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Comparative evaluation of tensile bond strength of auto polymerising and heat cure soft liner with different denture base resins after surface treatment: An *in vitro* study

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Abstract

Aim: To compare the bond strength of the auto polymerising and heat cure soft liner bonded to the Different heat cure acrylic denture base resins

Materials and methods: One silicone based autopolymerising soft liner (Mollosil) and one silicon based heat polymerized soft liners (Molloplast-B) were used in this study one twenty specimens (30mm x 10mm x10mm) were fabricated in stainless steel molds for testing Tensile strength. 240 blocks randomly divided into 12 groups, each group contained 20 blocks to fabricated 10 specimens per group. The specimen preparation and test for Tensile strength were carried out in accordance with the ISO Specification No. 10139 for soft denture liners.

Result: The Mean Tensile bond strength was found to be highest (3.20 Mpa) for Group12 - PMMA (Trevelon) after Surface treatment with MMA and alumina particles packed with Molloplast – B Mollosil - Mean Tensile bond strength of Group 1,2,3(control group) was found to be less than Group 7,8,9(after surface treatment). Mollopast B - Mean Tear bond strength of Group 4,5,6 (control group) was found to be less than Group 10,11,12 (after surface treatment) The lowest Tensile bond strength was found to be of Group 2 - non treated PMMA Ashwin (1.22 Mpa)

Conclusion: Bond strength of Molloplast-B was greater than bond strength of Mollosil.

Bond strength of Molloplast-B packed against denture base trevalon after surface treatment was even greater than the bond strength of Molloplast-B bonded with trevalon without surface treatment. The lowest tensile bond strength was seen with Mollosil cured against denture base Ashwin.

Keywords: Soft liners; Silicon based soft liners; Mollosil; Molloplast-b

1. Introduction

Edentulous patients often seek prosthodontic care to replace their missing teeth for improvement in esthetics, function, and speech [1]. Complete denture bases are fabricated commonly from rigid denture base materials like acrylic, vinyl and other resin polymers. The success of complete or partial dentures depends on esthetics, comfort and function [2]. The fit of the denture base to the alveolar ridge progressively declines as the alveolar ridge resorbs, which affects denture stability, support and retention thus jeopardizing denture success. In various clinical conditions like atrophic or resorbed ridges, xerostomia, dentures opposing natural dentition, bony undercuts, relining is indicated to recapture the fit of the denture base, especially when the denture still retains proper vertical dimension, occlusal relationship and esthetics1,3

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However one of their major drawbacks in silicone soft liners is the lack of durable bond to the denture base resin. The bond between the heat polymerized acrylic resin and the silicone soft liners failed quite often requiring repeated relines.

Therefore this study was done to compare the bond strength of the auto polymerising and heat cure soft liners bonded to the Different heat cure acrylic denture base.

2. Materials and methodology

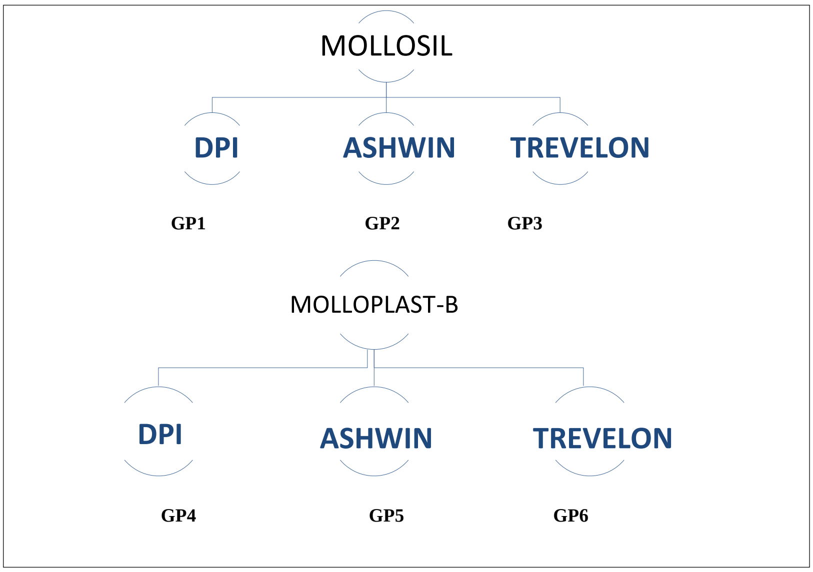
Samples were made into the shape of two denture base acrylic resin blocks, joined by a soft liner disc. Wax blocks of dimension 30mm x10 mm x 10 mm were prepared using metal mold. Fig 1.

