ISSN No:-2456-2165

Comparative Evaluation of the Tensile Bond Strength between Denture Base Resin to Two Different Denture Liners Altered by the Incorporation of Antifungal Agents": An Invitro Study

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Abstract:- Denture stomatitis is a common oral lesion seen with the use in patients using removable dentures (65%). Candida Albicans is known to be one of the major factor that causes this apart from the other commonly known factors. Denture stomatitis can be treated in several ways which may include using topical and systemic antifungal agents, cleansing agents to clean the denture, disinfection procedure, replacement of old and worn out denture, denture relining, reestablishment of atraumatic occlusion and nutritional restitution.

Denture relining materials are materials that act like shock absorbers where the lessen the force passed on to the tissues. Resilient liners degrade quite easily and also are susceptible to colonization by microbes which may cause different levels of denture stomatitis . Also rapid loss of viscoelasticity following clinical use due to leaching of plasticizer into the oral environment is observed. Hence frequent clinical evaluation and periodic replacement of the soft liners is required.

Antifungal agents can be incorporated to increase the clinical longevity of these materials and also to reduce the microbial accumulation.

Denture liners modified by antifungal agents at commercially available concentrations may affect their physical properties, which may impair the clinical performance of these materials. Also, another factor that may affect the longevity is the duration of the bond Therefore, this study evaluates the tensile bond strengths of denture liners modified by antifungal agents to the denture base resin.

Purpose:To evaluate and compare the tensile bond strength between denture base resin to two different denture liners altered by the incorporation of antifungal agents.

Methodology: Sixty six samples were divided into 6 groups (2 control groups and 4 test groups) containing 11 samples each, Each sample should contained 2 acrylic plates of dimension (20x20x4mm) and these acrylic plates were kept for 30 days at 37 degrees Celsius in distilled water.

Acrylic plate on which the liner was to be applied was sandblasted using the korox 110 powder to create surface irregularities. The stainless steel square split spacer was placed over the first acrylic plate .6.35gdenture liner powder will be blended uniformly with the specified amount of antifungal powder followed by mixing the denture liner liquid(5ml) to according to instructions specified by the manufacturer. The denture liner was injected into the hollow stainless steel square split spacer to overfill. The second acrylic plate was sandblasted to create surface irregularities before placing it over the syringed liner material and any flash of excess denture liner will be removed using a sharp surgical blade. A Weight of 5kg is placed over the second acrylic plate and the liner material was allowed to set. The specimens were kept in distilled water again for 24hours at 37°c before testing is done. The specimens were subjected to the testing by the universal testing machine.

Results: At the end of the testing, the results revealed that both the liner materials showed no significant differences in their tensile bond strength of addition of fluconazole antifungal agent but significant differences were seen in the tensile bond strength with the denture base resin on addition of miconazole antifungal agent.
Keywords—Denture liners, Resilient liners, Antifungal agents, Tensile bond strength

I. INTRODUCTION

Denture stomatitis is caused by an inflammatory response of the oral mucosarelated to the wearing of dentures usually involving candida(yeast) species[4] . Pathological changes can be seen in the oral mucosa in denture stomatitis [6,7] . Apart from Candida species , there are various other factors or causes that aggravate this condition such as trauma and probably a defect in the host defense mechanism. The current belief stresses on the fact that there is interplay among the factors in the pathogenesis of this disease , the extent to which interplay is present is still controversial.

The exact prevalence of denture stomatitis is unknown. Various authors have quoted figures ranging from 11 per cent to 67 per cent. Nyquist found that 27 per cent of 601 cases he studied were affected [7].

There are three major factors that are implicated in the initiation of denture stomatitis. The major factors being trauma, infection and allergy.

Candida albicans is the one of the most common and most invasive fungal organism that is seen in the oral cavity[8,9]. The pathogenic effects of candida in the causing of candidiasis is unkown .The first person to relate denture stomatis to candida albicans was Cahn[10].Candida albicans was seen more in denture stomatitis than in control[11,12]. The frequency with which Candida species were isolated in denture wearers with non- inflamed or inflamed palatal mucosa was reported and it was found that a significantly higher yield of Candida species was found in patients with denture stomatitis.[12,13].All of these studies suggest that Candida albicans is the main causative organism in denture stomatitis.

