INTERNATIONAL JOURNAL OF CURRENT RESEARCH IN CHEMISTRY AND PHARMACEUTICAL SCIENCES
(p-ISSN: 2348-5213: e-ISSN: 2348-5221)
www.ijcrcps.com
DOI: 10.22192/ijcrcps Coden: IJCROO(USA) Volume 4, Issue 12 - 2017

Research Article

DOI: http://dx.doi.org/10.22192/ijcrcps.2017.04.12.001

An *In vitro* Comparative Evaluation of Three Disinfectants on Heat Cure Acrylic Resin Specimens Contaminated with Standard and Clinical Strains of *S.mutans* Microorganism

Assadollah Ahmadzadeh[1], Effat Abasi Montazeri[2], Sara Mogharabi[3], Maryam Jarahzadeh[4*]

[1]Assistant Professor, Department of Prosthodontics, School of Dental Medicine , Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran
[2]Assistant Professor, Department of Microbiology, school of Medicine, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran
[3]Assistant Professor, Department of Prosthodontics, School of Dental Medicine , Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran
[4*]Dental student, Student Research Committee Center , School of Dental Medicine, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran
***Corresponding author**: Maryam Jarahzadeh, Student Research Committee Center, Dental student, School of Dental Medicine, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran
Tel: +989168022553 Email :Maryamjarahzade987@gmail.com

Abstract

Background and objectives: Dental prosthesis, due to contact with tools, people and different places, have a higher risk of contamination, while preventing and disinfecting them is very important. The aim of this study was to evaluate the effect of antimicrobial solutions of 0.5% sodium hypochlorite, 100% vinegar, and 0.2% chlorhexidine on heat cure acrylic resin specimens contaminated with standard and clinical strains of *S.mutans* microorganism.
Materials and methods: A total of 60 acrylic sheets were made with dimensions of 17×6×1mm in one shape and one size and the same thickness. First, a new colony of S. mutans standard strain was prepared. Then, the specimens were immersed in the microorganism suspension to form an *experimental biofilm*-related Candida infection.The specimens were divided into four subgroups of 15 and each group was immersed in sterile containers containing 0.5% sodium hypochlorite, 0.2% chlorhexidine, 100% vinegar, and water.A total of five samples were isolated from each group and were turbid in an interval time of 30min, 2hrs, and 4hrs, respectively. *Data were analyzed using* SPSS Ver 19.0.
Results: All three disinfectant solutions resulted in complete elimination of *S.mutan* micro-organism provided that the immersion time lasts about thirty minutes. The long term *effect of* vinegar after 2hrs reduced to 80% and the effect of hypochlorite after 4hrs significantly *reduced to 40%.*
Conclusion: Among the three denture cleansers used in the present study, all were considered to be effective in cleaning and removing bacteria from denture at specific time interval.

Keywords: Microorganism, *S.mutans*, Disinfectant, Denture,

Introduction

Dental prosthesis, due to contact with tools, people and different places, have high probability of contamination, and *disinfection* and sterilization of them are very important.The *prosthesis* becomes colonized with *various microorganisms* which can produce diseases such as pneumonia, conjunctivitis, and meningitis.[1]

Biofilms are the predominant growth state of *many microorganisms*. Dental *biofilm* pathogenicity in the *oral cavity* is magnified by specific *biofilm.* The connection and colonization of various microorganisms on the denture surface causes biofilm production in the oral cavity.[2] *Denture*-related *stomatitis* is a chronic biofilm-mediated disease and the *most common* form of oral candidiasis affecting two in every three complete denture wearers.[3,4] Denture plaque containing *Candida* could cause not only oral candidiasis, like oral thrush or denture-induced stomatitis, but also caries, root caries and periodontitis of abutment teeth.These *plaque* deposits *can* lead to serious problems, such as systemic infections with candida fungi, pneumonia, and even heart disease.[5] It is essential to pay attention to the condition of oral mucosal membrane and denture hygiene habits. Denture sanitization is an important element in the treatment of denture stomatitis and should be emphasized to the patients. The 6-month incidence of denture stomatitis can be significantly reduced by educating nursing home caregivers about oral heath care.The incidence of denture stomatitis and the duration of denture wear are highly correlated. Dentists can help prevent this condition by instructing patients to take their dentures out of their mouth for 6-8 hours each day. Mechanical plaque control and appropriate denture-wearing habits are the most important measures in preventing and treating the disease.[6]