Figure 1 Stainless Steel Mould

A sum of 240 wax blocks were made and invest in the metal flasks with gypsum product followed by dewaxing and processed by compression molding technique using short curing cycle follow The acrylic blocks **then** retrieved from flasks and finishing and polishing **was** done.

The surfaces of the blocks to be bonded to liner **were** cleaned with fine grit sandpaper of number 320. After finishing and polishing, 240 blocks randomly divided into 12 groups, each group contained 20 blocks to fabricated 10 specimens per grouped by bench cooling of the flask after the curing.

2.1. Control group(1-6)



Study design

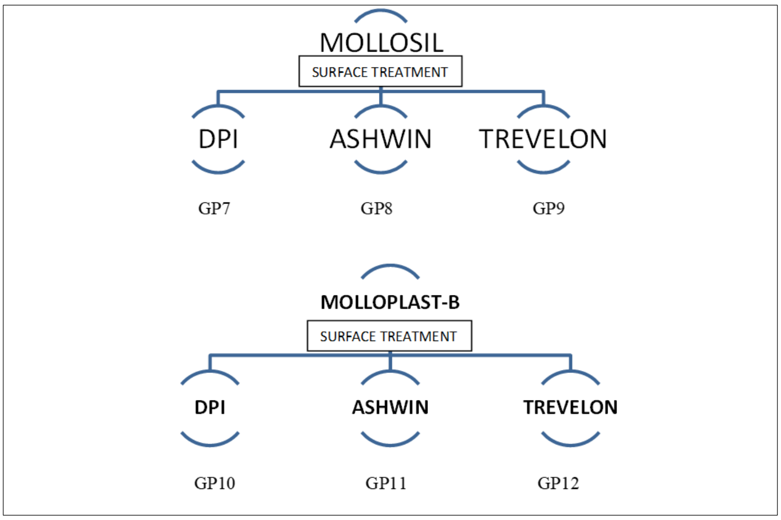
2.2. Surface treatment

The surfaces of denture blocks were cleaned off and application of MMA on the surfaces of blocks were done. **Fig 2.**Surfaces of blocks to be bonded to liner was treated by sandblasting with alumina particles **Fig 3** .The nozzle measuring about 1.0 mm in diameter was held in tight contact with each specimen and moved across the specimens for 30 seconds with 250µm aluminium oxide particles as the sandblasting medium at a pressure of 0.62 Mpa.

Figure 2 Application of MMA

Figure 3 sandblasting with alumina particles

2.3. GROUP (7-12)



After surface treatment

Figure 4 Mollosil

Figure 5 Molloplast-B

2.4. Preparation of group 1,2,3

Mollosil adhesive No. 03007 was applied on the dried and degreased surfaces of both blocks for only 1 minute. The blocks were then placed back in the flask. In the space created by the removal of spacer, **Fig 4**

Mollosil was packed by mixing both tubes according to manufacturer's instructions in the ratio of 1:1. The flask was closed and bench-pressed for about 10–15 minutes and the sample was removed. Thirty such samples were fabricated 10 specimens per group for DPI , Ashvin,Trevelon respectively and subjected to tensile testing.

2.5. Preparation of group 4,5,6

Fabrication of blocks was done using the same curing cycle as stated above. The blocks were removed and trimmed. The surfaces of denture blocks were cleaned off and Primo adhesive No. 03004 was applied uniformly with the brush one or two times to cover the surface of denture blocks. The blocks were kept to air dry and then placed back in the flask.