The yeast form of Candida albicans may be pathogenic and with clinical infection, the change in the environment favors the candida albicans to develop into the infectious filamentous form[4].The pathogenetic effect of candidiasis is uncertain . Hasenclever and Mitchell suggested that the main cause of pathogenesis being the endotoxin released by candida[16].Chattaway, Odds and Barlow found that the levels of endotoxin was not enough to cause the toxic effects.[17] According to the study conducted by Nyquist trauma is to be considered as a dominant aetiological factor, as it was seen commonly seen under ill fitting denture with traumatic occlusion. Investigators believing trauma to be a significant aetiological factor for denture stomatitis and tissue conditioners and fabricating new denture are advocated.[7]

Allergy to denture base material was thought to be a cause of denture stomatitis. Leaching out of monomer was thought to be the cause of allergy.[19]

Denture bearing tissues becomes extremely sore and abused in this condition. Failure in adhesion, rough surfaces, and changes in hardness are common factors that lead to more microbial accumulation and worsen the condition . Topical antifungal and systemic therapy, oral hygiene, denture cleaning, disinfection procedure, denture relining, replacement of old dentures, elimination of anatomic irregularities, reestablishment of atraumatic occlusion, and nutritional restitution are all options for treating denture stomatitis.[4]

Denture relining is one of the effective ways in improving the condition of oral tissues [4]. Denture relining materials absorb some of the chewing load on the denture during use, reducing the amount of energy transmitted to the para prosthetic tissue[24]. These liners may be classified as provisional or definitive, room temperature or heat-temperature vulcanized [4–6]. (liner article). Plasticized acrylic resins and silicone elastomers are the two major forms of resilient liners[9].Tissue conditioners or short-term soft liners are amorphous polymers that are formed in situ from a polymer powder and a liquid plasticizer [10, 11]. They are uncross-linked (formed by polymer chain entanglements but not cross-linked) and uncross-linked (formed by polymer chain entanglements but not cross-linked). Plasticizers are liquids with low molecular weights that reduce the glass transition temperature of stiff polymers and soften them. [7].

Tissue conditioners are limited by the impact of the oral environment on their physical qualities, which demand periodic material replacement [19]. The oral cavity's moist environment permits ethanol and ester plasticizers to seep into saliva, which is subsequently absorbed by the gel's polymeric phase[12, 13, 20, 21]. Plasticizer plays a major role in the viscoelasticity of the denture. Relining material hence the leaching of the plasticizer from the denture relining material will lead to loss of the property.

Hence frequent clinical evaluation and periodic replacement of the soft liners is required[23].Resilient liners can readily disintegrate and are prone to microbial colonisation, which can cause denture stomatitis in varying degrees. Antimicrobial compounds have been recommended for use in temporary soft denture liners[22,23].Resilient liners modified by the various drugs are effective against denture stomatitis for the following reasons: 1) Contact between the prosthetic biofilm and diseased tissues is avoided, avoiding reinfection through the denture base.; 2) They differ from conventional topical antifungals in that they release antimicrobials gradually through the liners, allowing for an effective therapeutic concentration in infected sites despite the diluent effects of saliva/swallowing and tongue movements; 3) Therapy is based on the use of the relined denture, removing the need for patient compliance.; 4) Relining with soft material helps the denture base to re-adjust to the supporting tissues and reduces damage.; 5) The duration of use of a denture relined with a short-term resilient liner is short, comparable to the duration of treatment with a conventional topical antifungal (14 days), with the benefit of regenerating injured tissues and preventing biofilm accumulation until denture replacement or relining with long-term materials. [22,23,24]

Several reports have suggested that the combination of nystatin chlorhexidine is not effective in vitro against candida albicans. The most likely reason for this is that a chlorhexidine-nystatin salt is formed, and thus formed combined drug complex inactive against the microoraganism.[20]. Flucanozole and miconazole has been proven to be effective agents against candida. According to J.M Van custem et al miconazole has been proven efficacy against candida albicans.[21]

Oppositely , Mechanical and physical properties may get affected if drugs at commercially available concentration are incorporated.[1,25,26,27].which in turn may affect the clinical performance of the materials during their time of use.

