produce some undesirable effects such as dissolution, hydrolysis, microcrack formation. All these physical properties lead to the dye penetration (9).The reason for the use of the acid is to increase the surface area of the drilled area in tooth, because the acid liquid working on material corrosion leads to the occurrence of protrusions and a small drill is working to increase the adhesion between the filling and the tooth. Yet but adhesion was not strong ,due to the presence of gaps which led to the produced the penetration of the dye to reach down to the dentine layer.The leakage depth of these samples (D,F) was score (1). This means penetration of the dye arrived in enamel layer. The adhesion between the filling and the tooth was good. While some gaps were persistent they were less in number, as for samples (A, B, C, E, G), which led to the penetration of the dye and reach down to the enamel layer. As such the acid works to increase the adhesion between the filling and the tooth, which indicates the arrival of the dye to the enamel layer .The adhesion of these samples (D, F) of the same group was higher than in samples (A, B, C, E, G). Because that amount of dye penetration depends on the type of bonding agent also in the spreading of bonding agent over the tooth by brush , and other factors like etching time ,dentin moisture (10). The leakage depth of these sample (H) was score (3). This means that penetration of the dye arrived the cavity floor portion . It shows that adhesion between the filling and the tooth was bad. The adhesion or cohesion of molecules were not enough and this means the existence of large gaps between the composite and the tooth, which led to the penetration of the dye to reach the cavity floor portion. Therefore the adhesion of this sample (H) is much less than in samples (A, B , C, D, E, F, G) because the self-adhesive acid only have insufficient ability to etch the area of tooth surface providing weak bond strength(inadequate micromechanical retention) . Short contact time with composite prior to polymerization can explain the low etching level and higher microleakage degree .These results were supported by (11). as shown in (Table.2) first group samples.

Table (2): Show Group (1) [Acid Itching + Bonding]

Sample	A	B	C	D	E	F	G	H
Leakage depth	2	2	2	1	2	1	2	3

The Results of Laser and Bonding (Second Group)

When using the (laser + Bonding) for the second group samples for examination by cutting the teeth longitudinally after has been all teeth immersed in a freshly prepared solution of 2% methylene blue for 14 days at (37°C) .The result, were as follows (A , C, D, F ,G , H the result appears 75% score 1) while (B the result appears 12.5% score 0 and E the result appears 12.5% score 2) . The leakage depth of these samples (A, C , D , F, G, H) was score (1). This means that penetration of the dye arrived in enamel layer. the adhesion between the composite and the tooth was good while some gaps were persistent with less percentage. This led to the penetration of the dye to reach down to the enamel layer only because the effect of the laser beam on the excavated area to tooth, resulted in protrusions and a small drilling, increase the adhesion between the tooth and composite, it led to the penetration of the dye and reach down to the

enamel layer These results were supported by (12).Difference should be noted when using the acid to samples of the first group and laser to samples of the second group. Note that the laser has increased the adhesion between the composite and the tooth to reverse the acid. Because the laser works to increase the surface scarification more than the acid. So the cohesion of the particles between the composite and the tooth when using the laser to samples of the second group is more than the cohesion of the particles between the composite and the tooth when using the acid to samples of the first group. These results are identical with the results shown by (13). The leakage depth of sample (B) was score (0). This shows that there is no penetration of the dye, or in other words, does not have a leakage dye, and this shows that the adhesion between composite and tooth is very strong, meaning that the cohesion of the particles between the composite and the tooth is very strong. This proves no available gaps between the particles of the composite and the tooth, so the adhesion of sample (B) is stronger than samples (A,C,D,F,G,H). This group because of the higher roughness of the laser treated samples, could be attributed to the effect of the laser energy discharge that promoted a distinct surface changes in the form of pores caused by material removal by the laser and elevations caused by fusing and melting of the most superficial layer and its solidification (14).The leakage depth of these sample (E) was score (2).This means penetration of the dye arrived in dentine layer. The adhesion between the composite and the tooth was not good. In other words, cohesion between the particles is not strong, there are gaps between the particles led to the arrival of the dye to the dentine layer. Despite that the adhesion of these samples (A,B,C,D,F,G,H) is stronger than sample (E) of the same group, because the amount of the composite may not be equally distributed in all places of sample (E). This result agrees with (15).as shown in (Table. 3) second group samples.

