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Effect of disinfection on shear bond strength between heat activated acrylic resin denture base and commercially available denture teeth: An *in vitro* study

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Abstract
Background and Objectives: Acrylic resin had a long history of been used in the fabrication of denture fabrication since they exhibit a better chemical bond between teeth and denture base. With increasing use of dentures, detachment of teeth from dentures also increased proportionally. Denture disinfection is an essential procedure for maintaining good hygiene of the denture. The aim of the study is to evaluate the effect of disinfection on shear bond strength between denture teeth and heat activated denture base.
Objectives
1. To evaluate the shear bond strength between heat activated acrylic resin denture base and denture teeth measured using a universal testing machine (Instron) expressed in MPa.
2. To analyse the bonding failure between the denture tooth and heat activated acrylic resin interface using a stereomicroscope at 25 X magnification.

Methodology: Two commercial brands of denture teeth (Acryrock and Ivostar) and heat activated acrylic resin denture base were tested. There were 12 subgroups in the study. Each brand of denture teeth was divided into six subgroups comprising of five experimental subgroups and one control group. In subgroup A1B1 and A2B2 (chemical disinfection) the specimens were immersed in 4% of chlorhexidine and sodium perborate monohydrate solution for 15 minutes daily for 19 days respectively, Subgroup A3B3 specimens (mechanical disinfection) were subjected to mechanical disinfection for 14 hours and in Subgroup A4B4 and A5B5 specimens were subjected to mechanical disinfection for 14 hours followed by disinfection with 4% chlorhexidine solution and sodium perborate monohydrate solution for 15 minutes daily for 19 days respectively. In Control group A6B6 specimens were immersed in distilled water at 37degree Celsius for 19 days. Shear bond strength testing was performed at denture tooth resin interface in a universal testing machine at a cross head speed of 1mm/minute. Bond strength failure rates were quantified and classified as adhesive, cohesive or mixed. Data were analyzed by independent t test and chi-square test.
Results: In subgroupA1B1 and subgroupA2B2, (chemical disinfection) the specimens immersed in 4% of chlorhexidine (p=0.615) and sodium perborate monohydrate (p=0.615), for 19 days respectively, subgroup A3B3 (mechanical disinfection) specimens were subjected to mechanical disinfection for 14 hours (p<0.01), subgroup A4B4 and A5B5 (mechanical-chemical disinfection) (p<0.01) and (p<0.01) respectively, subgroup A6B6 (control group) (p=0.054). For bond failure analysis where p value for subgroup A1B1 is 0.856, p value for subgroup A2B2 is 1.000, P value for subgroup A3B3 is 1.000, p value for subgroup A4B4 is 0.670, p value for subgroup A5B5 is 0.670, p values for subgroup A6B6 0.856. Disinfection with 4% chlorhexidine solution exhibited mixed pattern of bond failure while sodium perborate monohydrate solution demonstrated both mixed and adhesive type of bond failure. Mechanical disinfection and Combination of mechanical and chemical disinfection exhibited adhesive type of failure.
Interpretation and Conclusion: Disinfection with 4% chlorhexidine, sodium perborate monohydrate, brushing and combination of mechanical and chemical disinfection reduced the bond strength between denture teeth and heat activated denture base.

Keywords: PMMA (polymethyl methacrylate), shear bond strength, bond failure, disinfection, denture teeth

Introduction
Artificial teeth have long been used in fabrication of complete denture and more recently for implant supported dentures.

Acrylic resin had a long history of being used in the fabrication of partial and complete dentures. During prosthesis fabrication, a strong bond between denture teeth and heat activated denture base is obtained through the crosslinking between acrylic teeth and PMMA material. It is easier to adjust, have high resiliency, resistant to thermal alteration and less prone to fracture under impact, chemical bond to denture base, esthetic acceptability. Although it has all the mentioned advantages, it has few drawbacks which includes porosities, dimensional changes, allergic reactions, difficulty to insert in areas of undercut areas in some individuals [1].