Studies of *microbial* biofilms *have* led to realize that chemical *antimicrobial* agents play a significant role in the removal of microorganisms and microbial plaques.[10]The efficacy of a *disinfectant* depends on *sufficient* length of treatment. The sufficient immersion time is *effective* to inactivate most oral microorganisms.There are various chemical disinfectants such as sodium hypochlorite, chlorhexidine, glutaraldehyde, alcohol, hydrogen peroxide, iodophors, and phenols which *despite their* success some researches have *cited drawbacks.*[11-15]

Recent scientific investigations clearly demonstrate the antimicrobial properties of household materials such as vinegar to disinfect acrylic resins and oral prostheses. The acetic acid in undiluted vinegar may be used effectively for cleaning dentures, and, unlike bleach solutions, vinegar residues left on dentures were not associated with mucosal damage.[16,17] Chlorhexidine is a potent antiseptic agent. It reduces plaque formation and inhibits the growth of Gram-positive cariogenic microorganisms including *S. mutans*. It binds to negatively charged constituent parts including bacterial cell walls, salivary pellicle and mucosa, giving it high substantivity.[16,17] At low concentrations (<1%), chlorhexidine is bacteriostatic by interfereing with cell wall transmission leading to leakage of intracellular components. At high concentrations (>1%), it is bactericidal by causing precipitation of the intracellular cytoplasm. It also inhibits the action of glycosyltransferase, thus preventing adhesion of bacteria to the tooth surface.[16,17] Alkaline hypochlorite solutions have also shown good results for disinfecting the denture. Antibacterial and antifungal properties of this solution can inhibit the growth of *bacteria*.[9,18] *Sodium hypochlorite*(NaOCl), also called as liquid *bleach*, is a powerful oxidizing agent that is *widely used* as a disinfecting and *bleaching* agent.[19] Sodium Hypochlorite 5% is a broad-spectrum disinfectant that has an effect on a large number of aerobic and anaerobic bacteria.[20,21] Various studies have shown that *sodium hypochlorite reduce* the adhesion of all *Candida albicans* strains. *This solution* is *inexpensive* and readily available *and has a wide spectrum* of antimicrobial.[22] However, these solutions have not only bad taste, but, most importantly, may damage denture materials, depending on the immersion time and concentration.[13,14,19] For example, they may whiten acrylic resins and cause corrosion to metal components.[23,24,25] Other studies have shown that immersion in solutions such as 1% sodium hypochlorite and 4% chlorhexidine can reduce the hardness of acrylic resins depending on the duration of immersion and the concentration of the solution.[26,27].A variety of *denture* disinfection methods *have* been studied. *Further researche*s are needed to develop towards developing *solution* cleansers.The aim of this study was to evaluate the effect of antimicrobial solutions of 0.5% sodium hypochlorite, 100% vinegar, and 0.2% chlorhexidine on heat cure acrylic resin specimens contaminated with standard and clinical strains of *S.mutans* microorganism.

Materials and Methods

The present study was an *in vitro experimental study* conducted in the *Department of Prosthetics*, School of Dental Medicine and Laboratory of Microbiology, School of Medicine, Ahvaz Jundishapur University of Medical Sciences in 2016. This study was carried out to evaluate the efficacy of three disinfectants of 0.5% sodium hypochlorite (Pakshoma,Iran,Tehran), 100% vinegar (Melas Gostar,Iran,Tehran) and chlorhexidine 0.2% (Iran Naju,Iran,Tehran) on on Akropars heat cure acrylic resin (Marlik Corporation, Iran-Tehran), which has been contaminated with *S. mutans*. In order to make an acrylic sample the plaster (Pars dental, Tehran, Iran) was

