

## Effect of Chemical Disinfectants in Complete Dentures- A Comparative Study

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### ABSTRACT

#### Aim

Purpose of our research was to compare and evaluate various chemical disinfectants used to cleanse complete dentures.

#### Methodology

Forty-five edentulous patients wearing dentures were divided into three categories: Group I disinfected their dentures by immersing in 0.2% chlorhexidine gluconate solution for 30 mins twice a week and Group II used 1 percent sodiumhypochlorite solution for 30 mins twice a week. for immersion, Group III had a positive control group consisting of dentures that were not disinfected. The inter-molar distance was measured with Digital Vernier calipers.

#### Results

Group I showed highest decline in number of bacterial colonies after 60 days followed by Group II. Least decline was seen in III. Highest dimensional changes was seen in Group I followed by Group II dentures.

#### Conclusion

Soaking in sodium hypochlorite solution was effective only as a short-term disinfectant as compared to Soaking in chlorhexidine gluconate solution.

**Keywords** Denture Disinfectants, Denture Cleansers, Complete Denture Hygiene.

## INTRODUCTION

The awareness for the need of infection control in cross-contamination during dentistry procedures for patients, dentists and laboratory technicians has increased due to the prevalence of some infectious diseases such as AIDS and Hepatitis B.<sup>1</sup> When dental prostheses are repaired or adjusted in dental practice, they are contaminated with bacteria, viruses, and fungi,<sup>2</sup> due to inadequate disinfection of prostheses, the contamination of dental appliances and inadequate laboratory procedures before placing the prostheses in the mouth.<sup>1,3,4</sup> Potential sources of transmission of infectious diseases from patients to dental technicians include prostheses in contact with oral tissues, saliva and blood. When prostheses are removed from patients' mouths at various stages of trial and insertion, they may be contaminated by pathogenic organisms which can be transmitted through direct contact with the aerosol raised during trimming, finishing and polishing procedures.<sup>5</sup> The need to disinfect prostheses has resulted in the widespread search for disinfectant agents that are innocuous to the prosthesis surface. Various chemical agents are used in actual prosthesis disinfection, i.e. chlorine, iodophors, and aldehyde compounds.<sup>6</sup> Studies<sup>7,8</sup> included immersion in 2% alkaline glutaraldehyde, 0.5% and 1% sodium hypochlorite, 3% aqueous formaldehyde, hydrogen peroxide as alternative methods of dental prosthesis disinfection. In addition, 1% sodium hypochlorite, 4% chlorhexidine gluconate and 3.78% sodium perborate proved to be effective in reducing the number of microorganisms on dental prostheses.<sup>3,9</sup> Chlorine dioxide (Alcide LD) is effective in eliminating microorganisms from the internal and external surface of acrylic resin.<sup>10</sup> The importance of an infection control protocol in the dental laboratory is clear. Both the outer and inner surfaces of a dental prosthesis must be disinfected because they are both potential sources of contaminating microorganisms. Chau et al recommend 0.25% sodium hypochlorite solution for this kind of disinfection.<sup>11</sup> Several studies<sup>12-19</sup> demonstrated that various disinfectants affect the physical properties of denture base resins such as hardness<sup>13,19</sup> transverse strength<sup>14,16</sup>, roughness<sup>12,15</sup> and deterioration on the surface of the denture resin.<sup>14</sup> The color stability of denture base resins can be significantly affected by disinfectant solutions such as glutaraldehyde, chlorhexidine, phenolic-based, alcohol-based and hypochlorite disinfectants.<sup>13</sup> Roughness affects the patient's comfort and prosthesis longevity. A smoother surface leads to better esthetic results and less biofilm retention.<sup>20</sup> Several authors emphasized that irregular surfaces increase retention of the microorganisms and may affect oral health.<sup>15,21-23</sup> Garcia et al.<sup>13</sup> also observed surface changes in the samples that were submitted to disinfection and Machado et al.<sup>15</sup> showed that roughness of hard reline material was affected by immersion in sodium perborate. Disinfectant agents may alter the surface of acrylic resins.<sup>13,15</sup> Current studies reveal that the samples immersed in sodium hypochlorite 1% showed a statistically significant increase in roughness compared to the control group. However, they did not differ from the other groups. An ideal denture cleanser should be simple to use, effectively remove organic and inorganic matter from denture surface, have bactericidal and fungicidal properties and should cause least amount of damage to the denture base.<sup>24</sup> Chemical agents for denture cleansing have the advantage of being simple to use and several studies have shown their efficacy in reducing biofilm formation *in vitro*<sup>25-27</sup> and *in vivo*.<sup>28</sup> Many patients in long-term care hospitals cannot adequately brush their dentures because of disease, dementia and poor manual dexterity. Such inadequate cleaning may allow for the growth of *Candidal* and bacterial spp., which could serve as reservoirs for disseminating infections. According to several studies, the use of denture cleansers significantly reduced the number of microorganisms on dentures in patients, especially in a hospitalized geriatric population.<sup>29</sup> Various studies, show positives and possible negatives with the use of denture cleansers. Investigations and studies have pointed out that, the correct use of chemical cleansers is not associated to alterations in mechanical properties of denture