Adhesion between denture teeth and acrylic resin denture base is important for the integrity and durability of dentures. Majoriy of denture repairs are mainly attributed to debonding of teeth from denture base. Resin denture teeth are often preferred, as they can bond chemically to resin denture base where as for porcelain teeth it can bond mechanically only. Implant supported dentures are often associated with high masticatory function and there is insufficient acrylic resin thickness in anterior region due to the presence of attachments, therefore there is increased chance of debonding in implant supported dentures.

The unexpected detachment of teeth from dentures is a very important issue that compromises integrity and clinical service ability of complete denture. Debonding of denture teeth from denture base is a common complication reported with denture base. Debonding is common with anterior part of denture, especially with maxillary central incisors. Debonding of denture teeth consumes dentist time and effort and also increases the frequency of appointments and laboratory cost and distress to the patient. The most common type of denture failure occurs between an acrylic resin tooth and acrylic resin denture base, accounting for approximately 33% of failure10. Bonding failures between acrylic denture base and denture teeth may result from excessive loading, remaining wax at tooth acrylic resin interface, insufficient monomer during polymerization & inefficient curing methods. It has been estimated that between 22% and 30% of denture repairs involve tooth de-bonding, usually in the anterior region of the denture [10]. This detachment may be attributed to a lesser ridge lap surface areas available for bonding and the direction of the stresses encountered during function. Studies have evaluated the frequency of various denture repairs, found that tooth debonding to be the most frequent repairs for conventional dentures. About one third of denture repair is due to tooth debonding [5]. Bonding failure of denture teeth to the denture base can occur adhesively or cohesively. Adhesive failure occur if there is no trace of any denture base resin on tooth surface after the fracture. Cohesive failure occurs if there is a presence of any trace denture base resin on the surface of denture tooth or remnants of denture tooth on denture base [3]. In the clinical scenario, resolving tooth debonding will avoid denture repairs. Bonding failure can be limited to an extent when denture teeth and denture base resin are from the same manufactures [66].

Denture wearers may present with oral candidiasis as a consequence of biofilm formation and poor oral hygiene of both denture and oral cavity. Several studies have demonstrated the adherence of candida species to denture base resin. Candidial species has been well established as a microbial factor in the etiology of denture related stomatitis. Another concern has been continuous swallowing or continuous aspiration of microorganism from dental plaque which have significant implication on general health of the patient particularly in case of immunocompromised or medicated elderly individual. Older patient present with difficulty in mechanical cleaning due to manual dexterity. chemical solution can use alternative to mechanical disinfection [23]. Therefore, proper routine cleaning of the denture is essential for prevention and treatment of denture stomatitis. Ideally a method for disinfection should be effective without any detrimental effect on properties of materials may be employed. Denture hygiene is accomplished either by mechanical [brushing], or by chemicals [chlorhexidine, denture cleanser (sodium perborate monohydrate)] or by both. Mechanical and Chemical agents may change the properties of acrylic resin denture base. In the clinical scenario, resolving tooth debonding will avoid denture repairs.

Till date not much studies have been reported in literature investigating the effects of disinfection on the bond strength between the denture teeth and heat activated denture base.

In this context, the present study evaluated the effect of different disinfection (mechanical, chemical and combination of both) methods on the bond strength between two commercial brands of denture teeth and heat activated acrylic resin denture base.

The null hypothesis assumed that there is no difference in bond strength among two different commercial brands of denture teeth, and the disinfection method do not affect the bond strength between denture teeth and heat activated acrylic denture base.

Methodology

Study hypothesis

There is no difference in shear bond strength between heat activated acrylic resin denture base and different commercially available denture teeth after different methods of disinfection.

Study design

Experimental Invitro study

Study setting

- Department of Prosthodontics and Implantology, Government Dental College, Thiruvananthapuram.
- College of Engineering, Thiruvananthapuram.
- Sree Chitra Tirunal institute For Medical Science and Technology.