invested in the lower part of the flask and a glass slab was placed in the lower part on the plaster. Following the hardening of the plaster and application of biofilm on the edges of the slab, a metallic mold with dimensions 1 × 6 × 17 mm was placed on the glass surface and the upper half of the plaster was invested all around the flask. After hardening of the second stage of plaster, while the glass slab was in place, the third stage was invested and sealed in the flask and placed under pressure until the plaster became hard. In this way, the acrylic samples were enclosed in the lower and upper parts of the glass slabs. The purpose of this kind of *investing* the cast and a waxed denture in a *flask* was to obtain completely polished acrylic resin *samples* without finishing process.Then; the mold was filled with acrylic molding paste. After *acrylic performing* on *Stage* 3, samples were placed in the sintering machine (Kavo Ewl type 5518) at 70 ° C for 9 hours. A total of 64 acrylic sheets were made with the dimension of 1 × 6 × 17 mm at the same shape, size, and thickness.To protect acrylic sheets from dehydration, they were immersed in a sterile container containing sterilized distilled water and then were exposed to a *temperature* of about 121^{o}*C* for 15 *minutes* and pressure of one atmosphere autoclave. The spesimens were *kept* in a *refrigerator until use*. At the outset, to ensure the sterilization of the specimens, two acrylic sheets as a negative control were exposed to 2ml of liquid *medium* of brain heart infusion (*BHI*) *broth* (*Merck KGaA*, *Darmstadt*, *Germany*) for 24 h at 37 °C. *Following incubation* for *24 hrs* at *37°C,* the samples were examined for turbidity.To validate the accuracy of the results, the samples were cultured in solid-culture media of Blood Agar.

In this study, the *biofilm formed* by the *S*. *mutans* (ATCC1683) reference *strain*, retrived from the Iran Scientific and Industrial Research Center in the form of lyophilized vials. After breaking the vial, standard strains were transfered to the TSB liquid medium and incubated for 24 hours at 37 ° C. Afterwards, they were cultured on a solid medium for 24 hours.

Then and there, Suspension with concentration of 0.5 McFarland units (1.5 × 108 cells / mL) was prepared using colony and saline. In the next step, the remaining 62 samples were immersed in the microorganism suspension to form *an experimental biofilm*. After 24 hours, the specimens were removed from the suspension and washed with sterile distilled water. Then, they were placed on sterilized dry gauze pad. To ensure the contamination, two samples were transfered to the liquid *medium* of brain heart infusion (*BHI*) *broth* (*Merck KGaA*, *Darmstadt*, *Germany*) for 24 h at 37 °C as positive control and their turbidity were examined. The rest of the specimens were divided into four subgroups of 15 and each group was immersed in sterile containers containing 0.5% sodium hypochlorite, 0.2% chlorhexidine, 100% vinegar, and water. At 30 minutes, 2 hours and 4 hours, 5 samples were separated from each subgroup and washed with distilled water and were placed on sterilized dry gauze pad. Each sample was placed in test tubes containing 10cc BHI medium and the lid of test tube was closed. The test tubes were incubated at 37 ° C for 24 hours and then were *examined* for growth by observing *turbidity*. In order to ensure the results of the liquid medium, all of the BHI culture media were also sampled into a Blood Agar medium.

As a final point, the results of *S.mutans* growth in an interval time of 30 minutes, 2 hours, and 4 hours in 0.5% sodium hypochlorite disinfectants, 0.2% chlorhexidine, and 100% vinegar were examined. *Data were analyzed using* IBM *SPSS* 19.0 software (IBM,Armonk, NY, USA).

Results

Statistical analysis showed that after 30 minutes immersion of the samples in each of the three *disinfectants* solutions, all of them were able to completely eliminate the growth of *S. mutans*. Similarly, the results of two hours immersion were consistent with the results of 30 minutes immersion, with the exception of vinegar, whose effect has fallen by 20% (downtrend pattern) and reached to 80%.The results of the four-hour period were similar to those of two previous periods, with the difference that the hypochlorite effect is reduced to 40%.

Discussion

Despite the great advice on brushing as an effective way of removing denture biofilms, this method is more dependent on the denture's owner's skill and may have limited effects in some cases.[28] A practical way of compensating for this is the simultaneous use of brushing and immersion in solutions. This method is recommended as *denture-cleaning methods.*[29,30]

Alkaline hypochlorite solutions have revealed favorable results for denture hygiene. They exhibit *fungicidal* and *bactericidal properties* in the presence of organic matrix of the biofilm and can remove stains.[30,31]Various studies have r*ecommended* dilution of *sodium hypochlorite* (*Bleach*) for decontamination.[32,33] *Sodium hypochlorite has* not only *bad taste*, but, most importantly, may *damage denture* materials, depending on the immersion *time* and *concentration.*[33] It has been shown that immersion in denture cleanser solution, *sodium hypochlorite*, can affect the flexural strength and structure of acrylic resins.[34,35,36] Several studies have reported the antimicrobial activity and denture biofilm removal capacity of 1% - 5.25% sodium hypochlorite.[37,38,39] However, *there* is *no* clear consensus on *time-concentration* to achieve the highest efficacy and *minimal* adverse effects on dentures.

