Research Article

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Effect of Surface Pretreatment (Acid Etching) on Bond Strength of Polymethamethacrylate (PMMA) to the Soft Denture Lining Material

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ABSTRACT

Background: This study was conducted to investigate the effect of acid etching on bond strength of denture base to a soft liner in presence of artificial saliva, one RTV (Room temperature vulcanization, Ufigel P) silicone soft liner, and one HTV(Heat cure vulcanization, Molloplast B) were selected

Materials and Methods: DPI, Heat cure PMMA is used as a denture base.80 specimens were fabricated and divided into two groups, half samples were lined by Molloplast B and the other half were lined with Ufigel p. these subgroups were further divided into two groups. From each of the surface treated groups 10 samples tested the same day for tensile bond strength and the other 10 samples were stored in artificial saliva for 7 days and then tested for tensile bond strength. The universal testing machine is used for tensile strength measurement.

Results: Acid etching of pmma surface enhanced the bonding between liner and pmma resin. Artificial saliva significantly reduces the bonding between PMMA and liner.

Conclusion: Acid etch treatment of the pmma surface enhanced the bonding between liner and PMMA.

Keywords: Surface Pretreatment, Polymethamethacrylate, Soft Denture Lining.

INTRODUCTION

Soft denture lining material is a polymeric material placed on the intaglio surface of the denture base. It compensates for the lost tissue thickness and functions and absorbs some of the masticatory forces. soft lining material has been used in dentistry for more than a century. Adequate bonding between lining material and denture base resin is necessary to avoid bond failure and it creates a potential surface for bacterial growth and plaque or calculus formation. Favorable properties of a denture liner become useless in the absence of a good bond to the denture base material.[1,2]

Silicone base liners are long term lining material but have little or no chemical adhesion to denture base resin, so adhesive primer is used to aid bonding to the denture base resin. So the bonding of silicone soft denture liners depends on the tensile strength of the adhesive liners and the adhesive primer used.[1]

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Bond strength can be altered by various methods namely, mechanical roughening by metal, sandpapering, laser, sandblasting, chemical treatment with acids, acetone, acid etching, and mechanochemical treatment.

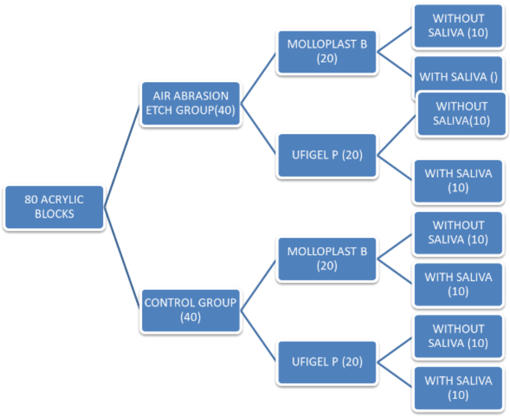
During use, soft lining materials are immersed in saliva and during denture storage in water or an aqueous cleaning solution.soft denture lining materials undergo two responses during immersion leaching out of plasticizers and other soluble components and absorption of water and saliva.[12,13]

MATERIALS AND METHODS

160 pmma blocks size (10 *10*40) prepared(FIG 2). To prepare equal blocks first metal die of this size is prepared and putty index taken and poured with wax and flasked in a conventional manner.40 specimens were prepared from these blocks half were lined by Molloplast b by flasking and half were lined with ufi gel p without any surface pretreatment(control group) and the rest 40 were acid etched with 36 % phosphoric acid for30 seconds, ashed with water under pressure for 30 seconds with three way syringe and dried for 20 seconds with air spray.(test group)and a half (20)were lined by Molloplast b and half (20) were lined with RTV Ufigel p. these subgroups were further divided into two groups. From each of the surface treated groups, 10 samples tested the same day for tensile bond strength and the other 10 samples were stored in artificial saliva for 7 days and then tested for tensile bond strength.

The specimen was subjected to tensile stress on UTM (universal testing machine) and deformed using a crosshead speed of 5 mm per minute. The load at which failures occurred was recorded. The machine has two arms which move in the opposite direction during tensile bond testing at 5 mm/ minute pulling acrylic blocks apart and stretching the soft liner until it debonds and the final maximum stress valur recorded.(FIG 6) The values were calibrated and the tensile bond strength was calculated using the following formula: Tensile bond strength = Load in newtons

Surface area in mms (Grouping of test specimen)



Flow Chart 1: Flow chart of experimentation.

Fig 1: Stainless steel (S.S.) steel master die (10*10*40MM).

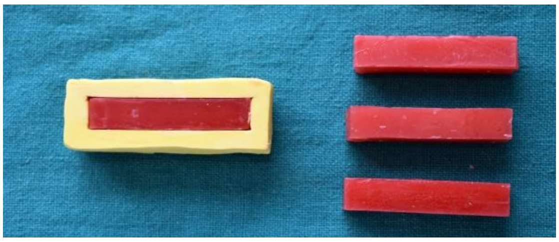


Fig 2: Wax blocks obtained from index mold.