base materials.<sup>30,31</sup> Allergy or harmful effects by the proper use of cleansers following manufacturer's direction have also not been reported.

## AIM OF THE STUDY

Purpose of our research was to compare and evaluate various chemical disinfectants used to cleanse as well as maintain the color stability of complete dentures.

## METHODOLOGY

45 edentulous patients who had worn their dentures for 2–8 years were randomly selected. Medical history and oral examination were conducted to exclude the presence of local disorders. Patients under antimicrobial therapy and smokers were excluded from the study. The procedure was clearly explained to all participants who signed a consent form for the same. Selected patients were randomly divided into three categories as follows.

**Group I** -Patients were asked to disinfect their dentures by immersing in 0.2% chlorhexidine gluconate solution for 30 mins twice a week.

**Group II**- Patients were asked to disinfect their dentures by immersing in 1 percent sodiumhypochlorite solution for 30 mins twice a week.

**Group III**- A positive control group consisting of dentures that were not disinfected. After each disinfection process, the dentures were rinsed and stored in tap water. On the first visit, bacterial swabs were collected from dry sterile cotton swab for all groups in mid palatal and alveolar ridge region for 30secs. These bacterial swabs were used to inoculate aerobic bacterial culture in blood agar media for 3 days at 37degrees. The species studied included Streptococcus species, Staphylococcus species & Escherichia coli species. The patients were then asked to follow the specified disinfection regime for 60 days & Bacterial swabs were recollected using the above-mentioned procedure. Bacterial colonies were counted with the aid of light microscope after 72 hrs of culturing and multiplied to express them in Colony Forming Units (CFU)/ml. For dimensional changes, the inter-molar distance and depth of cast (from the line joining the mesio-palatal cusps of the Ist molars straight down to the palate) was measured using a Digital Vernier calipers, with an accuracy of .001mm on first visit as well as after 60 days of disinfection. The distances were measured three times and mean was calculated. Statistical analysis for the present study was done by applying following formulas: Mean Value, Standard Deviation (S.D), Student 't' test and 'p' value – with 5% level of significance.

## RESULTS

A total of 45 dentures were studied. The mean aerobic bacterial colony count was recorded for Group I, Group II & Group III on both visits. (Table 1) The readings of the first visit were considered as baseline & decline in the number of bacterial colonies indicated the effectiveness of the disinfection method. It was also observed that after 2<sup>nd</sup> visit i.e. 60 days after the initial visit, significant decline of colonies was noted in Group I, and least decline seen in positive control group III. In case of dimensional changes, insignificant changes were observed. However, out of the three groups, chlorhexidine group had the highest dimensional change in terms of intermolar distance as well as depth of denture. (Table 2) Significant colony forming units were detected in group III as compared to group I, which shows that

chemical disinfectant are indeed an effective solution to keep denture hygienic and reduce bacterial infections.