Chlorhexidine is a broad-spectrum biocide effective against Gram-positive bacteria and fungi. Over the years, chlorhexidine has been used in the dental practice as an excellent antiplaque antigingivitis, and antistomatitis agent. Chlorhexidine not only exhibits special property of substantivity, it also possesses a broad antimicrobial spectrum which makes its use in wide variety of oral disorders. Nearly, all disciplines of dentistry use this material in different formulations like mouth wash, gel, spray, varnish, and restorative material.[46,47] Vinegar is mainly a dilute aqueous solution of acetic acid and this is reflected in its physical and chemical properties. The acid part of vinegar is what gives it its sour taste and its antiseptic (germ killing) properties as well as its cleaning properties.[48,49,50]
In the present study the *Streptococcus mutans* was selected. *Streptococcus mutans* is a Gram-positive organism that is the primary causative agent in the formation of dental cavities in humans. This organism is facultatively anaerobic, Gram-positive coccus-shaped bacterium commonly found in the human oral cavity and is a substantial contributor to tooth decay.[51,52]
The present study showed that after half an hour, all solutions were able to eliminate all colonies, while after two hours, the vinegar had an effect of 80% and after 4 hours the hypochlorite effect was 40%.

Lavanya *et al*., 2015, in India examined the effectiveness of sodium hypochlorite 1%, chlorhexidine 2%, vinegar 100%, and sodium perborate 3.8% for disinfection of acrylic resin specimens *contaminated with Staphylococcus aureus*, *Escherichia coli*, and *Candida albicans* microorganisms. They used 150 standard acrylic resin samples, of which 30 were considered as controls. Finally, each of the subgroups of study had 10 samples. The results showed that the four disinfectants had a *good effect* on *bacterial* biofilms. Chlorhexidine and sodium perborate had only a complete disinfectant effect on *Candida albicans* than two other bacteria; this finding is consistent with the results of the present study. Similarly, vinegar was effective at inhibiting the growth of *Escherichia coli* rather than two other bacteria.

Silva *et al*., 2015, in Brazil examined antimicrobial action of sodium hypochlorite (0.25% and 0.50%) and 10% *castor oil* solution for *denture* cleaning. In this study, 320 samples of acrylic resins were infected with *Staphylococcus aureus, Pseudomonas aeruginosa, Candida albicans, Bacillus subtilis, Escherichia coli, Streptococcus mutans, Enterococcus faecalis*, and *Candida glabrata*, and then each group (10 samples) *were placed in disinfectant solution for 20 minutes.* Moreover, a group was placed as a negative control in the saline solution. The bacterial colonies were incubated at 37 ° C for 24 hours on a solid culture medium. *The results showed that sodium hypochlorite* (*0.25*% and 0.50%) *completely eliminated all* detectable *microorganisms*. The *castor oil solution eliminated B*. *subtilis* and *reduced* counts for *other* strains.[27]The results of Silva *et al*.'s study were inconsistent with the results of present study. Williams and Lewis suggested that *surface roughness* favored *colonization* by the *microorganisms*, *contributing indirectly* to *tissue injury*.[53]Sodium hypochlorite as a disinfectant has the following advantages: It can easily store and transport when it is produced on-site. Dosage is simple. Transportation and storage of sodium hypochlorite are safe. Sodium hypochlorite is as effective as chlorine gas for disinfection. Sodium hypochlorite produces residual disinfectant.[54,55] This material was proposed by Rodrigues *et al*. as the most effective method for disinfection of prostheses made of acrylic resin, provided that it has 2% active chlorine and 30 minutes immersion time.[56]Chau *et al*. confirmed that immersion for more than 10 minutes in sodium hypochlorite guarantees the disinfection of the surface of the material. However, its disadvantages include corrosion and rusting on the surface of metals, causative effects on the surface of the skin and other cells, and the destruction of linen clothes.[58]