Fig 3: fabrication of UFI GEL P specimen.

Fig 4: Fabrication of Molloplast B specimen.

Fig 5: Test specimen immerced in artificial saliva for 7 days.

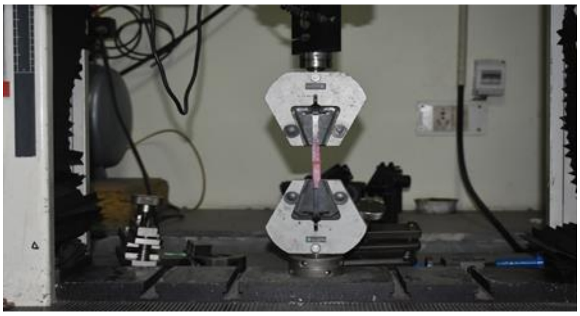


Fig 6: Specimen tested at UTM.

Table 1. Comparison of mean tensile bond strength of Malloplast B without saliva between the cases and controls using independent t test.

Groups	Sample size	Mean	SD	Mean difference	t value	p value	Significance
Case	10	1.48	0.05	0.06	2.623	0.017	Statistically significant
Control	10	1.42	0.03				

The case group showed higher mean tensile bond strength of Malloplast B without saliva than the control group with mean difference of 0.06 mpa which is statistically significant (p<0.05)

Graph 1: Comparison of mean tensile bond strength of Malloplast B without saliva between the cases and controls.

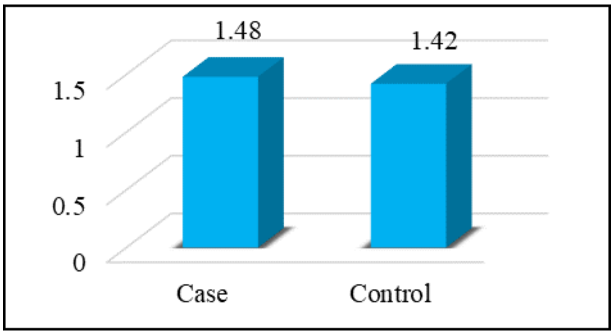
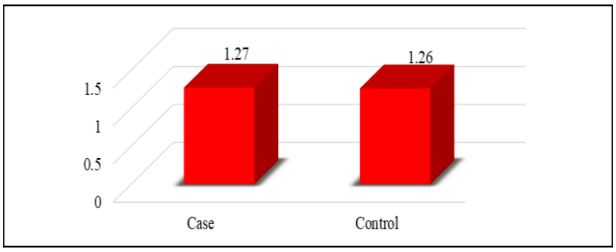


Table 2: Comparison of mean tensile bond strength of Malloplast B immersed in saliva between the cases and controls using independent t test.

Groups	Sample size	Mean	SD	Mean difference	t value	p value	Significance
Case	10	1.27	0.07	0.01	4.847	0.000	Statistically significant
Control	10	1.26	0.04				

The case group showed higher mean tensile bond strength of Malloplast B immersed in saliva than the control group with mean difference of 0.01 mpa which is statistically significant (p<0.05)

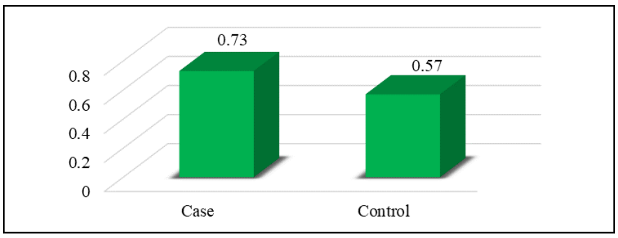


Graph 2: Comparison of mean tensile bond strength of Malloplast B immersed in saliva between the cases and controls.

Table 3: Comparison of mean tensile bond strength of Ufi Gel P without saliva between the cases and controls using independent t test.

Groups	Sample size	Mean	SD	Mean difference	t value	p value	Significance
Case	10	0.73	0.04	0.16	11.217	0.000	Statistically significant
Control	10	0.57	0.03				

The case group showed higher mean tensile bond strength of Ufi Gel P without saliva than the control group with mean difference of 0.16 mpa which is statistically significant (p<0.05).

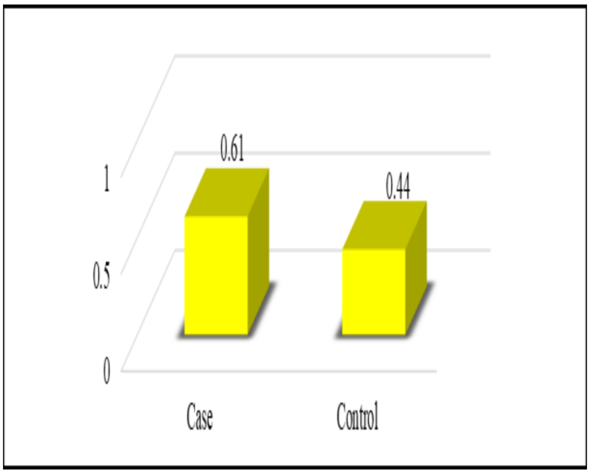


Graph 3: Comparison of mean tensile bond strength of Ufi Gel P without saliva between the cases and controls.