Table (3): Show Group (2) [Laser + Bonding]

Sample	A	B	C	D	E	F	G	H
Leakage depth	1	0	1	1	2	1	1	1

The Results of Laser, Acid Itching and Bonding (Third Group)

When using the (laser + acid itching+ bonding) for the third group samples for examination by cutting the teeth longitudinally after has been all teeth immersed in a freshly prepared solution of 2% methylene blue for 14 days at (37°C) .The result is as the following: (A ,B, C, F ,G the result appear 62.5% score 0) while (E,F,H the result appear 37,5% score 1). The leakage depth of these samples (A,B,C,F,G) was score (0). This shows that there is no penetration of the dye, or in other words, does not have a leakage dye. This indicates that the adhesion between the composite and the tooth is very strong. The reason the using of Laser, acid itching and bonding together in this group of samples. Which led to a very strong adhesion between the composite and the tooth. This is because the acid work to increase the surface area of the drilled tooth led to erosion material and the occurrence of protrusions and small dig, as well as when exposing the excavated area of the tooth of the laser beam, the laser works on scarification surface becomes roughness, or the laser work on the occurrence of protrusions and a small drill, but percentage more than acid, so the cohesion between the particles of composite and the tooth very was strong. This shows that there was no gaps that led to leakage which was a result of laser, acid, and bond with us, so it was very strong adhesion. (16). found that the micro tensile bond strength was significantly lower in the acid-etched group than the Nd:YAG laser-etched enamel group for both bonding agents used .In addition Nd:YAG laser showed improved marginal sealing and decreased microleakage of composite resins restorations (17). The leakage depth of these samples (D,E,H) was score (1).This means penetration of the dye arrived in enamel layer. The adhesion between the composite and the tooth was good while still some gaps, but in less percentage , so the cohesion between the particles between the composite and the tooth was good. which led to the penetration of the dye and reach down to the enamel layer , The reason is the use of laser, acid and bond, which led us to increase the strength of adhesion between the composite and the tooth, But did not get the desired adhesion in these samples. When using the (laser, acid and Bond) for all samples Group third , we note the adhesion of these samples (D, E, H) less than the samples (A, B, C, F, G) of this group same ,The reason for this, may be the amount of the composite is not equal distributed in all places , or light cure did not reach all the places, Probability composite did not press or loaded evenly from all places , as well as the

teeth were put in the water in order to provide the same conditions inside the mouth so the water works to shrink the composite, so that saliva inside the mouth contains the amount of water it leads to shrink of the composite. Notes from the result of third group of samples that possessed the highest values of adhesion, also show no penetration of dye this indicate high roughness area of drilling in the tooth surface because using of the laser and acid with us this improved tensile bond strength compared to acid treatment alone these results same results shown by(18).While the result of first group samples that possessed less values of adhesion and this indicates penetration of the dye significantly ,because the surface less roughness area drilling in the tooth, the reason for this using of the acid only these results agreement with(19). as shown in (Table. 4) third group samples.

Table(4): Show Group (3) [Laser : + Acid itching + Bonding]

Sample	A	B	C	D	E	F	G	H
Leakage depth	0	0	0	1	1	0	0	1

The Results Statistical Analysis of Microleakage

According to the results of the microleakage evaluation of this study the statistical analysis shown that there was significant difference for sample (A) between (acid itching and bonding) with (laser and bonding) as well as (laser, acid itching and bonding).This means p <0.05, because of the difference in the depth of the leakage. as shown in figure (4).Also the statistical analysis shown that there was significant difference for sample(B) between(acid itching and bonding) with (laser and bonding) as well as difference between (acid itching and bonding) with (laser,acid itching and bonding). This means p <0.05. Because of the difference in the depth of the leakage, as shown in the results of the microleakage that there was no significant difference for the same sample between(laser and bonding) with (laser, acid itching and bonding). This means p >0.05. Because the has same depth of leakage as shown in figure (4).