Nascimento *et al*., 2003, reported that 100% white vinegar has effective antimicrobial activity against *E. coli* and *S. aureus* for acrylic resins.[48]Vinegar and other acetic acid solutions have become very popular due to the toxicity of chlorine and other disinfectants.[48,59] Sodium perborate tablets are used for removing *dentinal* debris and preventing breakage of instruments and can be efficient in removing *biofilm*.[60,61] Rudd *et al*., 1984, stated that immersion of hypochlorite in *5 minutes* with concentration of 5.25% eliminates all microorganisms and 1% concentration in 10-15 minutes can eliminate *strains* of *Staphylococcus aureus*, *Bacillus subtilis*, *Escherichia coli*, *Pseudomonas aeruginosa,* and *Candida albicans*.[37] Other studies showed that immersion of 1.5% concentration in 20 minutes and 2% in 5 minutes could be effective against *Candida albicans*.[64,65] *Furthermore*, the concentration of hypochlorite *can* influence the physical *properties* of denture *acrylic resin*.[34,35] Paranhos *et al*.2013,studid the surface roughness and flexural strength of an acrylic resin submitted to simulated overnight immersion in denture cleansers.they used the solution of *0.5*% and *0.25*% *sodium hypochlorite* for 20 minutes. The results showed changes in color and increase of surface roughness of acrylic resin, but different concentrations of hypochlorite did not have much clinical difference. Additionally, 20 min daily soaking *had* Impact of denture cleaning method and overnight storage condition on *denture biofilm.*[34]

Conclusion

All three disinfectant solutions resulted in complete elimination of *S.mutan* micro-organism provided that the immersion time lasts about thirty minutes. The long term *effect of* vinegar after 2hrs reduced to 80% and the effect of hypochlorite after 4hrs significantly *reduced to 40%.*

References

1- Pavarina AC, Pizzolitto AC, Machado AL, Vergani CE, Giampaolo ET. An infection control protocol: effectiveness of immersion solution to reduce the microbial growth on dental prostheses. J Oral Rehabil. 2003; 30: 532-6.

2- Hibino K, Samaranayake LP, Hagg U, et al. The role of salivary factors in persistent oral carriage of Candida in humans. Arch Oral Biol. 2009; 54(7):678–83.

3- Atashrazm P,Sadri D, Prevalance of oral mucosal lesions in a group of Iranian depedent elderly complete denture wears. Journal of contemp Dent pract. 2011;14(2):174-8

4- Salerno C, Pascale M, Contald M, Esposito V, Busciolano M, Millio L, et al. Candida-associated denture stomatitis. Med Oral Patol Oral Cir Bucal. 2011; 16(2): 139-43.

5- Kossioni AE. The prevalence of denture stomatitis and its predisposing conditions in an older Greek population. Gerodontology 2011;28(2):85-90.

6- Jnanadev KR, Satish Babu CL, Shilpa Shetty S, Surendra Kumar G P, Sheetal HS. Disinfecting the acrylic resin plate using electrolyzed acid water and 2% glutaraldehyde: a comparative microbiological study. J Indian Prosthodont Soc. 2011;11(1):36-44.

7- Paranhos HFO, Salles AES, Macedo LD, Silva-Lovato CH, Pagnano VO, Watanabe E. Complete denture biofilm after brushing with specific denture paste, neutral soap and artificial saliva. Braz Dental J. 2013; 24(1):47-52.

8- Paranhos HFO, Silva CHL, Souza RF, Cruz PC, Freitas KM, Ito IY, et al. Effect of three methods for cleaning dentures biofilms formed in vitro on acrylic resin. J Prosthodont. 2009;18(5):427-431.

9- Andrade IM, Andrade KM, Pisani MX, Silva-Lovato CH, Souza RF, Paranhos HFO. Trial of an experimental castor oil solution for cleaning dentures. Braz Dent J. 2014; 25(1):43-7.

10- Sharaffedin F,Sadeghi AR,Kohanteb G.Comparison of the effect of Deconex(solarsept),Micro10 and Cidex in disinfecting dental instruments. J Dent Shiraz univMed Sci. 2005; 6(1,2):38-46.

11-Vojdani M, Zibaei M. Frequency of bacteria and fungi isolated from pumices in dental labratories. J Res Health. 2006; 6(1): 33-38.

