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DIFFERENTIATION OF CHLOROFORM ETCHING TIME ON ACRYLIC RESIN DENTURE TEETH TO SHEAR BOND STRENGTH WITH RESIN COMPOSITE

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ABSTRAK

*Resin komposit sudah dikenal untuk memodifikasi anasir gigi tiruan resin akrilik agar tampak serasi. Kekuatan perlekatan bahan anasir gigi tiruan resin akrilik dengan resin komposit lemah. Untuk memperkuat perlekatan diperlukan bahan etsa. Untuk mengetahui perbedaanh lama etsa dengan khloroform terhadap kekuatan geser perlekatan resin komposit dengan anasir gigi tiruan resin akrilik. Sampel terdiri dari lapisan anasir gigi tiruan resin akrilik (7X7X4 mm) dan silinder resin komposit (5 mm diameter, tebal 2mm). Enam puluh anasir gigi tiruan resin akrilik gigi dietsa dengan kholoroform dan 15 sampel tanpa perlakuan untuk kontrol. Resin komposit diaplikasikan ke permukaan resin akrilik gigi tiruan yang telah dietsa menggunakan cetakan bercelah. Antarmuka antara resin akrilik dan resin komposit ditempatkan pada mesin uji universal (Autograph, Shimadzu, Jepang) dengan kecepatan 1 mm/menit) sampai terpisah. Data dianalisis dengan uji ANOVA satu arah. Hasil komparasi kekuatan geser perlekatan anasir gigi tiruan resin akrilik dengan resin komposit menggunakan bahan etsa kholroform pada pasangan 5 detik dibandingkan dengan 30 detik, 5detik dengan 60 detik, 5detik dengan 120 detik, 30 detik dengan 60 detik, 30 detik dengan 120 detik, 60 detik dengan 120 detik didapatkan bahwa seluruh pasangan perlakuan terdapat perbedaan yang bermakna ($p<0.05$). Anansir gigi tiruan resin akrilik yang tidak dietsa menunjukkan kekuatan geser perlekatan yang paling rendah.. Lama waktu pengetsaan dengan khloroform selama 30 detik menunjukkan kekuatan geser perlekatan dengan resin komposit yang paling besar.**(FMI 2013;49:173-176)***

Kata kunci: *anasir gigi tiruan resin akrilik, resin komposit, kloroform, kekuatan geser perlekatan.*

ABSTRACT

*Resin composite has become popular in modifying denture element of acrylic resin. Bond strength of the denture element of acrylic resin with the resin composite is weak. Etching materials are needed to strengthen the bond. The aim of this research is to determine the different of etching time with chloroform to the shear bond strength of resin composite with denture element of acrylic resin. The samples were consisted of denture element of acrylic resin (7X7X4 mm) and resin composite cylinders (diameter 5 mm, thicness 2mm). Sixty denture element of acrylic resin were etched with chloroform and 15 samples were untreated for control. Resin composite was applied onto the surface of acrylic resin denture element that had been etched using split mold. The interface between the acrylic resin denture teeth and resin composite were placed on universal testing machine (Autograph, Shimadzu, Japan), with 1 mm/min cross-head speed until it was broken. Data were analyzed using one way ANOVA test. There were significant differences of shear bond strength of acrylic resin denture teeth with resin composite using chloroform etching materials for 5 compared to 30 seconds, 5 compared to 60 seconds, 5 to 120 seconds, 30 to 60 seconds, 30 to 120 seconds, 60 to 120 seconds ($p<0.05$). The denture element of acrylic resin which was not etched showing the lowest shear bond strength. The duration of etching with chloroform which was 30 second showing the highest shear bond strength with composite resin**(FMI 2013;49:173-176)***

Keywords: *denture element of acrylic resin, resin composite, chloroform, shear bond strength.*

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INTRODUCTION

Patients having lost some anterior teeth and wearing posterior denture wanted to get the best aesthetic profile. McGivney and Car (2000) stated that the most important thing of artificial tooth is to improve the aesthetic and functional as incisors. The selection and arrangement of anterior teeth is a difficult stage and sometimes makes the dentists feel guilty. The creativity to improve the esthetic of artificial teeth requires artistic sensitivity higher than science. There are many things to consider choosing the artificial teeth. McCabe (1990) said that the anterior artificial teeth should look like the real teeth to get a good look. Fit collaboration of artificial tooth from the edge of incisor tooth to the gingiva is a requirement to fulfill. In elderly patients who already lost some of their teeth, the color and character of the teeth often did not compatible with its

artificial teeth. Denture occlusive surface also sometimes did not contact with the opposing teeth. When the anterior teeth are focused more on the aesthetics, the posterior teeth must be focused on the ability to restore chewing function. Modification technique of acrylic resin denture element with light-cured composite is needed to improve the esthetic and chewing function (Thean et al 1996).