While the statistical analysis shown that the was significant difference for sample (C) between (acid itching and bonding) with (laser and bonding) as well as (laser, acid itching and bonding). This means p <0.05, because of the difference in the depth of the leakage as shown in figure (4). The statistical analysis shown that there was no significant difference for sample(D) between (acid itching and bonding) with (laser and bonding) as well as (laser, acid itching and bonding). This means p >0.05, because has same depth of leakage as shown in figure (4).

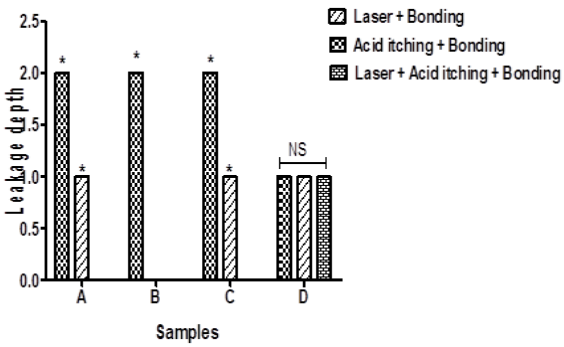
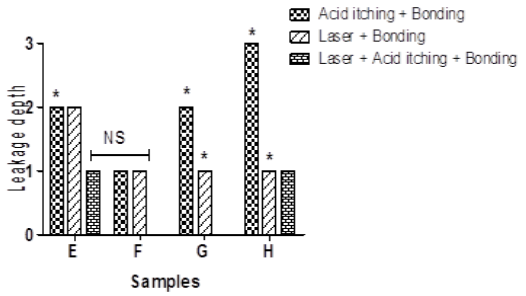


Figure (4): The statistical analysis for (acid itching and bonding) with (laser and bonding) and (laser, acid itching and bonding) for sample (A,B,C,D) NS = no significant , *p <0.05 Significant

The statistical analysis shown that was no significant difference for sample(E) between (acid itching and bonding) with (laser and bonding) . This means p >0.05. Because it has the same depth of leakage, but the statistical analysis shown that there was significant difference for the same sample between (acid itching and bonding) &(laser and bonding) with(laser, acid itching and bonding). This means p <0.05, Because of the difference in the depth of the leakage as shown in figure (5) .But note the statistical analysis shown that there was no significant difference between(laser, acid itching and bonding) for sample(E) with (acid itching and bonding) and (laser and bonding) for sample(F). This means p >0.05, because it has the same depth of leakage ,but the statistical analysis shown that there was significant difference for the sample(F) between (acid itching and bonding)&(laser and bonding)with (laser, acid itching and bonding). This means p <0.05, because of the difference in the depth of the leakage as shown in figure (5).While The statistical analysis shown that there was significant difference for sample (G) between (acid itching and bonding)with (laser and bonding) as well as (laser, acid itching and bonding) .This means p <0.05, because of the difference in the depth of the leakage as shown in figure (5) .The statistical analysis shown that there was significant difference for sample(H) between (acid itching and bonding) with (laser and bonding) & (laser, acid itching and bonding) . This means p <0.05, Because of the difference in the depth of the leakage. But the statistical analysis shown that there was no significant for sample (H) between (laser and bonding) with (laser, acid itching and bonding) .This means p >0.05,

Because the has same depth of leakage as shown in figure (5).



Figure(5): The statistical analysis for (acid itching and bonding) with (laser and bonding) and (laser, acid itching and bonding) for sample (A,B,C,D) NS = no significant , *p <0.05 Significant**.**

Conclusions

Within the limitations of this study the following conclusion can be drawn: The uses of (laser, acid etching and bonding). The laser irradiation group showed less microleakage than the acid etching group.

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