Original Article

Comparative Evaluation of the Effect of Different Disinfection Solutions on the Bond Strength of Commercially Available Soft Denture Liner Materials – *In Vitro* Study

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Abstract

Background: Elastic materials used in dental prosthetics to line removable dentures should be characterized by biocompatibility toward oral tissues, shape, and color stability; resistance to abrasion; and durability of the junction between the lining and the denture. The resilient lining materials present problems during clinical use, such as weakening of bond between lining and denture loss of resiliency, color alterations, and porosity. **Materials and Methods:** A study was conducted to determine the effect of disinfection on tensile strength of two commercially available soft liners. Sixty samples were divided into two groups and acrylic blocks were bonded with Viscogel and Molloplast soft liners. Specimens were tested after 24 h. The tensile bond strength was evaluated by a universal testing machine. **Results:** Results show that Molloplast-B has higher tensile bond strength than Viscogel after disinfection treatment. **Conclusion:** After the single disinfectant cycle, the bond strength values of both the soft denture liner materials were reduced but statistically, it was not significant.

Keywords: Bond strength, Disinfectant, Soft liner (According to MeSH).

Introduction

As per the concept of M.M de Van, Prosthodontic management of edentulous patients is not only concerned about replacement of missing tooth but it is also about preservation of supporting structures and maintaining its optimum health.[1] The denture base materials are compatible with the oral mucosa and denture bearing area but however certain conditions predispose the tissues to irritation and trauma which warrants the use of resilient liners.[2]

The resilient liners act by absorbing the energy produced during mastication and protect the underlying tissues. Soft denture lining materials are used in treatment of patients with ridge atrophy and resorption, bony undercuts, bruxing tendencies, congenital or acquired oral defects requiring obturation, etc.[3]

Although soft liners are used commonly in treatment of abused tissues, one most common problem encountered by most of the clinician is the debonding which occurs commonly and becomes rigid leading to rough surface which acts as a nidus for plaque accumulation. This leads to bacterial and fungal infections of oral mucosa which requires topical treatment of tissue surface of denture with disinfectant solutions.[4-7]

The most common disinfectants used are 5% sodium hypochlorite, 2% glutaraldehyde, and 5% chlorhexidine. This study was conducted to evaluate the effects of various disinfection solutions on the tensile bond strength of soft denture liner material.

Materials and Methods

This *in vitro* study was conducted in Department of Prosthodontics, Crown and Bridge in P. M. Nadagouda

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Memorial Dental College and Hospital Bagalkot, Karnataka. (Ethical Clearance not available) The effect of disinfection treatments on the tensile bond strength of two different soft denture liner materials was evaluated using Universal Testing Machine at Indian Institute of Science, Bangalore.

Armamentarium

1. Viscogel soft denture liner (Figure 1)
2. Molloplast-B soft denture liner (Figure 1)
3. Heat cure acrylic denture base resin (DPI, India)
4. Metal die
5. Disinfectant solution (2% glutaraldehyde, 5% sodium hypochlorite).

Fabrication of metal dies

The steel metal dies were fabricated in the BVV Sangha's Basaveshwar Engineering College, Bagalkot A metal die was fabricated consisting of two metal blocks measuring 40 mm in length, 10 mm in height, and 10 mm in thickness with a separable metal plate measuring 3 mm in length, 10 mm in height, and 10 mm in thickness in between two blocks.

Preparation of specimens

The metal die was invested (Figure 2) in dental flask in Type III dental stone to prepare moulds using split mould technique. The two metal blocks were removed from the investment leaving the 3 mm metal plate in between and packed with heat cure acrylic resin and processed as per manufacturer instructions.

The processed two acrylic blocks (Figure 3) of 40 mm in length, 10 mm in height, and 10 mm thickness in dimensions were then trimmed and smoothened. The bonding surface of the Polymethyl Methacrylate (PMMA) block was also smoothened to create mechanical bond between soft denture liner and PMMA. A total of 60 specimens were made.

The acrylic block was placed in the flask and soft liner is mixed as per manufacturer's instruction and packed into the space created by removal of central metal plate. For Molloplast samples, a primo-adhesive was applied to the bonding surface of acrylic block prior to packing. The soft liners are then cured and later, the samples are trimmed for any flash which might be present.

Grouping of samples

The 60 samples were divided into two groups of 30 specimens each. In each group, 10 specimens were taken as control group and immersed in distilled water. The remaining 20 specimens served as test group out of which 10 were immersed in 2% alkaline glutaraldehyde solution and 10 were immersed in 5% sodium hypochlorite solution for 10 min.

Tensile bond strength determination using UTM: All the specimens were tested after 24 h. The tensile bond strength was evaluated by a universal testing machine (Unitek 9450PC), at a cross sectional speed of 5 mm/min with a 500 kg load cell. The specimens were placed under tension until bond failure occurs. The load at which bond failure occurred was recorded.

The type of failure was observed by using stereomicroscope at magnification of 10×. The failure that occurred at the resilient lining and acrylic resin interface were recorded as adhesive and those that occurred within the resilient liner were considered as cohesive. The data was submitted to statistical analysis using Mean, Standard Deviation, and students unpaired *t*-test.

Results

The results (Table 1) show that within both the group, there was not much difference in tensile bond strength after treatment with disinfectant at 5% level of significance. However, between the groups, Mollopast-B showed higher tensile strength values than Viscogel with highest value in control group (water).