Clinical performance of the denture liner may be impaired because of the change in physical properties that may occur due to the addition of the antimicrobial agents. Also, the durability of the bond between the denture base and the resilient liner is another factor. Therefore, this study evaluates the tensile bond strengths of denture liners modified by antifungal agents to the denture base resin.[3]

II. AIM OF THE STUDY

To evaluate and compare the tensile bond strength between denture base resin to two different denture liners altered by the incorporation of antifungal agents.

III. OBJECTIVES

- To evaluate the tensile bond strength of Kooliner liner and Permasoft liner on the denture base resin after addition of Miconazole antifungal powder to the denture liners.
- To evaluate the tensile bond strength of Kooliner liner and Permasoft liner on the denture base resin after addition of Miconazole antifungal powder to the denture liners.
- To evaluate the tensile bond strength of Kooliner liner and Permasoft liner on the denture base resin after addition of Fluconazole antifungal powder to the denture liners.
- To compare the tensile bond strength of Kooliner liner and Permasoft liner on addition of Miconazole antifungal powder.
- To compare the tensile bond strength of Kooliner liner and Permasoft liner on addition of Fluconazole antifungal powder.

IV. METHODOLOGY

A. MATERIAL

Heat cure acrylic samples were fabricated as substrate for primer application using DPI-Heat cure material. Two denture liners were used, GC kooliner liner and Dentsply permasoft liner. The antifungal powders used were Miconazole antifungal powder 2% (DK GEL) and Fluconazole antifungal powder 0.5% (FLUCOS) .The materials are listed in Table 1.

B. STUDY DESIGN

Each specimen consisted of 2 acrylic plates of dimension (20x20x4mm) and a handle size of 6-8mm width and 15-20mm height. 66 similar acrylic specimens were fabricated and kept in distilled water at 37℃ for 30days.These acrylic specimens were grouped as 6 groups of 11 specimens each in which 4 are test groups and 2 are control groups. These specimens were sandblastedon the side which comes incontact with the denture liner and washed thoroughly with water.The denture liner powder was mixed with the measured quantity of the antifungal agent (TABLE A) and the denture liner liquid was incorporated according to the manufacturer’s instruction. The material was then syringed to overflow in the stainless steel spacer kept over the acrylic plate. The second acrylic plate was sandwiched over this and Weight of 5kg was placed over the specimen and allowed to set.

GROUP 1-(control group) Kooliner liner alone on denture base resin
GROUP 2-(control group)Permasoft liner alone on denture base resin
GROUP 3- Kooliner liner with Fluconazole on denture base resin
GROUP 4- Kooliner liner with Miconazole on denture base resin
GROUP 5- Permasoft liner with Fluconazole on denture base resin
GROUP 6- Permasoft liner with Miconazole on denture base resin

The specimens were kept in distilled water at 37℃ for 24h and then subjected to testing with a TESCOL HPBSD model universal testing machine.

V. TABLES

TABLE SERIAL NUMBER	CONTENT
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Table 3	Mean tensile strength distribution of groups
Table 4	Comparison of tensile strength among the groups using one way anova
Table 5	Post hoc bonferroni test comparing individual groups

MATERIAL	BRAND NAME	MANUFACTURER
KOOLINER	GC	**GC Corporation 3-2-14 Hongo, Bunkyo-ku,Tokyo 113-0033, Japan.Tel +81-3-3815-1815**
PERMASOFT	DENTSPLY SIRONA	**Dentsply Sirona ,Charlotte (HQ), NCUnited States,13320 Ballantyne Corporate Pl**
HEAT CURE ACRYLIC	DPI HEAT CURE DENTURE BASE MATERIAL	**Dental Products ofIndia, The Bombay Burmah trading Corp. Ltd.**
MICONAZOLE ANTIFUNGAL POWDER 2%	DK GEL	**Hegde and Hegde Pharmaceutical LLP**
FLUCONAZOLE ANTIFUNGAL POWDER 0.5%	FLUCOS	**Oaknet Healthcare Pvt Ltd**