A recommended thickness for a soft liner is 3 mm , so 3 mm space was created with putty space template .Heat cure Molloplast-B soft liner **Fig 5** was packed in the space formed by removal of spacer. It was then bench-pressed for 15 minutes at 100–200 kvp. Polymerization was again done by placing the flask in cold water and heating slowly up to 100°C and further keeping it at 100°C for approximately 2 hours. Cooling of flask was done slowly. THIRTY such samples were fabricated 10 specimens per group for dpi , ashvin, trevelon respectively and subjected to tensile testing .

Same steps were followed after surface treatment to form GP 7-12. **Fig 6,7,8,9**

Figure 6 Flasking of pmma with spacer template(3mm)

Figure 7 soft reliner packed in flask (molloplast)

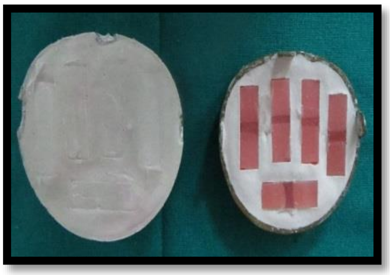


Figure 8 soft reliner packed in flask (mollosil)

Figure 9 finishing & polishing

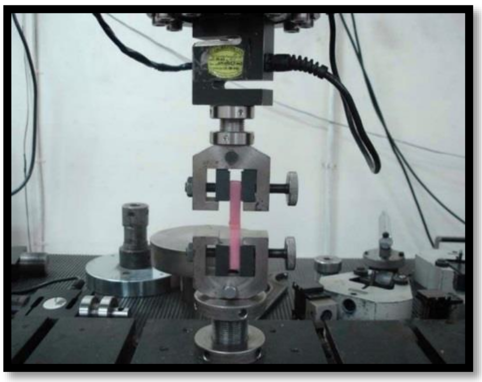


Figure 10 Universal testing machine

The Mean **Tensile** bond strength was found to be highest (3.20 Mpa) for Group12 - PMMA (Trevelon) after Surface treatment with MMA and alumina particles packed with Molloplast – B

Mollosil - Mean Tensile bond strength of Group 1,2,3(control group) was found to be less than Group 7,8,9(after surface treatment)

Mollopast B - Mean Tensile bond strength of Group 4,5,6 (control group) was found to be less than Group 10,11,12 (after surface treatment)

The lowest Tensile bond strength was found to be of Group 2 - non treated PMMA Ashwin (1.22 Mpa) (Table 1)

The results of the present study were subjected to statistical analysis to interpret the difference and the significance among various groups.

2.6. Statistical evaluation

Statistical analysis was performed by using descriptive and inferential statistics with Independent sample t-test to compare mean values between the two groups. Real scale data presented in mean+sd. One way Anova followed by Tukeys HSD for multiple comparisons was used to compare mean values between the 12 sub-groups.

P-value less than 0.05 considered as significant at 95% confidence level. Statistical software SPSS version 24.0 was used in the analysis.

Tensile strength was calculated as follows:

Bond strength = Maximum load (kgf)/Cross-sectional area (mm2)

kgf stands for kilogram force. 1 N/mm^2= 1Mpa

All the statistical tabulations were done using Microsoft Excel (Microsoft office 2016). The data was subjected to

- One-way ANOVA analysis
- Tukey-HSD post hoc test

2.6.1. One-way ANOVA analysis:

This analysis is employed to compare the means of three or more independent groups of observation. In this study, one-way ANOVA was used to determine the statistical difference in tear bond strength within 12 groups (1-12). There was statistical difference between 12 groups (F = 2660.467, P value =0.003).

