The Role of Surface Treatments On the Shear Bond Strength of Artificial Teeth to the Denture Base

تأ ثير معالجة أسطح الاسنان الصناعية على قوة الترابط بينها وبين سطح الطقم الاكريلي

Dr. Amaal kadhim ALSaadi, B.D.S.,M.Sc.
Lecturer, Dental Technologies Department, College of Healthy &Medical Technologies. E-mail: alsahdi_amaal@yahoo.com Mobil:07902399371

ABSTRACT:

The study examined the bond between different denture base resins and highly cross-linked acrylic denture teeth with different base surface-conditioning methods. Fourty specimens are prepared from two main groups, each group used a different type of heat cure acrylic resin denture base material .A, B (Rodex&Pigon) Each main groups subdivided into four subgroups according to surface treatment A1,B1=control, no surface conditioning A2,B2=retention groove, A3,B3=grinding, A4,B4=application of methyl methacrylate monomer, After 24 ho of storage in distilled water, compressive load was applied at 90° on the palatal surface of each tooth until fracture. Results**:** The statistical analysis showed that there were statistically no significant differences between the two type of denture base in improvement of shear bond strength, surfaces treatment of the teeth provided different bond between the acrylic denture base &teeth.

Key words: Bond, Acrylic teeth, Denture base resin, Surface treatment.

الخلاصة :
هذه الدراسة تقوم بفحص قوة الربط ما بين نوعين مختلفين من اسطح الطقم الاكريلي وبين الاسنان الصناعية وذلك بعد معالجة هذه الاسنان بثلاث طرق والمقارنة بينهم للوصول الى افضل طريقة لمنع انفصال هذه الاسنان عن سطح الطقم او انكسارها عند تعرضها الى قوى القطع خلال عملية المضغ، حيث تم تعريض الاسطح القاطعة للأسنان لقوى عمودية في منطقة ارتباط الاسنان بسطح الطقم الى ان حصل الكسر او الانفصال وبعده قياس مقدار القوة المسلطة اتضح بالمقارنة ان معالجة الاسنان بهذه الطرق المختلفة تعطي قوة ربط مختلفة مع سطح الطقم الاكريلي.

كلمات المفتاح: قوة الترابط ، الطقم الأكريلي ، معالجة أسطح الاسنان الاصناعية

INTRODUCTION

Loss of adhesion between denture teeth and denture base is a common clinical problem.[1,2]

Studies that have evaluated the frequency of various denture repairs have found that 22_30% of denture repairs involve tooth deboning [3,4]. Acrylic denture teeth have been widely used in removable prosthodontics due to their advantages over porcelain teeth, which include ease of adjustment, reduced cost, ability to bond to denture bases and higher shock absorbability. [5,6]

Many factors have been investigated as to their influence on the bond strength between artificial teeth and denture base, such as ageing, ridge lap grinding, bonding agents, solvents or monomer-polymer solution application, surface grooving, tooth material, crosslinking agent concentration, denture base material, separating medium, impurities or wax contamination.[4,7,8].

aim of this study was to evaluate the influence of surface treatments on the ridge lap area of acrylic denture teeth on their bond strength to denture base material, the null hypothesis tested was that surface treatment on the ridge lap area of acrylic denture teeth influences their bond strength to the denture base material.

MATERIALAND METHODES

With the aid of a silicon mold &according to manufacturing fourty maxillary central incisors (China) were bonded to two types of heat cured acrylic resin denture base A (Rodex,Turkey) & B (Pigon,China). All acrylic artificial teeth were flattened &embedded in resin.

Beforehand, foure different surface-conditioning methods were applied to the base surfaces of the teeth. Therefore, the two main group(A&B) were divided into four sub groups (n=10) for each denture base resin: A1= Control, no surface conditioning A2=Retention groove prepared by using an inverted cone carbide bur A3=. Grinding, A4= Application of methyl methacrylate monomer using Nº zero brush allowed to dry for 30 s.