Table 1: Description of materials used in the study

GROUPS	MICONAZOLE ANTIFUNGAL POWDER(DK GEL) in mg	FLUCONAZOLE ANTIFUNGAL POWDER (FLUCOS) in mg
1. (CONTROL) KOOLINER	0 mg	0 mg
2.(CONTROL) PERMASOFT	0 mg	0 mg
3. KOOLINER WITH FLUCONAZOLE	0 mg	100 mg
4. KOOLINER WITH MICONAZOLE	100 mg	0 mg
5.PERMASOFT WITH FLUCONAZOLE	0 mg	100mg
6.PERMASOFT WITH MICONAZOLE	100 mg	0 mg

Table 2 : Concentration of the antifungal agent used in the denture liner

VI. SPECIMENS FRABRICATION

Sixty six specimens were divided into 6 groups (2 control groups and 4 test groups) containing 11 specimen each. Each specimen consisted of 2 acrylic plates of dimension (20x20x4mm) with the acrylic based denture liner between the two plates. Firstly, the wax specimen of the acrylic specimen was fabricated with the help of the hollow square stainless mold of internal size (20x20x4mm). A Handle of 6-8mm width and 15-20mm height was made for the wax specimen . The wax specimens made were flasked in plaster of paris and dental stone mix (Fig 13) followed by dewaxing. The mold that was obtained from dewaxing was then used to make the acrylic samples. The acrylic denture base resin was processed at temperature of 74°c for 2 hours and boiling at 100°c for 1hr in the water bath of the curing unit.

The acrylic denture base resin was processed at temperature of 74°c for 2 hours and boiling at 100°c for 1hr in the water bath of the curing unit. Once these acrylic specimens were cured, they were cooled down for 30 min before deflasking. The acrylic specimens were subjected to finishing and polishing. The finished and polished specimens were kept in an incubator at 37 degrees Celsius, for 30 days in distilled water.

These stored acrylic specimens were now sandblasted using the Korox 110 powder for 15 seconds to create surface irregularities on the surface coming in contact with the acrylic based denture liner. These abraded specimens were washed and dried thoroughly before the liner application.

A stainless steel square split spacer was placed over the first acrylic plate. Denture liner powder 6.35g was blended uniformly with the specified weighed amount of antifungal powder 100mg (Table 2) followed by mixing the denture liner liquid 5ml to it according to the instructions mentioned by the manufacturer. The liner was injected into the hollow stainless steel square split spacer to overfill. The sandblasted second acrylic plate was placed over the syringed liner material and any flash of excess denture liner was removed using a sharp surgical blade. A Weight of 5kg was placed over the second acrylic plate and the liner material was allowed to set.

Fig. 1: Acrylic specimen with the acrylic based denture liner injected in between

VII. TESTING OF SPECIMENS

The Testing of the specimens were done at Department of Dental Materials at Yenepoya Dental College. Universal testing machine is a standard equipment for evaluating tensile bond strength of 2 dissimilar materials which are conjoined together. TESCOL HPBSD model universal testing machine was used . The two handles of the acrylic plate were positioned onto the jig of the Universal testing machine and the machine was allowed to apply load to separate the two acrylic specimens attached to the jigs of the testing machine . The load applied to separate the two acrylic plates joined by the liner was noted . All the specimens were tested in the same way and the tensile bond strength was calculated. shows the diagrammatic representation of how the specimens were subjected to testing . The tensile strength was calculated using the formula : fracture load/bonding area; N/ mm2 = MPa.