Study specimen

Table 1: Study specimen

Denture Tooth [2 types]	Sub Groups	Disinfection Method	
		Experimental	Control
Acryrock	A1	Chemical-4% Chlorhexide digluconate.	
	A2	Chemical-Denture cleansers (sodium perborate monohydrate)	
	A3	Mechanical-Tooth brush simulation	
	A4	Mechanical-Chemical [Tooth brush simulation + 4% Chlorhexide digluconate]	

	A5	Mechanical-Chemical [Tooth brush simulation + Denture cleanser (sodium perborate monohydrate)]	
	A6		Specimen immersed in distilled water for 19 days
Ivostar	B1	Chemical-4% Chlorhexide digluconate	
	B2	Chemical-Denture cleansers (sodium perborate monohydrate)	
	B3	Mechanical-Tooth brush simulation	
	B4	Mechanical- Chemical (Tooth brush simulation + 4% Chlorhexide digluconate)	
	B5	Mechanical-Chemical [Tooth brush simulation + Denture cleanser (sodium perborate monohydrate)]	
	B6		Specimen immersed in distilled water for 19 days

Sample size

$n = 2[\sigma 2/\delta 2 (Z \alpha + Z \beta)^2]$

Where,
α is Type I error
β is Type II error
o is standard deviation of measurements
δ is difference between average value of bond strength between the groups.
In this study α = 5%, so Zα = 1.96, β = 20% so Zβ = 0.84, σ = 1.5, δ = 2
Therefore sample size, n= 8.8
We have up sided the sample size to 10.
Since there were 12 groups in this.
Study, total sample size = 120.

Methods

1. Fabrication of test specimen

Two commercially available types (Acryrock & Ivostar) of teeth with a total of 120 maxillary central incisors were employed for the study. The teeth was surrounded by a cylindrical mould of height 7.5 mm and diameter 7.5 mm (according to ADA Specification no. 15 for acrylic teeth). Cylindrical mould was impressed with putty and wax poured into the putty mould to obtain wax cylinders. Teeth were fixed in the wax with the labial surface facing up.

2. Flasking and Dewaxing procedure

Flasking was done followed by dewaxing by putting the flask in boiling water (100 °C) for 4 minutes. The mould cavity was subsequently cleaned with a mild detergent solution and rinsed with boiling water.

3. Packing and Acrylisation

These procedures were followed by packing and acrylisation in acryliser unit in the conventional manner (Conventional curing cycle: Heat-polymerized specimens will be processed in a heat curing unit at 74 °C for 2 h and increasing the temperature of the water bath to 100 °C and processing for 1 hour). After bench cooling of the flasks, the specimens were retrieved and gross adhering of stone will be removed with hand instruments.

4. Finishing and Polishing

Gross blebs will be removed with a slow speed hand piece and acrylic bur and the specimens were finished, polished and stored in distilled water before the bond test being carried out. The testing was performed employing a universal testing machine.

5. Preparation of samples

Control group: The specimens of representative types of denture teeth were immersed in distilled water at 37 °C for 19 days to simulate the period of disinfection in the experimental groups. There were 2 control groups present in the study.

Chemical disinfection: Representative types of denture teeth were put in each in 4% chlorhexidine digluconate & fitty dent [14] denture cleanser (2 tablets in 150 ml of water) [15] under similar conditions. The disinfectant solution was replaced every day during the study period. Constant disinfection was performed using simulated repeated disinfection approaches for 19 days. Considering the daily disinfection protocol for 15 minutes, the present study simulated 5 years of daily disinfection. After chemical disinfection, the specimens were washed with distilled water at 37 °C, dried with absorbent paper and subjected to shear bond strength testing.

Mechanical disinfection: Representative types of denture teeth were subjected to toothbrush simulation using a tooth brushing machine containing nylon toothbrushes for brushing of 10 specimens simultaneously. Tooth brush with a soft nylon bristle with rounded end (18 µm diameter and 10 mm length) and 36 tufts (each one with a diameter of 170 µm). A solution of toothpaste (Plain Colgate) used in the proportion of 4.6 g of toothpaste to 6 ml of distilled water. A total of 3ml of toothpaste solution is injected into each tooth per minute. The toothbrushing machine applied a vertical force of 200 g on each specimen at 60 cycles/minute. A total of 20,000 cycles can be achieved, simulating 5 years of denture hygiene. The tooth brushing cycle was completed in 14 hours. After brushing, the specimen were washed with distilled water, dried with absorbent paper and subjected to shear bond strength testing. After toothbrushing, the samples were rinsed and stored in distilled water at temperature of 37 °C ± 1 °C. (Fig-1)

Mechanical-Chemical disinfection: Representative types of denture teeth were subjected to toothbrush simulation and further disinfection with 4% chlorhexidine digluconate & denture cleanser (sodium perborate monohydrate). It was completed in 19 days and 14 hours and stored in distilled water at 37 °C ± 1 °C.