2.6.2. Tukey-HSD post hoc test:

In this study, since significant differences were determined using One-way ANOVA, the results were further analyzed using the Tukey – HSD test at a significant level of 5 %. This was done to determine where the differences between groups and within each group lie. According to this multiple comparison test, there was significant difference (P value = 0.001) between atleast two groups

Table 1 Tensile Bond Strength, N/mm2

Control group (no surface treatment)												
S. No.	**Group 1 DPI MOLLOSIL**		**Group 2 ASVIN MOLLOSIL**		**Group 3 TRAVELON MOLLOSIL**		**Group 4 DPI MOLLOPLAST**		**Group 5 ASVIN MOLLOPLAST**		**Group 6 TRAVELON MOLLOPLAST**	
	LOAD N	**T.B.S N/mm^2**	**LOAD N**	**T.B.S N/mm^2**	**LOAD N**	**T.B.S N/mm^2**	**LOAD N**	**T.B.S N/mm^2**	**LOAD N**	**T.B.S N/mm^2**	**LOAD N**	**T.B.S N/mm^2**
1.	132	1.32	122	1.22	130	1.30	310	3.10	311	3.11	310	3.10
2.	130	1.30	120	1.20	132	1.32	315	3.15	315	3.15	305	3.05
3.	131	1.31	121	1.21	128	1.28	318	3.18	310	3.10	301	3.01
4.	133	1.33	123	1..23	133	1.33	323	3.23	319	3.19	300	3.00

5.	134	1.34	124	1.24	128	1.28	325	3.25	323	3.23	315	3.15
6.	132	1.32	122	1.22	132	1.32	305	3.05	321	3.21	320	3.20
7.	133	1.33	123	1.23	134	1.34	311	3.11	320	3.20	314	3.14
8.	132	1.32	120	1.20	132	1.32	309	3.09	314	3.14	325	3.25
9.	130	1.30	122	1.22	130	1.30	315	3.15	325	3.25	314	3.14
10.	133	1.33	124	1.24	128	1.28	317	3.17	312	3.12	320	3.20
Avg.	132	1.32	122	1.22	130	1.30	314	3.14	314	3.17	312	3.12

After surface treatment												
S. No.	**Group 7 DPI MOLLOSIL**		**Group 8 ASVIN MOLLOSIL**		**Group 9 TRAVELON MOLLOSIL**		**Group 10 DPI MOLLOPLAST**		**Group 11 ASVIN MOLLOPLAST**		**Group 12 TRAVELON MOLLOPLAST**	
	LOAD N	**T.B.S N/mm2**	**LOAD N**	**T.B.S N/mm2**	**LOAD N**	**T.B.S N/mm2**	**LOAD N**	**T.B.S N/mm2**	**LOAD N**	**T.B.S N/mm2**	**LOAD N**	**T.B.S N/mm2**
1.	210	2.10	215	2.15	220	2.20	315	3.15	305	3.05	320	3.20
2.	214	2.14	210	2.10	205	2.05	310	3.10	309	3.09	310	3.10
3.	215	2.15	220	2.20	203	2.03	312	3.12	311	3.11	315	3.15
4.	213	2.13	213	2.13	200	2.00	320	3.20	313	3.13	319	3.19
5.	220	2.20	216	2.16	210	2.10	323	3.23	309	3.09	315	3.15
6.	221	2.21	218	2.18	211	2.11	321	3.21	310	3.10	317	3.17
7.	213	2.13	210	2.10	205	2.05	320	3.20	316	3.16	330	3.30
8.	215	2.15	209	2.09	201	2.01	319	3.19	312	3.12	320	3.20
9.	219	2.19	213	2.13	200	2.00	321	3.21	322	3.22	325	3.25
10.	222	2.22	220	2.20	202	2.02	320	3.20	318	3.18	330	3.30
Avg.	216	2.16	214	2.14	206	2.06	318	3.18	312	3.12	320	3.20

Table 2 Comparison between control and cases

Group Statistics					
Group		**N**	**Mean**	**Std. Deviation**	**p-value**
TBS	Control	60	2.22	0.94	0.003
	After surface treatment	60	2.65	0.53	

p-value 0.003 signify that there is significant difference between control and cases with higher mean in after surface treatment.