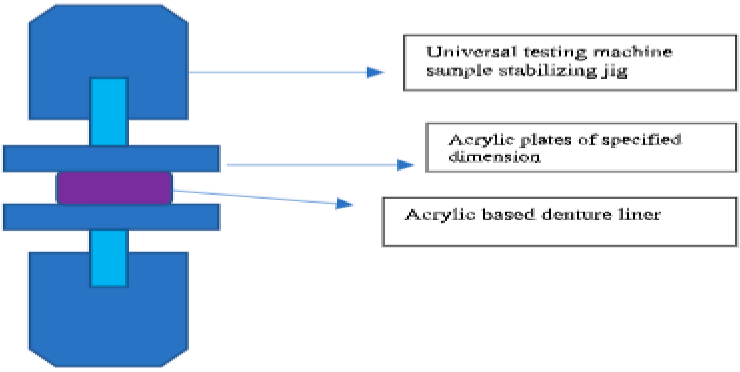


Fig. 2: Diagrammatic representation of the specimens being tested

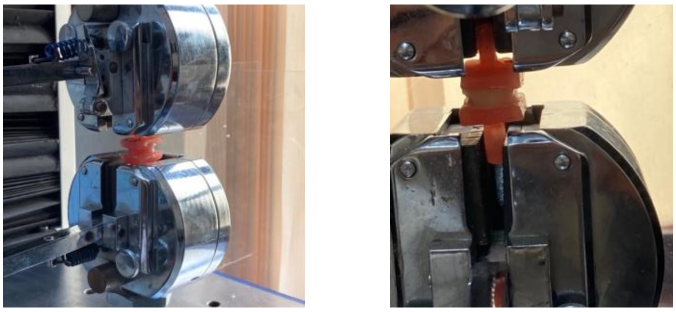


Fig. 3: Tensile bond strength testing by the universal testing machine

VIII. RESULTS

The Tensile bond strength between denture base resin and two different denture liners altered by addition of antifungal agent was subjected to test of normalcy of distribution of data (Shapiro Wilk test and Kolmogorov-Smirnov[a] test for correction). One way analysis of variance was applied on drugs at the specified concentration and showed a significant difference at P ≤ 0.05. A Post hoc Bonferroni test was done to compare between the individual groups. The statistical package SPSS VERS 20.0 (Armonk ,NY , IBM Corp) was used to do the analysis.

Table 1 shows standard deviation and mean tensile strength among the groups

Table 2 shows the comparison between the various groups using One way ANOVA which shows the statistical significance with respect to the tensile strength among the groups.

Table 3 compared the tensile bond strength of all the six groups using Post Hoc Bonfferoni analysis.

Group 1 and 2 when compared , for a mean load distribution of 13.8755 kgf for Group 1 and 7.5518 kgf for Group 2, statistically significant differences were seen with respect to the mean tensile strength between the two groups (P<0.05).

Group 1 and 3 when compared , for a mean load distribution of 13.8755 kgf for Group 1 and 13.5634 kgf for Group3, there were no statistically significant changes seen with respect to the mean tensile strength between the groups (P>0.05).

Group 1 and 4 when compared , for a mean load distribution of 13.8755 kgf for Group 1 and 11.3782 kgf for Group 4, there were statistically significant changes in mean tensile strength was seen between the two groups (p<0.05).

Group 1 and 5 when compared , for a mean load distribution of 13.8755 kgf for Group 1 and 7.4981kgf for Group 5 there were statistically significant changes in mean tensile strength seen between the groups (p<0.05).

Group 1 and 6 , when compared, for a mean load distribution of 13.8755 kgf for Group 1 and 6.1458 kgf for Group 6, statistically significant differences were seen between the two groups (P<0.05).

Group 2 and 3 when compared , for a mean load distribution of 7.5518 kgf for Group 2 and 13.5634 kgf for Group 3, there were statistically significant differences in mean tensile strengths between the two groups (P<0.05).Group 2 and 4 when compared for a mean load distribution of 7.5518 kgf for Group 2 and 11.3782 kgf for Group 4, there were statistically significant differences in mean tensile strengths between the two groups (P<0.05).

Group 2 and Group 5 when compared , for a mean load distribution of 7.5518 kgf for Group 2 and 7.4981 kgf for Group 5 , there were no statistically significant difference (P>0.05).

Group 2 and Group 6 when compared , for a mean load distribution of 7.5518 kgf for Group 2 and 6.1458 kgf for Group 6 , There were statistically significant differences in mean tensile strengths the two groups (P<0.05).

Group 3 and Group 4 when compared , for a mean load distribution of 13.5634 kgf for Group 3 and 11.3782 kgf for Group 4 , there were statistically significant differences in mean tensile strength between the two groups (P<0.05) .

Group 3 and 5 when compared, For a mean load distribution of 13.5634 kgf for Group3 and 7.4981 kgf for Group 5 . There were statistically significant differences in mean tensile strength between the two groups (p<0.05).

Group 3 and Group 6 when compared , for a mean load distribution of 13.5634 kgf for Group 3 and 6.1458 kgf for Group 6, there were statistically significant differences between the two groups (p<0.05).Group 4 and 5 when compared , for a mean load distribution of 11.3782 kgf for Group 4 and 7.4981 kgf for Group 5 , there were statistically significant differences in mean tensile strengths between Group 4 and Group 5 (P<0.05).