6. Shear bond strength measurement

Bond strength (s) is calculated using the formula,
S=F/A, where F is force measured in newton (N) and A is the area measured in mm^2
In the present study A is measured in length (thickness) x width.

where length (thickness) is taken as 3.75 mm and width is taken as 8.4 mm.

The specimen were mounted in the custom jig and the bond between denture tooth and acrylic resin denture base was measured at the tooth/resin interface using a universal testing machine (Instron). The machine used a direct pull on the incisal portion of the lingual surface in a labial direction at a height above the denture base resin bar with a crosshead speed of 1mm/min with load to fracture measured in MPa. (Fig-2)

Analysis of bond failure

The pattern of bonding failure between denture tooth and acrylic resin is evaluated by using a stereomicroscope using 25 x magnification. The failure pattern is quantified and classified into cohesive failure within denture tooth or cohesive failure within the acrylic resin, adhesive failure at the denture tooth-acrylic resin interface or mixed (adhesive-cohesive) failure.

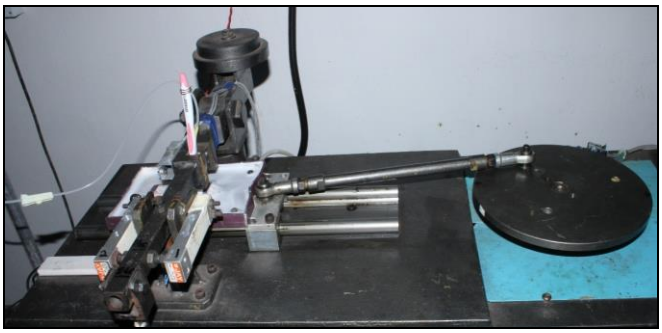

Fig 1: Set -up of tooth brushing machine assembly

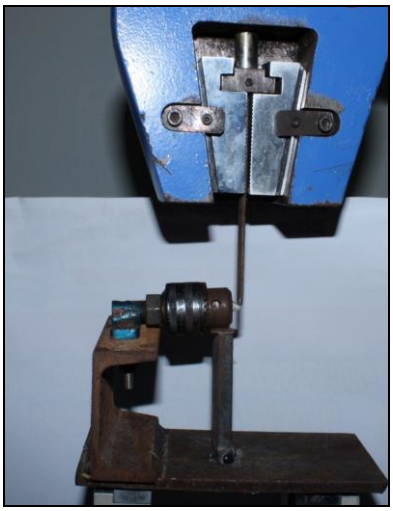

Fig 2: Specimen placed in a customized jig and subjected to bond strength measurement

Results

The present invitro study was done to evaluate the effect of disinfection on bond strength between denture teeth and heat activated denture base resin. 120 samples of denture teeth (Acryrock and Ivostar) were subjected to bond strength measurement. Bond strength was measured using universal testing machine in Mpa. The specimens were divided into 2 groups with 60 samples each. Each group were further subdivided into 6 subgroups with 10 samples each including the control group.

