Research Article

Effectiveness of 4 Different Disinfectants in Removing 2 Microorganisms from Acrylic Resins

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ABSTRACT

The aim is to analyse the effectiveness of 4 different disinfectants in disinfecting the acrylic resins. The objective is to examine which one of the 4 is more effective in disinfecting the acrylic resins. There are several routes of microbial contamination in dental laboratories, including the felt disks and pumice used in the polishing process and contact with contaminated hands. Other forms of contamination occur when prostheses are sent to dental offices for adjustments or repairs, because in certain steps of treatment, these materials may be contaminated by microorganisms from the patient's oral cavity. Microbial adherence capacity is influenced by differences in the surfaces of prostheses. Roughness in prostheses surfaces may cause micro traumas in oral tissues and are a site for colonization by microorganisms, contributing indirectly to tissue injury. The reason is to provide the use of suitable disinfectants in removing microbial species contaminated in acrylic resins.

Keywords: acrylic, disinfectants, effectiveness, microbial, prostheses.

INTRODUCTION

Prosthodontics has been cited as one of the dental specialties that most fail to look after the control measure for cross infection during laboratory and clinical procedures[1]. Acrylic resins are commonly used for denture fabrication since they exhibit adequate physical, mechanical, and esthetic properties[2].

Fabrication of dental prostheses using heat cured denture acrylic resins is one of the most commonest procedure in all the dental offices. There are several routes of microbial contamination in dental labs like polishing of the denture using pumice, felt disks, contamination with hands during contact and cross contamination. During the treatment, the dentures are taken to the laboratory for cleaning and shaping, this carries the microbes present in the patient's mouth.

Considering the cross contamination between the dental operatory and the dental laboratory, dental prostheses should be disinfected before delivering to the patient and sending it to the dental laboratory[2]. Oral cavity is colonized by various pathogens and this microbial reservoir can cause several infections including denture stomatitis, aspiration pneumonia, and gastrointestinal infections[6].

Microbial growth on the denture surface results from the adherence of microbial cells enhanced by surface roughness, and from adhesive interactions between Candida species and oral bacteria. Several studies have demonstrated an association between *C. albicans* or other species of Candida, and several oral bacteria such as *Streptococcus sanguis, Streptococcus salivarius, Streptococcus mutans, Fusobacterium nucleatum* and *Actinomyces viscosus*[5]. Denture stomatitis is possible source of other systemic infections in especially immune suppressed patients[3]. Candida albicans is the major causative organism for denture stomatitis, which is most common among denture wearers[6]. It has the ability to form structured biofilm when adhered to the denture base resins. The growth and metabolism of *S. mutans* changes the environmental conditions of the oral flora, which enables fastidious organisms to colonize and causes the formation of dental plaque.

To avoid the formation of biofilms on denture base resins, several disinfectants have been suggested for the disinfection. One of the safest and easiest method is to disinfect the prosthesis is by immersing in chemical disinfectants[2]. The best disinfectant should fulfill most of the requirements of the ideal agent while not causing any alterations in the structure of the prostheses[1]. Various chemical agents are used in actual prostheses disinfection such as immersing the dentures in 2% glutaraldehyde, 1% sodium hypochlorite, 100% vinegar, 2% chlorhexidine digluconate, 3.78% sodium perborate as alternative methods for disinfecting the dental prostheses.

Sodium hypochlorite is inexpensive and presents a broad spectrum of activity. Chau suggested that 1% sodium hypochlorite is effective in reducing the number of microorganisms in the inner surface of the material after 10 minutes[1]. Regardless of its efficiency as a disinfectant, it also has got few disadvantages like irritant effect on the skin, corrosive activity on metal surfaces and destruction of cotton. Glutaraldehyde based disinfectants was first suggested in 1962 after Pepper and Leibermann's studies. Advantage of this solution is that they are not inactivated when in contact with organic materials, no corrosive properties and do not degrade rubber materials and since it is toxic it should be manipulated with care.

Chlorhexidine is considered to be the best for dental biofilm control and also used against various dental diseases like stomatitis, gingivitis etc. Acetic acid is one component of vinegar. It is effective in controlling the oral and throat inflammatory processes and antisepsis of sores.

McCabe concluded that these products are complementary to prostheses hygiene and should be appointed in association with mechanical cleaning for complete biofilm elimination.