## DISCUSSION

Denture wearing and deficient denture hygiene are the predisposing factors for increasing the number of microorganisms in the oral cavity. So, the bacterial colonization increases and becomes more pathogenic, acting as a potential source of infection. *Candida albicans* adhesion to resin materials is promoted by oral environment temperature and the acquired pellicle formed over dentures. Nikawa et al. suggested from their findings appropriate control for denture plaque was essential to the long-term usage of the maxillofacial materials. In addition, the oral mucosa in close contact with the denture (the denture's fitting surface) cannot be mechanically polished and thus presents irregularities and microscopic pores that facilitate bacterial and fungal colonization. Keng and Lim found that plaque levels were significantly higher on the fitting surfaces of the maxillary and mandibular dentures than on the sites of polished surfaces. They reported that this could be due to stagnation, pooling of saliva, and the absence of contact with the tongue on the fitting surfaces. It is admitted that chemical disinfectants are more effective and used easily than mechanical cleaning. Chemical methods have the advantages of being simple to use. Similarly, Palenik and Miller and Salles et al. have found that mechanical cleaning of dentures were insufficient for reducing the number of microorganisms on dentures and palate.<sup>32</sup>In earlier works, denture base resins have been shown to undergo color changes from the use of denture cleansers, and the color stability of autopolymerizing resins was inferior to that of heat-polymerized materials, Khan et al, found that Triad VLC denture material showed greater staining than acrylic resin material because of the differences in water sorption of the two materials. it is imperative that laboratory bacterial cross contamination among denture patients be avoided, disinfection of dentures before and after laboratory procedures is necessary.<sup>33</sup>Chlorhexidine is not sporicidal and hence considered an intermediate-level disinfectant. Effectiveness of 0.2% on 0.12% CHX in reducing the clinical parameters were proved to be identical. Hence, 0.2% concentration is used in this study which is most commonly used concentration in mouthwashes. We found it to be least effective out of the studied methods though clinically insignificant dimensional changes were observed. Though various studies found it to be most effective with rapid activity & found it to be a valid alternative for the disinfection of acrylic resin. Chemical disinfection seems to be a safer method of disinfecting dentures in comparison with microwave irradiation, as disinfection by microwave irradiation causes alteration with regards to physical properties such as changes in dimensional stability. The limitation of this study was that this study evaluated the effect on only one denture base material.

## CONCLUSION

Soaking in sodium hypochlorite solution was effective only as a short-term disinfectant as compared to Soaking in chlorhexidine gluconate solution. Future studies are needed to evaluate the effect of various types of disinfection methods on different denture base and relined material with different concentration and disinfection protocols

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### TABLES

**Table 1- Mean colony counts of bacteria measured**

Groups	CFU/ml – 1 <sup>st</sup> visit	Mean±SD	CFU/ml (after 60 days regimen) II <sup>nd</sup> Visit	Mean±SD
Group I	102	2.33±1.45	30	1.20±0.78
Group II	117	2.74±2.01	78	1.55±0.89
Group III	123	2.98±2.14	120	2.03±1.23

**Table 2- Inter- molar distance and depth of denture measured with Vernier calliper**

Groups	Inter-molar distance		Depth of denture	
	Mean±SD (1 <sup>st</sup> visit)	Mean±SD (2 <sup>nd</sup> visit)	Mean±SD (1 <sup>st</sup> visit)	Mean±SD (2 <sup>nd</sup> visit)
Group I	1.43±0.88	1.56±0.93	2.54±1.3	2.9±1.65

Group II	1.45±0.56	1.48±0.68	2.31±1.411	2.67±1.51
Group III	1.41±0.134	1.42±0.23	2.30±1.36	2.31±1.38

**Table 3- Intergroup comparisons in the study**

Groups	CFU/ml		Inter-molar distance		Depth of denture	
	t- test	p value	t- test	p value	t- test	p value
Group I	1.229	0.031	1.71	0.083	1.56	0.077
Group II	1.45	0.076	1.78	0.09	1.63	0.19
Group III	1.89	1.33	1.99	1.12	1.977	1.14