Acrylic resins denture elements are often preferred because they have many advantages, which are natural, compatible with the denture base, cheap, and good quality of purity (thickness less than 1 mm) (Thean et al 1996). Being compared with porcelain teeth elements, dental acrylic resin elements are simply adjusted. The ability to bond with the denture base is even better. The ability to absorb water (shock absorbability) is also good (Chaves et al 2009). But, sometimes it does not fit the shape and color of remains teeth.

Light-cured composites system having harmonious colors to improve the color and shape of acrylic resins denture elements is one of the optional materials to improve the esthetic. Dentists do not need to have a supply (stock) of many elements of artificial teeth. This modification technique is more resistant to color change (discoloration) than the technique using acrylic resin (Ansari 1995). Composite with visible light (VLC) is very popular for prosthodontics applications because its characteristic has been improved. Application of the composite with visible light is very popular not only for replacing cracked or broken teeth, but also for other prosthodontics applications, such as making artificial tooth composite metal frames, partial denture, denture aesthetic modifications to align with the characteristics of adjacent natural teeth, renovation of the occlusal surface of posterior artificial teeth (Chatterjee et al 2011).

In modifying acrylic resin artificial teeth with resin composite a strong bond is needed so that the material will not split or broken. But the chemical bonds in these materials are weak, caused by a discrepancy between the chemical compositions of these materials. To strengthen these bonds, mechanical retention by roughening the surface of acrylic resin teeth is required. (Jagger et al 2002, Jacobsen et al 1997). Roughening surface for adhesion is a standard method to increase bond and enhance the style of van der Waals bond (Shen 1984).

The method used is by reviewing a solvent acrylic resin surface (chloroform or acetone) (Anusavice 1996). Other researchers put three materials for acrylic resin etching, namely methyl methacrylate monomer, acetone and chloroform (Vojdani et al 2008, Hasan 2009). To associate resin composite elements to denture acrylic resin, bonding material (commonly used to tooth enamel) is needed. Basically the application of bonding material is for increasing micromechanical on one side of acrylic resin and composite on the other side. The bonding materials used to attach the acrylic resin with resin composite are unfilled resin glued on etched acrylic resin surfaces (Ansari 1995, Weiner 1987). When two materials with the same composition are placed together, the chemical bond will get stronger (Weiner 1987). To improve the bond shear strength, mechanical strength being able to rough the acrylic resin surface is required (Shen 1984). The purpose of this research is to determine the etching duration with chloroform to rough the surface of acrylic resin denture element, so that the shear strength between resin composite and acrylic resin denture elements can be optimized.

MATERIALS AND METHODS

This research was an experimental laboratory. The sample was two-layered tablet (the first layer was acrylic resin which was rectangular shaped and sized 7x7x4mm). The second layer was composite resin cylinders (Ø 5mm, t2mm). There are some steps to prepare the specimen as the first layer. Firstly, cut the first molar cusp of acrylic resin dental elements (Alfalux, Colombia) 0.5 mm thick. The edge and base of the denture elements were cut like the size of the first mold using a fissure bur, and then polished by rubbing paper.

Afterwards, self-cured acrylic (Hillon, England) was made and placed at the base of the mold. Dental elements having been cut were placed there on the top of self-cured which is flat and parallel to the edge of the mold. Then they were pressed with a weight of 0.5 kg for 30 minutes. The time was counted using stopwatch (Omega, Switzerland). After the first mold was filled with elements of dental acrylic, the surface of the tooth were spilled with etched chloroform materials (E Merck, Germany) 10 µl using a micropipette (Socorex, Isba SA, Switzerland) then rinsed with aquades and dried with tissue paper. Then the second mold was put together with the first mold. The hole in the second mold was filled with resin composite typed unfilled (Heliobond, Ivoclar, Germany) and microfilled typed universal hybrid (superlux, DMG, Hamburg), then irradiated (Lytex, California, USA) for 40 seconds. The number of each treatment group was 10 pieces.