Group 4 and Group 6 when compared , for a mean load distribution of 11.3782 kgf for Group 4 and 6.1458 kgf for Group 6 , There were statistically significant differences in the mean tensile strengths between the two groups (P<0.05).Group 5 and 6 when compared , for a mean load distribution of 7.4981 for Group 5 and 6.1458 for Group 6 . There were statistically significant differences in the mean tensile strengths between the two groups (p<0.05).

Graph 1 revealed that the mean distribution of tensile bond strength among the different groups . Group 1 (control group) with Group 3 and Group 4 (test groups) when compared showed significant differences between Group 1and Group 4 but not much difference was seen between Group 1 and Group 3.

Group 2 (control group) with Group 5 and Group 6 (Test groups) when compared showed significant differences between the Group 2 and 6 but not much was seen between Group 2 and 5.

Groups	N	Minimum	Maximum	Mean	Std. Deviation
1	11	.176	.208	.18936	.010510
2	11	.095	.116	.10318	.007494
3	11	.173	.206	.18745	.010280
4	11	.153	.180	.16627	.008451
5	11	.090	.110	.09927	.006084
6	11	.069	.099	.08018	.009293

Table 3 : Mean tensile strength distribution of groups

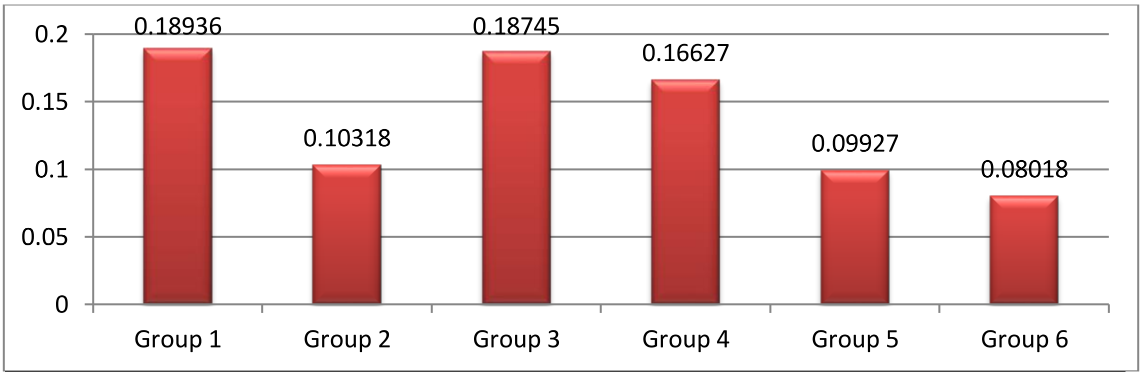
	F value	P value
TENSILE STRENGTH	337.35	0.00*

Table 4:Comparison of tensile strength among the groups using one way anova

*** significant**

Group	Groups	Mean Difference	p value
1	2	0.08618	.000*
	3	0.00191	1.00
	4	0.02309	.000*
	5	0.09009	.000*
	6	0.10918	.000*
2	3	-0.08427	.000*
	4	-0.06309	.000*
	5	0.00391	1.000
	6	0.02300	.000*
3	4	0.02118	.000*
	5	0.08818	.000*
	6	0.10727	.000*
4	5	0.06700	.000*
	6	0.08609	.000*
5	6	0.01909	.000*

Table 5: Post hoc bonferroni test comparing individual groups



Graph 1: Mean tensile strength distribution of the groups

IX. DISCUSSION

Addition of drugs at concentrations commercially accessible the denture liners may prevent it from microbial degradation but it might take a toll on its physical properties like tensile bond strength[26,36]. There is little to no literature available on the properties of tensile strength and elongation percentage after modification of temporary soft liners by drugs , hence thisresearch compared the tensile bond strength of two commercially available acrylic-based denture liners, Kooliner (GC) and Permasoft (Densply Sirona), that had antifungal agents added to the basic resin.