All specimens were stored at 37°C for 24 h in distilled water. Then, the fracture test was carried out in a testing machine (Instron universal testing machine. 1000 Newton load was applied at 90° from the long axis of each denture tooth on the palatal surface at across head speed of 0.5 mm/min until fracture.

fracture forces were calculated & resulting data were analyzed statistically by one way ANOVA.

RESULT:

ANOVA for group A and B , F Test 3.717 for group A and F Test =12.291 for group B

Table and figure (1,2), present the mean load (Kgf) required for specimen bond to failure. Table (3) present LSD of group A show there was statistically significant differences between A1&A4 group P=0.028, A3&A4group P=0.014.

Table (4)LSD of group B show that there was significant differences between B1,B2

P value(0.038)_B1,B3(0.010)_B2,B4(0.020)_B3,B4group(0.005).

t test between group A &B show significant difference only between group A2.B2 p=0.013.Table(5) Figure (3)

DISCUSSION

Factors affecting bond strength between plastic teeth and denture base have been investigated with different testing methods and the resulting data have been used to suggest technical procedures that enhance this bonding. However, few studies apply methods with load direction [8,9,10,11] and specimen design similar to clinical conditions, producing data that may not be clinically representative.

Lab research on bonding between artificial teeth and denture base usually employs testing methods with only one original or modified tooth surface contacting the denture base material. The failure of the bond between acrylic resin teeth and denture base material remains a clinical concern. However, it can be minimized by means of adequate bond strength between acrylic teeth and the resin base. It has been demonstrated that type of acrylic resin, method of polymerization, tooth surface conditioning and thermal stress can influence the resin/tooth bond [12,13,14]. Therefore, this study investigated whether the TBS of type, bond surface treatment.

The result of this study show that there is no significant differences between the two main group in improvement of (SBS) t_test between group A&B show that there is only significant difference between A2,B2 and the possible explanation for this differences that the bond between denture teeth & base resin depend on the type of acrylic resin base selected, more compatible combination of acrylic resin teeth and denture base resin may reduce the number of prosthesis failure and the resultant repair [15].

Modification of the ridge lap area of the acrylic teeth demonstrated an increase in bond strength [3], where as other studies showed no obvious advantages of these modification before packing the resin on the adhesive bond strength. (Saavedra et.al,2007) evaluated the adhesion between acrylic teeth and heat polymerized acrylic resin using a micro tensile test on teeth subjected to different surface treatments.

The results showed that the bond strength was significantly affected by the surface treatments, with the methyl methacrylate based adhesive showing the highest bond strength. In contrast, the findings of the present study regarding group A there is only a significant differences between A1,A4 subgroup & A3,A4 subgroup at (P-value 0.028) & (P-value 0.014) respectively demonstrated that wetting the ridge lap surface with denture base acrylic resin monomer significantly influence the results, possible explanation for these differences could be based on the composition of the chemical products used for etching the tooth bonding surfaces.
In our study B2&B3 subgroup give the least mean value although they have statistical significant differences value at (P-value 0.038) and (P-value 0.010) respectively the lack of difference among the mean of other subgroup suggest that the influence of mechanical retention due to cervical coverage or retention groove did not enhance bond strength between acrylic denture teeth & base materials.
Also B2,B4 & B3,B4 subgroup show significant difference at (P-value 0.020) & (P-value 0.005) respectively.

(S.B.Patil et.al,2006) evaluated the effect of retention grooves of different size on the adhesive bond strength, the result of the study show that the bond strength was increased by the mechanical retention applied, in contrast to our study the two type of denture resin base material used , mechanical retention means either in form of retention groove or grinding of the ridge lap area show that there is significant difference in comparison with control & monomer etch surface.

Conclusion:

differences were found only between the surface treatments grinding (worst results) and etching with monomer (best results) since it showed numerically higher bond strength than the other subgroups with mean & with statistical significance.