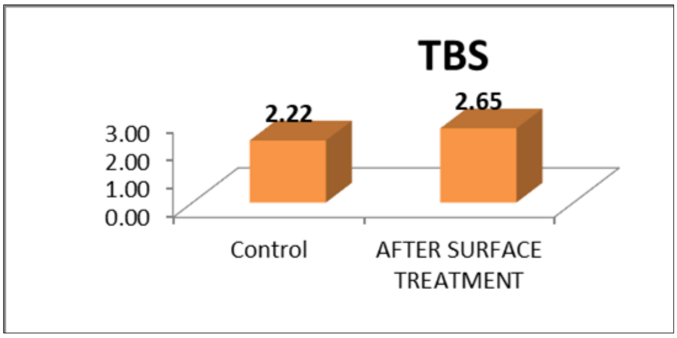


Figure 11 Comparison between control and cases

Table 3 Comparison between subgroups

Groups	N	Mean	Std. Deviation	95% Confidence Interval for Mean		Minimum	Maximum
				Lower Bound	Upper Bound		
Group 1	10	1.32	0.01	1.31	1.33	1.30	1.34
Group 2	10	1.22	0.01	1.21	1.23	1.20	1.24
Group 3	10	1.31	0.02	1.29	1.32	1.28	1.34
Group 4	10	3.15	0.06	3.10	3.19	3.05	3.25
Group 5	10	3.17	0.05	3.13	3.21	3.10	3.25
Group 6	10	3.12	0.08	3.06	3.18	3.00	3.25
Group 7	10	2.16	0.04	2.13	2.19	2.10	2.22
Group 8	10	2.14	0.04	2.11	2.17	2.09	2.20
Group 9	10	2.06	0.06	2.01	2.10	2.00	2.20
Group 10	10	3.18	0.04	3.15	3.21	3.10	3.23
Group 11	10	3.13	0.05	3.09	3.16	3.05	3.22
Group 12	10	3.20	0.07	3.15	3.25	3.10	3.30
Total	120	2.43	0.79	2.29	2.57	1.20	3.30

ANOVA

		Sum of Squares	df	Mean Square	F	p-value
TBS	Between Groups	74.339	11	6.758	2660.467	<0.001
	Within Groups	0.274	108	0.003		
	Total	74.613	119			

P-values in the above table less than 0.001 shows that there is difference between at least two groups. To see the group-wise significance, following tables with p-values need to be explored

Table 4 Multiple comparisons

I	J	Mean Difference (I-J)	p-value	Inference
Group 1	Group 2	**0.09900***	0.002	NS
	Group 3	0.01300	1.000	NS
	Group 4	-1.82800*	<0.001	S

I	J	Mean Difference (I-J)	p-value	Inference
	Group 5	-1.85000*	<0.001	S
	Group 6	-1.80400*	<0.001	S
	Group 7	-.84200*	<0.001	S
	Group 8	-.82400*	<0.001	S
	Group 9	-.73700*	<0.001	S
	Group 10	-1.86100*	<0.001	S
	Group 11	-1.80500*	<0.001	S
	Group 12	-1.88100*	<0.001	S
Group 2	Group 3	-.08600*	0.012	NS
	Group 4	-1.92700*	<0.001	S
	Group 5	-1.94900*	<0.001	S
	Group 6	-1.90300*	<0.001	S
	Group 7	**-0.94100***	<0.001	S
	Group 8	**-0.92300***	<0.001	S
	Group 9	**-0.83600***	<0.001	S
	Group 10	-1.96000*	<0.001	S
	Group 11	-1.90400*	<0.001	S
	Group 12	-1.98000*	<0.001	S
Group 3	Group 4	-1.84100*	<0.001	S
	Group 5	-1.86300*	<0.001	S
	Group 6	-1.81700*	<0.001	S
	Group 7	-0.85500*	<0.001	S
	Group 8	-0.83700*	<0.001	S
	Group 9	-0.75000*	<0.001	S
	Group 10	-1.87400*	<0.001	S
	Group 11	-1.81800*	<0.001	S
	Group 12	-1.89400*	<0.001	S
Group 4	Group 5	-0.02200	0.998	NS
	Group 6	0.02400	0.996	NS
	Group 7	0.98600*	0.000	S
	Group 8	1.00400*	0.000	S
	Group 9	1.09100*	0.000	S
	Group 10	-0.03300	0.947	NS
	Group 11	0.02300	0.997	NS
	Group 12	-0.05300	0.448	NS