The specimens in this study were divided into six groups. Group 1 and Group 2 included the denture liners without the addition of any antifungal agent (Control Groups). The rest 4 Groups were the denture liners incorporated with the antifungal agent (Test groups). Acrylic based denture liners (Kooliner and Permasoft) were used for this study. The test groups Group 3 and 4 were Kooliner liner with Fluconazole and Kooliner with Miconazole respectively , while Groups 5 and 6 were Permasoft liner with Fluconazole and Permasoft liner with Miconazole respectively. The universal testing equipment was used to evaluate the tensile binding strength of the liners with the denture base resin on the specimens.

When Group1 and Group 2 were compared, Group 1 had significantly better tensile strength which may be due to Methylmethracrylate in the bonding agent which shows good swelling properties and helps in introducing smaller Methylmethacrylate into the denture base polymer for better bonding properties and also due to its higher plasticizer content[24].

Surface preparation may also interfere with the bond strength. Sandblasting lowered tensile bond strength for the Permaflex soft liner in a research by Akin et al compared to the control group where sandblasting was not done[36]. When Kulkarni and Parkedhar et al compared Supersoft liners with Molloplast -B, they discovered that the sandblasting group had a poorer bond strength than the control and monomer groups [37]. Usumez et al. discovered that surface pretreatment of acrylic resin with 250 m enhanced the tensile bond strength. This discrepancy might be attributable to the acrylic resin type, particle size, and alumina abrasion pressure.

The addition of Miconazole antifungal powder to both the denture liners changed the tensile strength of both the materials over the 24hrs they were kept in distilled water. The effect of adding antifungals at commercially accessible concentrations on the tensile strength of tissue conditioners is little understood. [38,39].

Urban et al[39] observed that the incorporation of Nystatin at concentrations upto 1,000,000 U (0.164 g) did not interfere with the tensile strength of a tissue conditioner (DuraConditioner) after immersion in water for 7 days. After an interval of 14 days , Schneid[36] observed only cohesive failures when the tensile strength test was applied at the union between a heat-polymerized denture base acrylic resin and a tissue conditioner (Lynal) modified by commercial concentrations of Chlorhexidine (0.250, 0.500, and 1 g) and Ny (0.125, 0.250, and 0.500 g). This infers to the fact that the tensile bond strength of the material was not altered or was even improved by addition of these drug[38]. Thus, it is probable that the Minimum inhibitory concentration of Nystatin, Chlorhexidine, and Ketoconazole (0.032, 0.064, and 0.128 g, respectively) were insufficient to cause changes in the tensile strength and elongation of short-time resilient materials. These Minimum inhibitory concentration, which are much lower than the drug concentrations tested in the investigations of Urban et al[39] and Schneid[38] inhibited the fungal biofilm of materials tested (Trusoft and Softone) in 90%, which may be advantageous for maintenance of other properties of the modified polymeric matrix.

Conversely, in the present study, with the incorporation of Miconazole and Fluconazole, reduction of tensile strength of both materials was observed when Miconazole was added. Statistically significant changes were not seen when Fluconazole was added to both the denture liners. This result may be basically assigned to the quantity of drug incorporated to these materials also. Srivatstava et al[40] observed incomplete gelling of a tissue conditioner after the incorporation of origanum oil, which resulted in significant lower tensile strength values. The lower content of plasticizer with incorporation ofantimicrobial agent might have reduced the disentanglement of polymer beads, yielding a weak cohesion among the polymer chains[40]. Thus, it is probable that concentration of Miconazole and Fluconazole tested in this study interfered with formation of the polymeric matrix, reducing the tensile strength of soft liners[40].

The divergent outcomes found in this study for Fluconazole and Miconazole may also be explained by the varying distribution of each medication in the material matrix, as well as the various particle sizes of each drug[41]. Miconazole has a smaller molecular weight than Nystatin, Ketoconazole, and Chlorhexidine, and its tiny particles have a higher diffusibility inside the polymeric matrix, resulting in more solvation. [42]. As a consequence, it's possible that Miconazole's increased solvation generated poorer resilience and, as a result, lower tensile strength in the resilient materials studied in this work. Other factors that might explain the Miconazole and Fluconazole outcomes include the fragility of the modified polymeric matrix and material porosity after these medicines were included.[43]. Future research should be performed to test these assumptions under the same settings as this study.