REFERENCES

1. Meng GK, Chung KH, Fletcher-Stark ML, Zhang H(2010)Effect of surface treatment and cyclic loading on the bond strength of acrylic resin denture teeth with autopolymerized repair acrylic resin J. prosth. Dent:103:245-252.
2. Vallittu PK, Lassila VP, and Lappalainen R.(1993):Evaluation of damage to removable dentures in two cities in Finland. Acta. Odontol. Scand. 51:363-369.
3. Patil SB, Naveen BH, Patil NP. Bonding acrylic teeth to acrylic resin denture. Base review.2006;23:131-139.
4. Lauro Egidio,Luiz H.Maykot,Maria C.Marino.(2009):the role of surface tretment on bond the bond between acrylic denture base and teeth .J.Braz.Dent J 20(2):156_161.
5. Carolina de Andrade ,Romulo Rocha,Ana Lucia,and Raphael freitas.(2009).Effect of Ridge Lab S urface Treatment and Thrmocycling on Microtensile Bond Strength of Acrylic Teeth to Denture Base Resins.Braz.Dent J20(2):127_131.
6. Reinhold Lang & Carola Kolbeck & Rainer Bergmann & Gerhard Handel & Martin Rosentritt(2010):Bond of acrylic teeth to different denture base resins after various surface _conditioning methods clin oral investigation .
7. Saavedra G, Valandro LF, Leite FPP, Amaral R, Ozcan M, Bottino MA, etal . (2007)Bond strength of acrylic teeth to denture base resin after various surface condition methods before and after thermocycling. Int J Prosthodont ;20 : 199-201.
8. Saavedra G, Neisser MP, Sinhoreti MAC, Machado C. Evaluation of bond strength of denture teeth bonded to heat polymerized acrylic resin denture bases .Braz J Oral Sci 2004;3:458-464.
9. Barpal D,Curtis DA,Finzen F,Perry J, and Gransky SA. (1998): Failure load of acrylic resin denture teeth bonded to high impact acrylic resins. J. ProsthDent. 80:666.671.
10. Cardash HS, Liberman R, Helft M. The effect of retention grooves in acrylic resin teeth or tooth on denture base bond. J Prosdent 1986;55:526-528.
11. Zuckerman GR, A reliable methods for securing anterior denture teeth in denture bases. J Prosthet Dent 2003;89:603-607.

12. Barbosa DB, Barao VA, Monteiro DR, Compagnoni MA, Marra J. Bond strength of denture teeth to acrylic resin: effect of thermocycling and polymerization methods. Gerodontology 2008;25:237-244.
13. Geerts GA, Jooste CH. A comparison of the bond strength of microwave and water bath cured denture material . J Prosthet Dent 1990;70:406-409.
14. Cunningham JL. (2000): Shear bond strength of resin teeth to heat cured and light cured denture base resin. J oral Rehab:27:312-316.
15. Schneider RI, Curtis ER and Clancy JMS.(2002):TensiIe bond strength of acrylic resin denture teeth to a microwave or heat processed denture base. J. prosth. Dent: 88(2): 145-150.

	A1	A2	A3	A4
Mean	7,56	16,64	5,02	14,34
SD	1,495	2,104	1,107	4,628
Min	5,5	14	3,7	9,5
Max	9,3	19	6,4	19,5

Table(1) Descriptive of group A

Table(2) Descriptive of group B

	B1	B2	B3	B4
Mean	8,1	4,92	3,96	11,34
SD	2,943	1,475	1,732	2,251
Min	5,1	3	2,1	8,9
Max	12,4	6,6	6	14,5

ANOVA for group A F Test 3.717

Table(3)LSD of Group A

	P-value	Sig
A1&A2	**0.358**	**NS**
A1&A3	**0.450**	**NS**
A1&A4	**0.028**	**S**
A2&A3	**0.161**	**NS**
A2&A4	**0.423**	**NS**
A3&A4	**0.014**	**S**

ANOVA for group B F Test =12.291

Table(4)LSD of Group B

	P-value	Sig
B1&B2	**0.038**	**S**
B1&B3	**0.010**	**S**
B1&B4	**0.215**	**NS**
B2&B3	**0.201**	**NS**
B2&B4	**0.020**	**S**
B3&B4	**0.005**	**S**