12- Sato S, Cavalcante MR, Orsi IA, Paranhos Hde F, Zaniquelli O.Assessment of flexural strength and color alteration of heat-polymerized acrylic resins after stimulated use of denture cleansers. Braz Dent J. 2005;16(2):124-8.

13- Nirale RM, Thombre R, Kubasad G.Comparative evaluation of sodium hypochlorite and microwave disinfection on dimensional stability of denture bases. J Adv Prosthodont. 2012; 4(1):24-9.

14- Poorshahab M, Mostafapour R, Maktabkhan F. Comparison of the in fluence of 3 types of Denture cleanser on color change of acrylic resin of denture base. JRDS.2012; 9(1):15-19.

15- Ghahremani L, Rahbar M, Hesami A. Invitro evaluation of candida albicans adherence and growth on GC and acropars soft liners. JRDS. 2010; 7(3):8-14.

16- Lavanya SV, Kumar DC. Study to Assess the Disinfection of Dental Prostheses to Clear Locally Prevalent Microbial Strains. Journal of Evidence based Medicine and Healthcare 2015;47(2): 8304-8307.

17- Hashizume LN, Hosharuk MF, Morira MJS. Effect of affordable disinfectant solutions on Candida albicans adhered to acrylic resin for dental prosthesis. RGO, Rev Gaúch Odontol, Porto Alegre. 2015;3(63): 309-314.

18- Lima EM, Moura JS, Del Bel Cury AA, Garcia RC, Cury JA. Effect of enzymatic and NaOCl treatments on acrylic roughness and on biofilm accumulation. J Oral Rehabil. 2006; 33(5):356-62.

19- Souza RF, Paranhos HFO, Silva-Lovato CH, Abu-Naba'a L, Fedorowicz Z, Gurgan CA. Interventions for cleaning dentures in adults. Cochrane Database of Syst Rev.2009; 7;(4): 65-73.

20- Ercan E, Erdemir A, Zorba YO, Eldeniz AU, Dalli M, Ince B, et al. Effect of different cavity disinfectants on shear bond strength of composite resin to dentin. J Adhes Dent. 2009;11(5):343-6.

21- Reddy MS, Mahesh MC, Bhandary S, Pramod J, Shetty A, Prashanth MB. Evaluation of effect of different cavity disinfectants on shear bond strength of composite resin to dentin using two-step self-etch and one-step self-etch bonding systems: a comparative in vitro study. J Contemp Dent Pract. 2013;14(2):275-80

22- Pavarina AC, Pizzolitto AC, Machado AL, Vergani CE, Giampaolo ET. An infection control protocol: effectiveness of immersion solutions to reduce the microbial growth on dental prostheses. J Oral Rehabil. 2003; 30(5): 532-36.

23- Paranhos HFO, Peracini A, Pisani MX, Oliveira VC, Souza RF, Silva-Lovato CH. Color stability, surface roughness and flexural strength of an acrylic resin submitted to simulated overnight immersion in denture cleansers. Braz Dent J. 2013; 24(2):152-6.

24- Davi LR, Felipucci DNB, Souza RF, Bezzon OL, Silva-Lovato CH, Souza VOP, et al. Effect of denture cleansers on metal Ion release and surface roughness of denture base materials. Braz Dent J. 2012; 23(4):387-93.

25- Felipucci DNB, Davi LR, Paranhos HFO, Bezzon OL, Silva RF, Pagnano VO. Effect of different cleansers on the surface of removable partial denture. Braz Dent J. 2011; 22(5):392-7.