Since contact between infected tissues and contaminated denture base is the major reason for denture stomatitis and the purpose of resilient liners is to prevent this contact but the porosity of these materials leads to microbial colonization [44]. The porosity present in the denture base resin is also verified by naked eye and microscopic analysis[45,46] and also by method that measures the water sorption of the material[47,48]. Microscopic analysis is done to measure the porosity present in the resilient liners[49,50].

Ideally, a resilient liner should have insoluble components and low water sorption[51]. However, during their lifespan, these materials are immersed in saliva, foods, water, and hygiene solutions[52-54]. Since this exposure to the aqueous medium concomitantly causes water sorption and loss of plasticizers and other soluble components[55] , the performance and longevity of temporary acrylic-based soft liners depends on the equilibrium of these two mechanisms[56].

Ayse Mese et al[34]The influence of storage duration on the tensile bond strength and hardness of acrylic resin and silicone-based resilient liners that were either heat or auto polymerized onto denture foundation acrylic resin were investigated. The acrylic resin-based liners demonstrated a greater reduction in tensile bond strength values compared to the silicone products , these findings also support those of Jepson[57] and Mese[34], who reported that water storage reduced the liner tensile bond strength of acrylic resin based products more than that of silicone-based products. In the present study the samples were not stored for different time periods before testing which could have brought about more details on the changes in the tensile strength which is a limitation of this study . Moreover, the bond strength values of auto polymerized products showed greater reduction than those of heat-polymerized materials over the course of this current study. These findings agree with those of Mese[34] who reported that water storage reduces the bond strength of auto polymerized liners more than that of heat polymerized materials. Factors such as processing methods, water absorption, and bonding agents require further investigation to predict which materials will provide the best clinical service. Hardness, weight change, tensile strength, tear strength, and colour stability are additional properties of resilient denture liners that warrant investigation hence Selection of a particular liner cannot be based on any single property.

Even though previous studies[58] established clinically acceptable mean values for the tensile bond strength between resilient liners to denture base resins, there are no references of adequate values for the tensile strength only of the material. Therefore, additional studies on these properties, especially for short-term resilient liners, are still required. The results demonstrated that, for most experimental conditions, the tensile strength was not statistically different between the two temporary soft liners analyzed. Despite the similar composition of these materials, according to the literature[29,30], it is expected that GC Kooliner, which is a hard liner presents a plasticizer than Permasoft, which is a temporary resilient liner, which might result in a large difference.

X. CONCLUSION

It was concluded within the limitations present in this study that among the drugs tested, addition of antifungals to the temporary resilient liners for the treatment of denture stomatitis had no negative impact on the tensile bond strength. However, Fluconazole showed no statistically significant changes whereas the addition of Miconazole showed borderline differences in the tensile strength.

Future in vitro investigations are needed to examine additional important features of modified soft liners before clinical indication of this approach for denture stomatitis therapy. Furthermore, because significant elements such as the oral environment and denture base design were not examined in this technique, the results of this in vitro study should be cautiously transferred to clinical situations.Also, only two commercially available acrylic based denture liners were evaluated, therefore the results cannot be extrapolated to other brands.

XI. SUMMARY

Resilient materials absorb stress and have long been used to repair tissues that have come into touch with the denture foundation. During function, these materials absorb some of the chewing stress on the denture, lowering the energy delivered to the corresponding muscles and para prosthetic tissue. Denture lining materials are susceptible to microbial colonization. Hence, antifungal agents can be added according to improve the longevity of the material and also at the same time disrupting the plaque accumulation. The addition of antifungal agents may affect the physical properties of the denture liners.

This study evaluated the tensile bond strength of two different commercially available acrylic based denture liners with the denture base resin on addition of the antifungal agents. Within the limitation of this study, the results depict that there was statistically significant decrease in the tensile bond strength of both Kooliner and Permasoft on addition of Miconazole whereas Statistically significant changes were not seen on using Fluconazole.

It can be concluded from this study that at minimum concentration , the antifungal agent like Fluconazole can be added to improve the clinical longevity of the liner at the same time not affecting its physical properties drastically whereas Miconazole at the concentration used in this study may affect with the tensile strength of the denture liner.

A future study revealing the causes for the actual decrease of the tensile bond strength should be considered.

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