1. For subgroup A1B1, (specimen immersed in 4% chlorhexidine solution for 15 minutes daily for 19 days), the mean bond strength and standard deviation values of Acryrock and Ivostar were 9.5±0.9 and 9.3±1.1. It was found that the p value was 0.615 (p>0.05).
2. For subgroup A2B2, (specimen immersed in denture cleanser for 15 minutes daily for 19 days) the mean bond strength and standard deviation values of Acryrock and Ivostar were 8.0±0.9 and 7.7±1.3. It was found that the p value was 0.615 (p>0.05).
3. For subgroup A3B3, (specimen subjected to tooth brush stimulation using a tooth brushing machine for 14 hours) the mean bond strength and standard deviation values of Acryrock and Ivostar were 5.6±1 and 8.1±1. It was found that the p value was <0.01 (p<0.05).
4. For subgroup A4B4, (specimen subjected to tooth brush stimulation using a tooth brushing machine for 14 hours and further immersed in 4% chlorhexidine solution for 15 minutes daily for 19 days) the mean bond strength and standard deviation values of Acryrock and Ivostar were 5.7±0.9 and 7.5±0.9. It was found that the p value was <0.01 (p<0.05).
5. For subgroup A5B5 (specimen subjected to tooth brush stimulation using a tooth brushing machine for 14 hours and further immersed in denture cleanser solution for 15 minutes daily for 19 days) the mean bond strength and standard deviation values of Acryrock and Ivostar were 5.4±0.9 and 7.2±0.7. It was found that the p value was <0.01 (p<0.05).
6. For subgroup A6B6, (specimens immersed in distilled water), the mean bond strength and standard deviation values of Acryrock and Ivostar were 10±1.1 and 11.2±1.6 respectively. p value was found to be 0.054 (p>0.05).

As per the study, highest mean bond strength was found to be with subgroup A6B6 (control group) and lowest mean bond strength was found to be with subgroup A5B5. Independent t test was used to compare quantitative parameters between categories. It was found that the results were statistically significant with subgroups A3B3, A4B4, A5B5 as p value was <0.05. For Subgroup A1B1, A2B2, A6B6 the results were statistically non-significant as p-value was > 0.05.

Specimens were subjected to analysis of bond failure using stereomicroscope with 25X magnification. The specimens for bond failure were divided into 2 groups (Acryrock and Ivostar) with 3subgroups *viz* adhesive, cohesive and mixed failure.

1. In subgroup A1B1, chisquare value of bond failure between denture teeth and heat activated denture base is 0.31, p value was found to be 0.856 (p>0.05). Mixed bond failure was dominant in this subgroup
2. In subgroup A2B2, chi square value of bond failure between denture teeth and heat activated denture base is 0 and p value was found to be 1.000 (p>0.05). Mixed and adhesive bond failure were dominant in this subgroup.
3. In subgroup A3B3 chi square value of bond failure between denture teeth and denture base is 0, p value was found to be 1.000 (p>0.05). Adhesive bond failure was dominant in this subgroup.
4. In subgroup A4B4, chi square value of bond failure between denture teeth and denture base is 0.8, p value was found to be 0.670 (p>0.05). Adhesive bond failure was dominant in this subgroup.
5. In subgroup A5B5, chi square value of bond failure between denture teeth and denture base is 0.8, p value was found to be 0.670 (p>0.05). Adhesive bond failure was dominant in this subgroup.
6. In subgroup A6B6, chi square value for bond failure

between denture teeth and heat activated denture base is 0.31, p value was found to be 0.856 (p>0.05). Mixed bond failure was dominant in this subgroup.

As per the study, the mean bond failure pattern for subgroup A1B1, A2B2, A3B3, A4B4, A5B5, A6B6 were statistically non-significant as p values were greater than 0.05. The specimens with highest bond strength demonstrated mixed bond failure while the specimens with lowest bond strength exhibited adhesive failure. Chi-square test was used to find association between categorical variables.

Statistical analysis

For all statistical interpretations, p<0.05 was considered the threshold for statistical significance. Independent t test was used to compare quantitative parameters between categories in bond strength measurement and data were expressed in its mean and standard deviation. Chi-square test was used to find association between categorical variables in bond failure. Statistical analyses was performed by using a statistical software package SPSS, version 20.0.

Discussion

Debonding of denture teeth from acrylic resin denture base is a major concern in prosthodontic practice. It is attributed to multiple reasons which includes excessive loading, fatigue, insufficient tooth cleaning, contaminations and inappropriate polymerization technique [1]. In implant-supported dentures [41], lack of proprioception causes debonding. Debonding is usually observed in anterior region of denture.