I	J	Mean Difference (I-J)	p-value	Inference
Group 5	Group 6	0.04600	0.665	NS
	Group 7	1.00800*	<0.001	S
	Group 8	1.02600*	<0.001	S
	Group 9	1.11300*	<0.001	S
	Group 10	-0.01100	1.000	NS
	Group 11	0.04500	0.695	NS
	Group 12	-0.03100	0.966	NS
Group 6	Group 7	0.96200*	<0.001	S
	Group 8	**0.98000***	<0.001	S
	Group 9	1.06700*	<0.001	S
	Group 10	-0.05700	0.334	NS
	Group 11	-0.00100	1.000	NS
	Group 12	**-0.07700***	0.040	S
Group 7	Group 8	0.01800	1.000	NS
	Group 9	**0.10500***	0.001	S
	Group 10	-1.01900*	<0.001	S
	Group 11	**-0.96300***	<0.001	S
	Group 12	-1.03900*	<0.001	S
Group 8	Group 9	**0.08700***	0.010	NS
	Group 10	-1.03700*	<0.001	S
	Group 11	**-0.98100***	<0.001	S
	Group 12	-1.05700*	<0.001	S
Group 9	Group 10	-1.12400*	<0.001	S
	Group 11	-1.06800*	<0.001	S
	Group 12	-1.14400*	<0.001	S
Group 10	Group 11	0.05600	0.361	NS
	Group 12	-0.02000	0.999	NS
Group 11	Group 12	**-0.07600***	0.046	NS

*The mean difference is significant at 0.05 level P value < 0.05 denotes significance at the 5% level, S- Significant, NS- Non significant

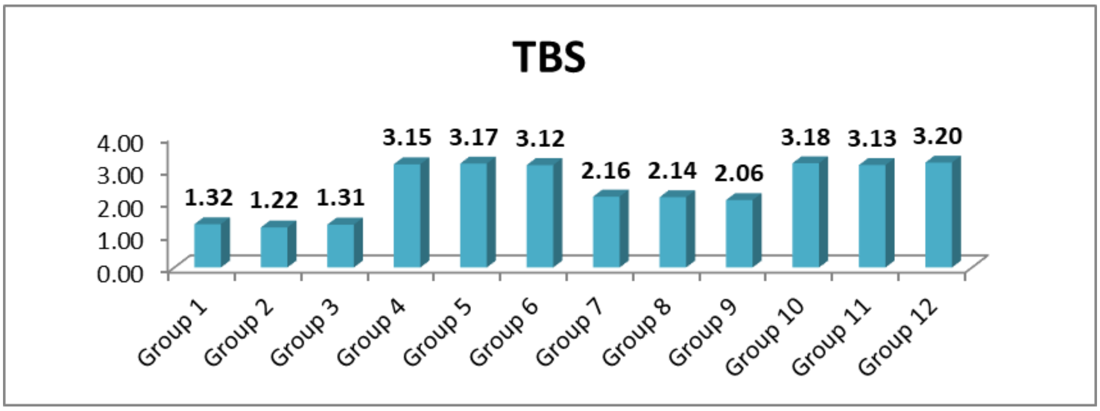


Figure 12 Comparison of Mean Tear bond strength between Group 1-12

3. Discussion

Soft liners are mainly used on complete dentures, where it is necessary to absorb masticatory loads and are indicated for patients who are unable to tolerate the pressures transmitted by the denture to the underlying mucosa of the edentulous ridge.