Table(5) t-test between group A and Group B

	t-test	P-value	Sig
A1&B1	**0.748**	**0.496**	**NS**
A2& B2	**2.862**	**0.013**	**S**
A3&B3	**2.077**	**0.106**	**NS**
A4&B4	**1.317**	**0.258**	**NS**

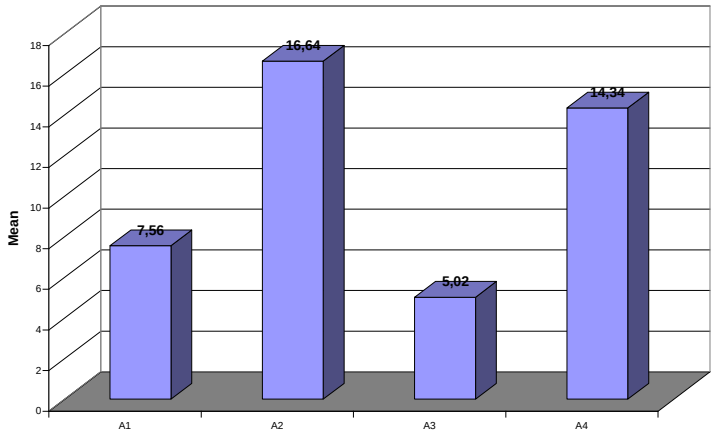

Figure (1)

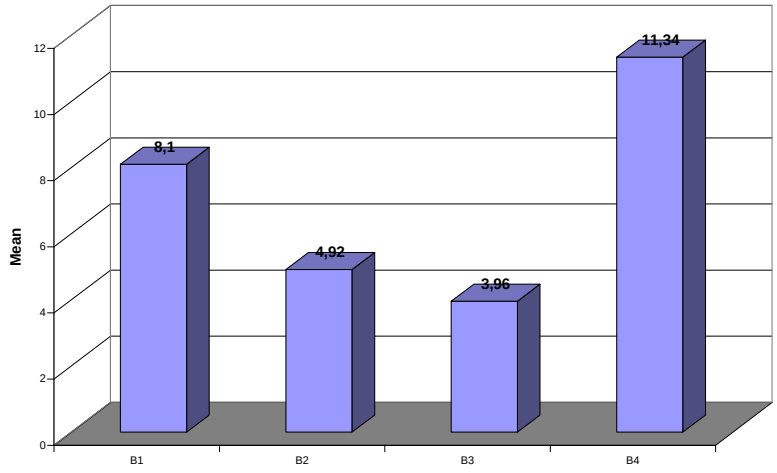

Figure (2)

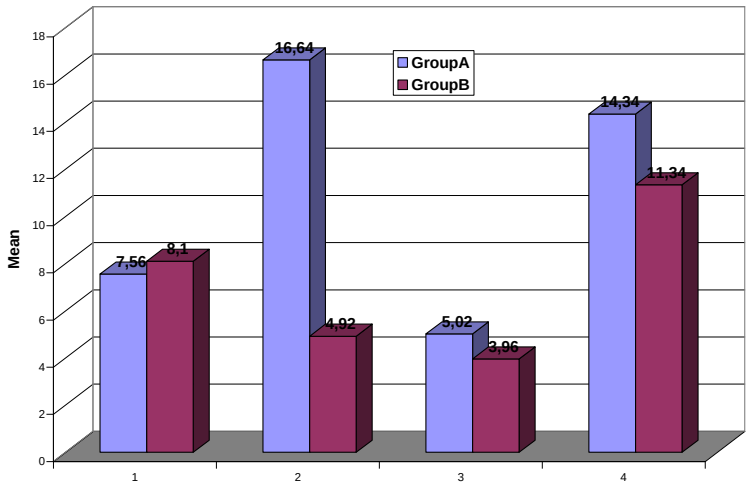
Mean
18
16
14
12
10
8
6
4
2
0
GroupA
GroupB
7,56
8,1
16,64
4,92
5,02
3,96
14,34
11,34
1
2
3
4

Figure (3)