The study reveals that Molloplast-B has higher bond strength (Graph 1) when compared to Visco gel after immersion in water, 2% glutaraldehyde and 5% sodium hypochlorite. The results showed that the bond strength in both the groups was reduced after immersion in 2% alkaline glutaraldehyde and 5% sodium hypochlorite; however, it was statistically insignificant (Table 1).

Discussion

The most common reason for failure of resilient liner is debonding leading to a rough intaglio surface.[8] This leads to growth of microorganism which mandates the use of disinfectants.

Figure 1: Soft denture liners

Table 1: Tensile bond strength value of viscogel and molloplast-B

Solution	Tensile strength		*P*-value (T<=t) (two tailed)	*t*-test	Level of significance
	Viscogel	Molloplast-B			
Distilled water (control group)	0.4589	0.5608	0.0000797	−6.79323	5%
Alkaline glutaraldehyde	0.4562	0.5504	0.003561	−0.29628	5%
Sodium hypochlorite	0.4559	0.5427	0.003159	−3.98967	5%

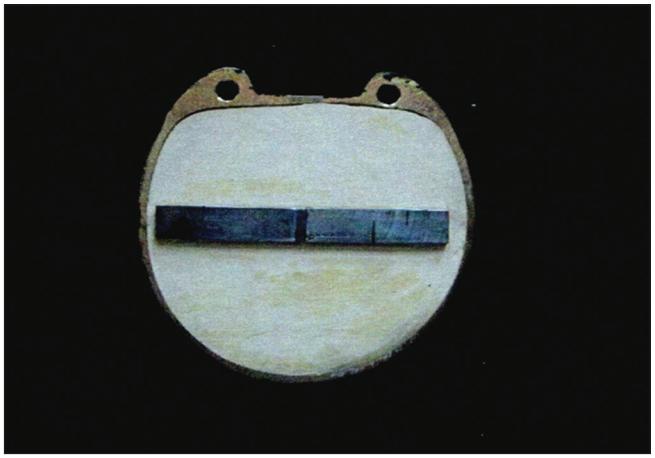


Figure 2: Investment of metal die

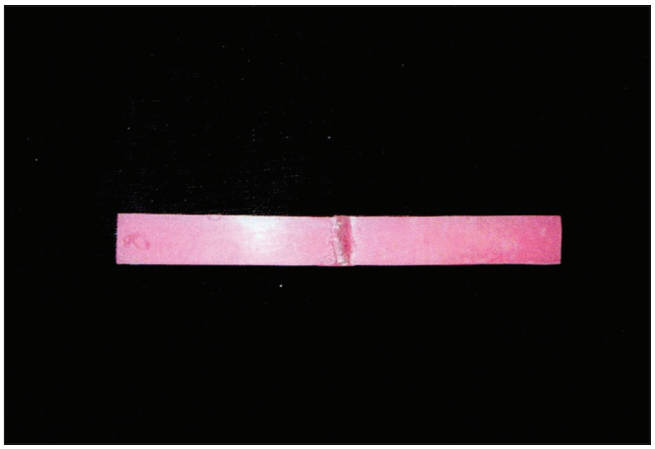
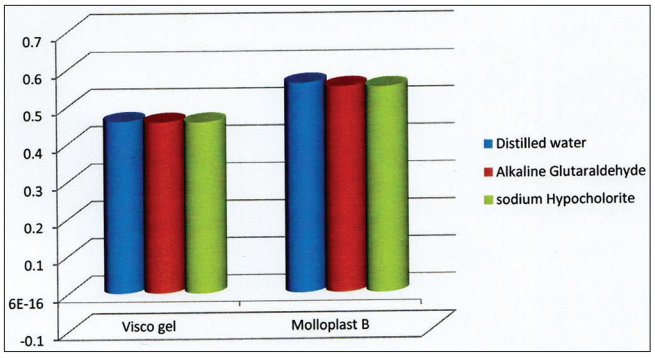


Figure 3: Prepared specimen with soft liner



Graph 1: Comparison of tensile bond strength of visco-gel and molloplast-B after immersion in distilled water (control group), 2% alkaline glutaraldehyde and sodium hypochlorite

Two soft liners were used in this study, one with acrylic based (Viscogel) while the other is silicone based (Molloplast). The tensile bond strength of two soft liners was evaluated after disinfecting procedure. The chemical disinfectants used in this study were 2% alkaline glutaraldehyde and 5% sodium hypochlorite.[9]

The high bond strength of Molloplast-B was attributed to the adhesive bonding system. The primo-adhesive which was used contain a silicone polymer in a volatile solvent that bonds strongly with acrylic. In case of Viscogel, bonding primarily is chemical in nature and partly mechanical due to the surface roughness of specimen. Moreover, the plasticizer used in Viscogel generally leaches out faster leading to decrease in tensile strength.[10]

Both soft liners showed cohesive type of failure as evident from the fact that particles or layers of soft liners were seen adhered to the acrylic surface. This indicates that failure happened mostly within the material and the bond strength of soft liner to acrylic was greater than the tensile strength of the material.[11]

Limitations of the study were that the samples were subjected to one single disinfection cycle. Further investigations are required to know the effect of repetitive disinfection cycles on the bond strength of the materials tested.

Conclusion

1. After the single disinfectant cycle, the bond strength values of both the soft denture liner materials were reduced but statistically it was not significant.
2. The Molloplast-B has higher tensile strength value as compared to Visco-Gel after treatment with water, 5% Sodium hypochlorite and 2% Gluteraldehyde.

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