26- Pavarina AC, Vergani CE, Machado AL, Giampaolo ET, Teraoka MT. The effect of disinfectant solutions on the hardness of acrylic resin denture teeth. J Oral Rehabil. 2003; 55: 749-52.
27- Salles MM, Oliveria VC, Souza RF, Silva CHL, Paranhos HFO. Antimicrobial action of sodium hypochlorite and castor oil solutions for denture cleaning – in vitro evaluation. Braz Oral Res. 2015;29(1):1-6.
28. Paranhos HFO, Salles AES, Macedo LD, Silva-Lovato CH, Pagnano VO, Watanabe E. Complete denture biofilm after brushing with specific denture paste, neutral soap and artificial saliva. Braz Dental J. 2013;24(1):47-52.
29. Paranhos HFO, Silva CHL, Souza RF, Cruz PC, Freitas KM, Ito IY, et al. Effect of three methods for cleaning dentures biofilms formed in vitro on acrylic resin. J Prosthodont 2009 Jul;18(5):427-431.
30. Andrade IM, Andrade KM, Pisani MX, Silva-Lovato CH, Souza RF, Paranhos HFO. Trial of an experimental castor oil solution for cleaning dentures. Braz Dent J. 2014 Jan-Feb;25(1):43-7.
31. Lima EM, Moura JS, Del Bel Cury AA, Garcia RC, Cury JA. Effect of enzymatic and NaOCl treatments on acrylic roughness and on biofilm accumulation. J Oral Rehabil. 2006 May;33(5):356-62.
32. Nikawa H, Hamada T, Yamashiro H, Kumagai H. A review of in vitro and in vivo methods to evaluate the efficacy of denture cleansers. Int J Prosthodont. 1999 Mar-Apr;12(2):153-9.
33. Souza RF, Paranhos HFO, Silva-Lovato CH, Abu-Naba'a L, Fedorowicz Z, Gurgan CA. Interventions for cleaning dentures in adults. Cochrane Database of Syst Rev. 2009 Oct 7;(4):CD007395.
34. Paranhos HFO, Peracini A, Pisani MX, Oliveira VC, Souza RF, Silva-Lovato CH. Color stability, surface roughness and flexural strength of an acrylic resin submitted to simulated overnight immersion in denture cleansers. Braz Dent J.2013;24(2):152-6.
35. Davi LR, Felipucci DNB, Souza RF, Bezzon OL, Silva-Lovato CH, Souza VOP, et al. Effect of denture cleansers on metal Ion release and surface roughness of denture base materials. Braz Dent J. 2012;23(4):387-93.
36. Felipucci DNB, Davi LR, Paranhos HFO, Bezzon OL, Silva RF, Pagnano VO. Effect of different cleansers on the surface of removable partial denture. Braz Dent J. 2011;22(5):392-7.
37. Rudd RW, Senia ES, McCleskey FK, Adams EDJr. Sterilization of complete dentures with sodium hypochlorite. J Prosthet Dent. 1984 Mar;51(3):318-21.
38. Silva FC, Kimpara ET, Mancini MN, Balducci I, Jorge AO, Koga-Ito CY. Effectiveness of six different disinfectants on removing five microbial species and effects on the topographic characteristics of acrylic resin. J Prosthodont. 2008 Dec;17(8):627-33.
39. Orsi IA, Junior AG, Villabona CA, Fernandes FH, Ito IY. Evaluation of the efficacy of chemical disinfectants for disinfection of heat-polymerised acrylic resin. Gerodontology. 2011 Dec;28(4):253-7.
40. Ferreira CM, Bonifacio KC, Froner IC, Ito IY. Evaluation of the antimicrobial activity of three irrigation solutions in teeth with pulpal necrosis. Braz Dent J. 1999;10(1):15-21.
41. Medical Microbiology by David Greenwood, Mike Barer, Richard Slack & Will Irving; pg 16; 18th Edition, 2012; Churchill Livingstone (ELSEVIER).
42. Textbook of Microbiology by Dir Prof C. P. Baveja, pgs 104, 131; Fourth Edition, 2012, Arya Publications.
43. Kulak Y, Arikan A, Kazazoglu E: Existence of Candida albicans and microorganisms in denture stomatitis patients. J Oral Rehabil 1997; 24: 788-790
44. Radford DR, Sweet SP, Challacomb SJ, et al: Adherence of Candida albicans to denture-base materials with different surface finishes. J Dent 1998; 26: 577-583.
45. Davenport JC: The denture surface. Br Dent J 1972; 133: 101- 105.
46. Mello GB, Gontijo Filho PP, Aguiar S: Utilizac¸ ˜ao de antimicrobianos, clorexidina e merc´urio em odontologia e resistˆencia de microrganismos isolados da cavidade 6uccal. Rev Cons Reg Odontol Minas Gerais 2000; 6: 79-87.
47. Guimar˜aes Junior L: Biosseguranc¸a e Controle de Infecc¸ ˜ao Cruzada em Consult´orios Odontol´ogicos (ed 1). S˜ao Paulo, Brazil, Santos, 2001.
48. Nascimento MS, Silva N, Catanozi MPLM, et al: Avaliac¸ ˜ao comparativa de diferentes desinfetantes na sanitizac¸ ˜ao de uva. Braz J Food Technol 2003; 6: 63-68.
49. Utyama IKA: Avaliac¸ ˜ao da atividade antimicrobiana e citot´oxica in vitro do vinagre e´acido ac´etico: perspectiva na terapˆeutica de feridas. Master Dissertation. Ribeir˜ao Preto, Brazil, School of Nursing University of S˜ao Paulo, 2003.
50. Silva FC, Rosa LP, Koga-Ito CY, et al: Desinfecc¸ ˜ao de places acr´ılicas ortodˆonticas com hipoclorito de s´odio e glutaralde´ıdo: estudo in vitro. Rev Odontol UNICID 2004; 16: 35-40.
51. Smith AJ, Jackson MS, Bagg J. The ecology of Staphylococcus species in the oral cavity. J Med Microbiol. 2001 Nov;50(11):940-6.
52. Salerno C, Pascale M, Contaldo M, Esposito V, Busciolano M, Milillo L, et al. Candida-associated denture stomatitis. Med Oral Patol Oral Cir Bucal. 2011 Mar;16(2):e139-43.
53. Williams DW, Lewis MAO: Isolation and identification of Candida from the oral cavity. Oral Dis 2000; 6: 3-11.
54. Cotrim LEF, Santos EM, Jorge AOC:Procedimentos de biosseguranca realizados por cirurgioes-dentistas e laboratorios durante a confeccao de proteses dentarias. Rev Odontol UNESP 2001; 30: 233-244.