After the specimens had been made completely, they were immersed in water at a temperature of 370C for 48 hours in an incubator in order to suit the mouth

conditions. Then, the specimens were removed from the incubator and soon inserted into the brass tube tools. Furthermore, the brass tools would be placed on Autograph (Shimadtzu-Japan) for testing the shear bond strength of acrylic resin with resin composite by putting the interface between the acrylic resin and resin composite on the test machine to separate at a speed of 1 mm/min.

RESULTS

The results were obtained from the data being grouped according to treatment group given, etching with chloroform for 5, 30, 60 and 120 seconds. The control group (non-etched) had the lower average shear strength of attachment than etched surface of acrylic resin. The biggest average shear strength of the attachment was the one being etched for 30 seconds. The data about etching with chloroform were analyzed using one-way ANOVA test. Before the ANOVA test conducted, homogeneity test using Levene test had been done. The homogeneity test result was 1294 value with significance level 0.281 ($p > 0.05$). This meant that the data derived from the same diversity (homogeneous) source. ANOVA test results were in Table 2. The force causing resin composite separated from acrylic resin was the shear force and the averaged attachment shear strength of acrylic resin elements denture with resin composite. It could be seen in Table 2 below. In table 1, there was a difference between the solvent without chloroform treatment and with chloroform treatment at various times ($p < 0.05$).

DISCUSSIONS

The principle of the modification of acrylic resin denture element with composite was strong bond to unite so that the two materials were not easily removed or damaged. Etching on the surface of acrylic resin denture element aimed to coarsen the surface so that the bond between the acrylic resin denture elements with resin composite was optimized (Sharma et al 2001, Minami 2004). The bond affecting the shear bond strength between the acrylic resin denture elements and resin composite was mechanical bond, van der Waals bond, and little chemical bond. The bond was affected by the surface treatment of acrylic resin denture elements before resin composite material is applied on. Standard method to increase the van der Waals bonding was coarsing the surface before attaching materials on the top of it so that the bond got stronger. Clean surface would also provide an efficient place to form a stronger bond (Shen 1984). The group whose surface was not etched showing the lowest shear strength than the other groups whose surfaces were etched (Bunch et al 1987, Cucci et al 1998, Arena et al 1993).

Acrylic resin surface not being etched was smooth but dirty because the ex-drilling dust could not be cleaned even by an ultrasonic cleaner. Ex-drilling dust would interfere the bond between acrylic resin denture element and with resin composite because the bonding material impossibly penetrated into the acrylic holes, so the resin composite just sticked to acrylic resin denture element. The group whose surface was etched for 30 seconds showing the greatest shear bond strength between the acrylic resin denture elements with resin composite. This was due to the result that 30 seconds was enough to clean the surface and dissolve the acrylic resin. The group whose surface was etched for 5 seconds showing lower shear bond strength because there were little ex-drilling dust. The groups whose surfaces were etched for 60 seconds and 120 seconds showed the lower shear bond strength than the group being etched for 30 seconds due to early damage to the surface of the acrylic resin. The damaged acrylic surface had weak bond.

Table 1. One-way ANOVA table. The effect of chloroform etching material to shear bond strength of acrylic resin denture elements with composite resin.

Source of diversity	Unrestrained degrees	Square total	Central square	F Hit test	Prob.
Inter control	4	1376083.3	3440. 826	7928.007	0.00
In control	70	3037.517	43.393		
Total	74	1379120.8			

Table 2. The mean and standard deviation of shear bond strength of acrylic resin denture elements with resin composite with chloroform etching material.

No	Treatment	Mean± SD (MPa)
1	Control	156.6467 ± 7.1998
2	Chloroform 5 second	453.000 ± 7.3921
3	Chloroform 30 second	569.0667 ± 8.062
4	Chloroform 60 second	417.0667 ± 3.3957
5	Chloroform 120 second	366.5667 ± 5.8275

CONCLUSION

According to researches about differentiation of chloroform etching time on acrylic resin denture teeth to shear bond strength with resin composite, 30 minutes duration is the greatest timing for chloroform etched to show the shear bone strength between the denture elements of acrylic resin with resin composite.

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