Bond strength like any other strength property is statistical in nature, since the presence of intrinsic or extrinsic flaws strongly influences the fracture. The factors that influences bond strength are method of processing, stress distribution, processing temperature and variables, stages of resin, brands of tooth and type of resin [11]. Hugget *et al*. 1982 [67] reported that almost 30% of denture repairs were related to tooth debonding. Studies conducted by Cunningham, Bennington affirmed that bond failure between denture base material and resin teeth remained a significant problem for treatment success and wax or sodium alginate contaminated surfaces produced highly significant weaker bonds [42]. Clancy and Boyer 1989 [56] compared the bond strength of heat, light and autopolymerizing denture base to denture teeth and concluded that a strong bond existed between heat polymerized resin and denture teeth compared to light polymerized resin. Schneider *et al*. 2002 [57] evaluated the bonding of two resin teeth to microwave and heat polymerized denture base and found that heat polymerized have better bond strength than microwave processed denture base. Strength of teeth bonding to different resin is different, with acrylic resin provides the greater bond strength with the artificial teeth, it can be attributed to better monomer release at the junction and an increase in temperature of the polymerization and the type of tooth [63]. Noufal *et al*. 2017 [64] investigated the effect of increasing the temperature by autoclave on shear bond strength of artificial teeth and concluded that autoclaving polymerization can be an effective alternative to denture resin processing. Cardash *et al*. 1990 [52] observed that high impact heat cured denture base resin offered a higher bond strength than conventional resin. Zidan *et al*. 2020 [59] observed that effect of surface conditioning with monomers on ridge lap surface of acrylic teeth and concluded that there is an improvement in shear bond strength. Laser surface treatment improved the bond strength with limited success over the chemical or mechanical techniques [5]. CAD/CAM and 3-D printed dentures demonstrated decreased bond strength compared to conventional dentures [60].

Denture disinfection is recommended as an essential procedure for preventing cross infection and also for maintaining healthy oral mucosa. Hence denture cleansers should be advised regularly for cleaning the dentures the present study evaluated the effect of disinfection on shear bond strength between heat activated acrylic resin denture base and two commercially available denture teeth. Based on the data, the null hypothesis was rejected. The two different brands of denture teeth set employed in the study were Acryrock and Ivostar (both are crosslinked acrylic teeth). Ivostar denture teeth are composed of 3 layers *viz* enamel layer, dentin layer and an intermediate layer while Acryrock is composed of 2 layers *viz*., enamel layer and dentin layer. Each layer has varying degrees of hardness and roughness. In the present study, Ivostar demonstrated increased bond strength compared to Acryrock.

The present study clearly demonstrated that the PMMA denture base with artificial teeth specimens without any disinfection methods exhibited greater bond strength (control). While mechanical and chemical disinfection methods demonstrated a significant change in the bond strength. Brushing with conventional mild specific tooth paste and tooth brush is the most common and routine way of disinfection. In the present study, specimens were subjected to tooth brushing with soft bristled brush along with Colgate solution for 14 hours to simulate 5 years of disinfection. Bond strength between heat activated denture base and denture teeth is mainly affected by the force and duration of brushing. This is consistent with the data support of Health JR 1983 [39]. Meanwhile, Hansen *et al*. 1999 [53] concluded that reduced bond strength of dental braces after mechanical disinfection were most likely due to attrition between tooth brush and brace surface.

Chemical methods of disinfection are not commonly used because of lack of knowledge, unavailability and cost factor. Immersing the acrylic resin in chemical solution can alter their physical properties. Some disinfectants can cause hydrolysis and decomposition of acrylic resin [1]. Furthermore, chemical components of some disinfectant solution cause softening and degradation of polymers, thus causing a plasticizing effect. In the study chemicals used were 4% chlorhexidine solution and fitty dent solution (active ingredient is sodium perborate monohydrate). Chlorhexidine is a dicationic chemical exihibiting substanstivity and pin cushion effect. Chlorhexidine at lower concentration acts as bacteriostatic and at higher concentration as bacteriocidal. Sodium perborate monohydrate is bacteriocidal with excellent efficiency against bacterial plaque and good cleansing effect. The specimens were immersed in the solution for 15 minutes daily for 19 days to simulate 5 years of disinfection. In the present study, disinfection with 4% chlorhexidine solution and fitty dent solution minimally affect the bond strength between heat activated denture base and denture teeth. Reduction in bond strength after immersing in chemical solution depends on the concentration and exposure time.