55. Coordenacao N:Controle de Infeccoes e a Pratica Odontologica em Tempos de AIDS: Manual de Condutas (ed 1). Brasilia, Brazil, Ministrerio da Saude, 2000.
56. Rodrigues EA, Reis RF, Camargo RW: Efic´acia de trˆes desinfetantes em pr´oteses totais ‘a base de resina acr´ılica. Odontol Mod 1994; 21: 11-15.
57. Chau VB, Saunders TR, Pimsler M, et al: In-depth disinfection of acrylic resins. J Prosthet Dent 1995; 74: 309-313.
58. Bell JA, Brockmann MS, Feil P, et al: The effectiveness of two disinfectants on denture base acrylic resin with an organic load. J Prosthet Dent 1989; 61: 581-589.
59. Makino S, Cheun H, Tabuchi H, et al: Antibacterial activity of chaff vinegar and practical application. J Vet Med Sci 2000; 62: 893-895.
60. Gornitsky M, Paradis I, Landaverde G, et al: A clinical and microbiological evaluation of denture cleansers for geriatric patients in long-term care institutions. J Can Dent Assoc 2002; 68: 39-45.
61. McCabe JF, Murray ID, Kelly PJ: The efficacy of denture cleansers. Eur J Prosthodont Rest Dent 1995; 3: 203-207.
62. Silva PMB, Acosta EJTR, Pinto LR, Graeff M, Spolidorio DM, Almeida RS, et al. Microscopical analysis of Candida albicans biofilms on heat-polymerised acrylic resin after chlorhexidine gluconate and sodium hypochlorite treatments. Mycoses. 2011 Nov;54(6):e712-7.
63. Jose A, Coco BJ, Milligan S, Young B, Lappin DF, Bagg J, et al. Reducing the incidence of denture stomatitis: Are denture cleansers sufficient? J Prosthodont. 2010 Jun;19(4):252-7.

Access this Article in Online

Website: www.ijcrcps.com

Subject: Dental Sciences

Quick Response Code

DOI: 10.22192/ijcrcps.2017.04.12.001

How to cite this article:
Assadollah Ahmadzadeh, Effat Abasi Montazeri, Sara Mogharabi, Maryam Jarahzadeh. (2017). An *In vitro* Comparative Evaluation of Three Disinfectants on Heat Cure Acrylic Resin Specimens Contaminated with Standard and Clinical Strains of *S.mutans* Microorganism. Int. J. Curr. Res. Chem. Pharm. Sci. 4(12): 1-7.
DOI: http://dx.doi.org/10.22192/ijcrcps.2017.04.12.001