MATERIALS AND METHODS

In this in study, 40 heat cured acrylic resin (poly methymethacrylate) were used. Acrylic resins were polished. *For C.albicans*, sabaroud's dextrose agar (Hi media M063) and for *S.mutans,* mutans sanguis agar(Hi media M977) were used. The following disinfectants were used in this study: 2% glutaraldehyde, 100% vinegar, 2% chlorhexidinedigluconate and 1% sodium hypochlorite. The dentures were distributed into two groups for the assays between two microorganisms. The control group was not subjected for the disinfection process. Each strain was cultured in a respective culture medium: The disinfectants were grouped into the following:

Group 1 – 2% Glutaraldehyde

Group 2 – 1% Sodium hypochlorite

Group 3 – 2% Chlorhexidine digluconate

Group 4 – 100% Vinegar

The acrylic resins were autoclaved at 121°C at 15 lbs for 30 mins. This sterile acrylic resin dentures were contaminated one by one by transferring it to a beaker containing C. albicans and kept for 5 mins. After the 5 mins of holding period the resins were taken out. These contaminated acrylic resins were then transferred to 4 different beakers containing the disinfectants (Glutaraldehyde – 2 mins, Chlorhexidine digluconate – 10 mins, sodium hypochlorite – 10 mins, Vinegar – 1 min). Then to check for the anti microbial activity of the disinfectant, samples were collected from a measured area of 5 cm in diameter using a sterile swab. The swabs were inoculated on to the specific agar. This was followed by incubation for 24 hours at 37^{o}C aerobically. The same method was followed for S.mutans. The number of colonies were counted and tabulated.

RESULTS

Table 1: Mean Value of CFU of *Candida albicans*

Disinfectants	Before	After	%
Glutaraldehyde	216.2	18.4	8.51%
Sodium Hypochlorite	202	12.4	6.13%
Chlorhexidinedigluconate	214.5	14.6	6.80%
Vinegar	216	30.8	14.25%

Table 2: Mean Value of CFU of *Streptococcus mutans*

Disinfectants	Before	After	%
Glutaraldehyde	166.4	7	4.20%
Sodium hypochlorite	151.6	13.6	8.97%
Chlorhexidine diguconate	168.8	12.2	7.22%
Vinegar	170.9	20.2	11.8%

DISCUSSION

The probability of cross infection between the dental personnel and the dental office is high. Hence, adequate disinfection of prostheses is highly recommended to control cross infection. Heat sterilization is not applicable for acrylic dentures due to low ebullition temperature of the monomer present in the resin.

Therefore, chemical agents are the safest, inexpensive and a convenient method to disinfect the prostheses. It has been found that mechanical cleaning methods are inadequate in reducing the number of microorganisms present on dentures and palate. The mechanical and physical properties of the denture resins should also be considered during the disinfection process because heat cured acrylic resins exhibit dimensional change during the disinfection process.

Glutaraldehyde based solutions are commonly used for the disinfection process because it has the antimicrobial effectiveness and sporicidal activity. However due to its toxicity, this characteristic is considered a limitation for its use. Hence this study designed alternative methods of disinfectants that might be used for this purpose and to evaluate the antimicrobial effect.

In group 1 the dentures disinfected using 2% glutaraldehyde, the mean value of the colony forming unit (CFU) before and after disinfection showed a reduction to 8.51% when treated against C.albicans and 4.20% against S.mutans.

In group 2 using 1% sodium hypochlorite, the mean value of the CFU before and after disinfection showed a reduction to 6.13% when treated against C.albicans and 8.97% against S.mutans.

In group 3 using 2% chlorhexidine digluconate, the mean value showing the CFU before and after disinfection showed a reduction to 6.80% when treated against C.albicans and 7.22% against S.mutans.

In group 4 using 100% vinegar, the mean value showing the CFU before and after disinfection showed a reduction to 14.25% treated against C.albicans and 11.8% against S.mutans.

Among the 4 disinfectants tested against C.albicans, it is found that 1% sodium hypochlorite is more effective compared to others. Glutaraldehyde and chlorhexidine digluconate are less effective when compared with sodium hypochlorite. Vinegar had shown reduction in the total CFU when compared with the control group.

In S.mutans group, among the 4 disinfectants tested, Glutaraldehyde is found to be effective when compared with other chemicals.

Though Chlorhexidine digluconate is recommended for disinfection on a regular basis when compared to glutaraldehyde which is less effective.

CONCLUSION

In this study, chlorhexidine digluconate and vinegar were included to find out the disinfecting efficacy while comparing with glutaraldehyde and sodium hypochlorite. Chlorhexidine digluconate is found to show good disinfecting ability when compared to vinegar. Percentage reduction in CFU seen with vinegar is less than 15% against C.albicans as well as S.mutans.

Acetic acid is the main component in vinegar, it is already proved to have bacteriostatic and bacteriocidal properties. Vinegar has shown a reduction of more than 85% in CFU both in *C.albicans* and S.mutans. So, vinegar can be definitely used as a household disinfectant.

When it is used regularly, it will definitely keep the bacterial load under check.

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