Chemico-mechanical disinfection significantly reduced the bond strength between denture teeth and heat activated denture base. The combination of brushing alongside with further chemical disinfection with 4% chlorhexidine digluconate or with sodium perborate monohydrate reduced the bond strength between denture teeth and heat activated acrylic denture base. Several studies concluded that material surface becomes rougher after tooth brushing abrasion.

Meanwhile, certain other studies revealed increased surface roughness after immersing in chlorhexidine solution. The increased roughness of the polymer causes slow absorption of the disinfectant solution which further altered the structural and chemical properties of the polymer thereby decreasing the bond strength as reported by Neppelenbroek *et al*. 2005 [40]. Rigidity and surface morphology of heat activated denture base resin were affected by disinfectant solution as revealed by the findings of Shen *et al*. 1989 [55]. Daily use of denture cleansers can affect the mechanical and physical properties of heat activated denture base [35]. Disinfectant solution promote reduction in hardness of denture base resin [40]. Baia *et al*. 2020 [61] observed that prolonged immersion in 4% hydrogen peroxide decreased tooth bonding with the denture base.

Clinically, the most important stress factors leading to bond failure were the shear stress. The analysis of bond failure revealed mixed type of failure in control sample, while specimens which underwent mechanical disinfection with or without chemical disinfection demonstrated adhesive type of failure. These findings were concurrent with the study conducted by Fletcher stark, *et al*. 2011 [43]. Hatim and Hasan [58] concluded that the failure mode to be adhesive type with heat polymerised resin and mixed failure for microwave cured acrylic denture base. Specimens disinfected with 4% chlorhexidine solution exhibited adhesive and mixed type of failure while specimens with sodium perborate monohydrate demonstrated predominantly adhesive type of failure. The failure rates observed in the present study corroborated with the findings of Adaias. O. Matos *et al*. 2018 [1]. Bond failures in form of cracks and gaps occurs mainly in areas of load concentrations [62]. In contrast, Naveen Yadav *et al*. 2015 [11] evaluated the bond strength of acrylic teeth to heat activated acrylic denture base employing different polymerisation techniques and found that when denture teeth is fractured, the fracture path does not occur along the interface between tooth and denture base and fracture was found to be cohesive in nature. The study conducted by Sandra, *et al*. [44] evaluated the effect of thermocycling, teeth and polymerisation methods on bond strength of teeth and denture base and found that more than 80% of failures were of cohesive type.

Clinical significance

Mechanical disinfection with or without chemical disinfection decreases the bond strength.4% chlorhexidine and sodium perborate monohydrate solution alone can be used safely for denture disinfection without any detrimental effect on dentures as they do not significantly impair the bond strength between denture tooth and heat activated acrylic resin denture base with less potential for tooth debonding.

Limitations

1. The present study should be evaluated in an *in vivo* situation to simulate clinical scenario exactly.
2. In mechanical disinfection, brushing simulation was given only a single static force in vertical direction.
3. In addition, only 2 brands of acrylic teeth and 2 disinfectants solution were tested therefore, the present study should be interpreted with caution.
4. Limited sample size.

In future, studies should be performed to investigate how long term or repeated disinfection will affect the bond strength intraorally and how efficient is chemical and mechanical disinfection in maintaining normal health of the patient.

Conclusion

Within the limitations of the present study, it was concluded that:

1. Chemical disinfection with 4% chlorhexidine solution and sodium perborate monohydrate solution did not significantly reduce the bond strength between heat activated denture teeth and heat activated denture base
2. Mechanical disinfection with or without chemical disinfection significantly reduced the bond strength between the denture teeth and heat activated denture base
3. Control samples demonstrated the highest bond strength in both groups
4. Ivostar teeth showed better bond strength than Acryrock
5. Mixed type of bond failure as observed in control group and in 4% chlorhexidine solution. Disinfection with sodium perborate solution, demonstrated adhesive and mixed type of failure. In Mechanical disinfection with or without chemical disinfection predominantly had the adhesive failure pattern

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