DPI and Ashwin acrylic denture base resin are conventional PMMA heat cured acrylic denture base resin and Travelon HI is a high impact heat cure acrylic denture base resin.[4]

Soft reliners used in the study are Mollosil (Detax Gmbh & Co. Gmbh & Co. Germany) and Molloplast – B.

Mollosil a silicone resilient lining material is similar in composition to silicone impression materials, both are dimethylsiloxane polymers.[5]

Polydimethylsiloxane is a viscous liquid that can be cross-linked to form a rubber with good elastic properties. Mollosil primer have alkyl silicone resin in organic solvent for adhesive bonding with denture base resin and soft reliner. No plasticizer is necessary to produce a softening effect and they retain their resilience throughout their working life.[6-8]

Silicones used as soft lining materials are classified as autopolymerized (RTV—room temperature vulcanized) or heat-cured/ heat temperature vulcanized ((HTV). Examples of Autopolymerized Silicone-based Long-term soft denture lining materials (SLTSDL) include Permaflex Ufi Gel SC, Ufi Gel P, Mollosil Plus, Mollosil, Tokuyama Soft, Mucopren soft, Dentusil, GC Reline Soft, GC Reline Ultrasoft, and Softreliner Tough Mucosoft.

The use of heat temperature vulcanized (HTV)silicone in soft linings, such as in Molloplast B, Permaflex, Flexor, and Luci-Soft, has frequently been investigated. The typical materials, which cross-link with radicals, consist of polydimethylsiloxanes and an organic peroxide, such as benzoyl peroxide. Cross-linking is initiated by free radicals that are generated by the decomposition of organic peroxides at high temperatures[9-12]

3.1. Tensile bond strength

It is the maximum stress the material will with stand before rupture. The tensile bond strength of soft liners were tested using a universal testing machine .

Carlos Nelson Elias (2007)[13] used same instrument to find the tensile bond strength of soft liners.

In the present study the mean **tensile** bond strength was found to be highest for Group12(Trevelon+ Molloplast-B) after Surface Treatment - 3.20 Mpa followed by Group 10(Dpi+Molloplast) (3.18 Mpa) The lowest **Tensile** bond strength was found to be of Group 2(Ashwin) -1.22 Mpa.

The result of this study showed that the bond strength of silicone soft liner bonded to the treated surface of the acrylic denture base with methyl metha acrylate for 180 seconds and sandblasting was improved appreciably than untreated samples.

The results of this study was correlated with that of previous studies done by various workers who had done elaborate studies and it was understood that the swelling of the outer layer of denture base by MMA wetting and the penetration of the adhesive more effectively into the pores created improved the bonding ability between the denture base and soft liner.

In order to achieve success in the relining process in complete and partial dentures, the same type of heat-cured lining material should be used because of the need for similar tensile strength and bonding properties. Most bonds established between the materials tested appeared to be adequate but delamination of the material will still cause the reline to fail and require replacement of the lining. A clinician must consider using a material with good bonding properties, as well as good flexural properties combined with good handling properties.

Analysis of tensile bond strength values indicated significant differences ($p < 0.001$) among the two liners when bonded with different denture base resins.

PMMA (Trevelon) after Surface treatment with MMA and alumina particles packed with Molloplast – B showed highest Tensile bond strength (3.20 MPa) and least was observed with non treated PMMA Ashwin(1.22 MPa) being packed with Mollosil after being stored in artificial saliva at 37 ± 1 C.

The results of the present study revel that treating the acrylic denture base with methyl methacrylate improved the efficiency of bonding between a silicone-based resilient lining material and denture base.

In addition, the type of denture base material, the preparation of its surface with different-grit abrasive papers , sandblasting or the aging of denture base material substrates before Long-term soft denture lining materials (LTSDL)application could affect the results[14-16]

4. Conclusion

Within the limitations of this in vitro study, it was concluded that:

- Tensile test mode used for measuring the bond strength was effective in evaluating and ranking the bond strengths.
- Bond strength of Molloplast-B was greater than bond strength of Mollosil.
- Bond strength of Molloplast-B packed against denture base trevalon after surface treatment was even greater than the bond strength of Molloplast-B bonded with trevalon without surface treatment .
- The lowest tensile bond strength was seen with Mollosil cured against denture base Ashwin.