Table 4: Comparison of mean tensile bond strength of Ufi Gel P immersed in saliva between the cases and controls using independent t test.

Groups	Sample size	Mean	SD	Mean difference	t value	p value	Significance
Case	10	0.61	0.05	0.17	8.754	0.000	Statistically significant
Control	10	0.44	0.03				

The case group showed higher mean tensile bond strength of Ufi Gel P immersed in saliva than the control group with mean difference of 0.17 mpa which is statistically significant ($p<0.05$).

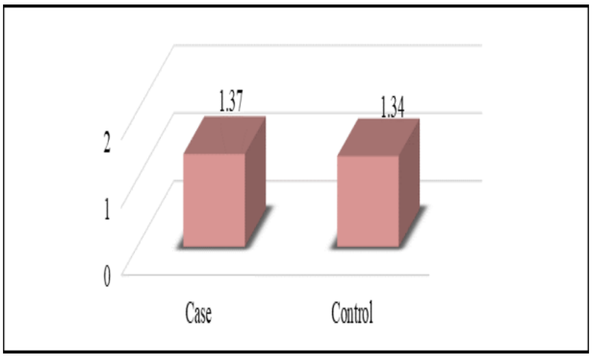


Graph 4: Comparison of mean tensile bond strength of Ufi Gel P immersed in saliva between the cases and controls.

Table 5: Overall comparison of mean tensile bond strength of Malloplast B between the cases and controls using independent t test.

Groups	Sample size	Mean	SD	Mean difference	t value	p value	Significance
Case	20	1.37	0.12	0.03	4.719	0.000	Statistically significant
Control	20	1.34	0.09				

The case group showed higher mean tensile bond strength of Malloplast B than the control group with mean difference of 0.03 mpa which is statistically significant ($p<0.05$)

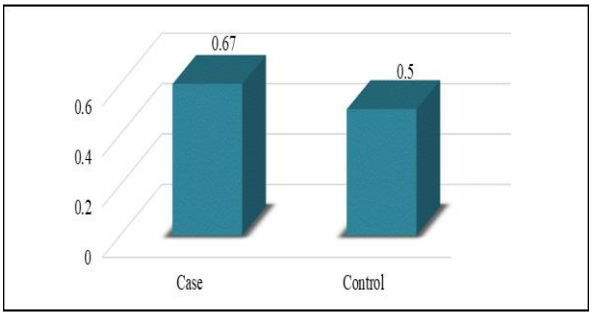


Graph 5: Overall comparison of mean tensile bond strength of Malloplast B between the cases and controls.

Table 6: Overall comparison of mean tensile bond strength of Ufi Gel P between the cases and controls using independent t test.

Groups	Sample size	Mean	SD	Mean difference	t value	p value	Significance
Case	20	0.67	0.08	0.17	6.798	0.000	Statistically significant
Control	20	0.50	0.07				

The case group showed higher mean tensile bond strength of Ufi Gel P than the control group with mean difference of 0.17 mpa which is statistically significant ($p<0.05$)



Graph 6: Overall comparison of mean tensile bond strength of Ufi Gel P between the cases and controls.

DISCUSSION

This test was intended to evaluate the effect of chemical pretreatment and artificial saliva effect on tensile bond strength 2 commercially available soft liner to heat-cured PMMA. resin resilient liner should have good adhesion to the pmma. Poor adhesion to the adhesion leads to functional and hygiene problems if they detach from each other during use. this study was undertaken to estimate the bond strength of different soft liners to pmma resin.

Test develop by various investigators for testing the bond strength include peel test, tensile test, and shear test. Peel test closely resembles intraoral forces but chances of cohesive failures are more. Craig and Gibbons 9 assessed TBS is 0.45 mm and is adequate adhesive value for an optimal bond. According to Kawano at el11 a bond strength of 0.44 mpa is acceptable for the clinical use of resilient lining materials khan et al reported that soft denture liners should have a minimum of 0.44 mpa bond strength to be acceptable for clinical use12.. both the soft liners have tensile bond strength higher than above so it indicates this study have got satisfactory bond strength for clinical application.

Phosphoric acid reactively dissolves hydrocarbons in the polar phosphoric phase of hydrocarbons depending on the carbon number and properties of an alkyl group. Since phosphoric acid increases the polarity hydrocarbons chains of PMMA, adhesion between soft liner and pmma increased.the treatment by which phosphoric acid introduces surface roughness at molecular level also. this could explain the higher strengths of the acid etched test specimen observed in this study.the bond strength values of all the resilient liner materials were lower with immersion in artificial saliva. these results agree with those of investigators.

CONCLUSION

1) Acid etch treatment of the pmma surface enhanced the bonding between liner and PMMA.

2) Mean bond strength of Molloplast b was significantly higher than ufi gel p in various surface treatment groups.

3) Both the material tested had mean bond strength values greater than the minimum acceptable standard(0.44 mpa) for clinical application.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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