Recommendations

- The highest tensile bond strength was seen with Molloplast- B cured against heat cure high impact PMMA. However, a number of silicone liners are available in the market. So further clinical studies, evaluating large number of liners are required to generalize the results and to verify the denture liner that offers the best intra oral performance.
- Laboratory tests do not necessarily represent the load that the lining material can withstand clinically because in laboratory test only one type of force is applied at a time, compared with the various masticatory forces that dentures are subjected to clinically. However, laboratory tests are useful in comparing and ranking the bond strength of resilient liners.
- The selection and use of the denture liners must be made with regard to other handling and physical properties such as tissue compatibility, softness, colour stability, dimensional stability and absence of taste and odour.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors have nothing to disclose or any conflicts of interest.

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None.

References

[1] Kawano F, Dootz ER, Koran A, Robert G. Comparison of bond strength of six soft denture liners to denture base resin. J Prosthet Dent 1992;68:368-71.

[2] Arena CA, Evans DB, Hilton TJ. A Comparison of Bond Strengths among Chairside Hard Reline Materials. J Prosthet Dent 1993; 70: 126-31.

[3] Dootz ER, Koran 3rd A, Craig RG. Physical property comparison of 11 soft denture lining material as a function of accelerated aging. J Prosthet Dent. 1993;69:114-119.Omer Kutay. Comparison of tensile and peel bond strengths of resilient Liners. J Prosthet Dent 1994;71:526-31.

[4] T. J. Emmer et. al. Bond strength of permanent soft denture liners bonded to the denture base. J Prosthet Dent 1995;74:595-601.

[5] Lewinstein I, Zeltser C, Mayer CM, Tal Y. Transverse bond strength of repaired acrylic resin strips and temperature rise of dentures relined with VLC reline resin. J Prosthet Dent 1995;74:392–9.

[6] Moodhy S. Al-Athel et. al. Effect of test method on the bond strength of a silicone resilient denture lining material. J Prosthet Dent 1996;76:535-40.

[7] Arima T, Nikawa H, Hamada T. Composition and effect of denture base resin surface primers for reline acrylic resins. J Prosthet Dent 1996; 75: 457-62.

[8] Aydin AK, Terzioglu H, Akinay AE, Ulubayram K, Hasirci N. Bond strength and failure analysis of lining materials to denture resin. Dental Materials 1999; 15: 211-218.

[9] El-Hadary A, Drummond JL. Comparative study of water sorption, solubility and tensile bond strength of two soft lining materials. J Prosthet Dent 2000; 83: 356-61.

[10] H. Murata et al. Dynamic Viscoelasticity of Soft Liners and Masticatory Function. J Dent Res 81(2):123-128, 2002

[11] Kulak-Ozkam Y, Sertgoz A, Gedik H. Effect of thermocycling on tensile bond strength of six silicone-based, resilient denture liners. J Prosthet Dent 2003; 89:303-10.

[12] A.V. Naik, J.L. Jabade. Comparison of tensile bond strength of resilient soft liners to denture base resins. The Journal of Indian Prosthodontic Society, June 2005, Vol 5, Issue 2.

[13] Carlos Nelson Elias. Effect of thermocycling on the tensile and shear bond strengths of three soft liners to a Denture base resin. J. Appl.Oral Sci. 2007; 15(1): 18-23

[14] Mese A. Bond strength of soft denture liners following immersion of denture cleanser. BiotechnolBiotechnol Eq. 2006;20:184e191.

[15] Suguru Kimoto et al. Randomized controlled clinical trial for verifying the effect of silicone-based resilient denture liner on the masticatory function of complete denture wearers. Int J Prosthodont 2006;19:593–600.

[16] Mutluay MM, Ruyter IE. Evaluation of bond strength of soft relining materials to denture base polymers. Dental Materials 2007; 23: 1373-1381.