Bacterial Contamination of Acrylic Resin Complete Denture/ in Vitro Study

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ABSTRACT

Background: Cross contamination of dental appliances in the dental clinics and laboratories may potentially be a health hazard to the dental team and the patient. This study aimed to evaluate bacterial contamination of acrylic complete denture as received from dental laboratory before delivery to the patient, and then to evaluate the effectiveness of disinfection with 2% chlorhexidine and Kin denture cleaner tablet.

Materials and methods: 45 newly made upper complete dentures undergone biaacterial examination for contamination before delivered to the patient. Samples were examined in two stages, first after finishing and polishing; when collected from the laboratory and before inserting to the patient mouth, second; after the samples were immersed in 2 different disinfectant materials, 2% chlorhexidine mouth wash and Kin denture cleaner tablet. After initial stage, the dentures were divided into 3 groups. Group 1 immersed in Kin denture cleaner tablet for 10 minutes, group 2 immersed in 2% chlorhexidine mouth wash for 10 minutes and group 3 immersed for 20 minutes in 2% chlorhexidine. Data were analyzed with a computer-run statistical program (IBM SPSS Version 23).

Results: High score of bacterial contamination was found initially in the sample collected from dental laboratory. Significant reduction in the colonies number was noticed after immersing the dentures in 2% Chlorhexidine and Kin denture cleaner tablets for10 minutes. There was nearly no contamination found with samples immersed in 2% chlorhexidine for 20 minutes.

Conclusion: Dental laboratory is a main source of microbial contamination. Immersion of the dental prosthesis in disinfectant materials is essential before inserting into the patient mouth. 2%chlorhexidine mouth wash was more effective as disinfection material as compared to Kin denture cleaner tablet.

Keywords: denture cleaner tablets, 2% chlorhexidine, prosthesis microbial contamination. **(J Bagh Coll Dentistry 2018; 30(2):1-4)**

INTRODUCTION

Acrylic resins are commonly used for complete denture fabrication since they exhibit adequate physical, mechanical, and esthetic properties. 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 mouth [1]. Considering the cross contamination between the dental operator and the dental laboratory, dental prostheses should be disinfected before delivering to the patient and before sending it back to the dental laboratory [2].

Recent studies showed that appliances received from laboratories are often contaminated and therefore there is a need for routine disinfection of such items before use and a review of storage conditions required [3].

An effective method to clean dental prosthesis surface and control microbial growth is the periodic mechanical disruption of the biofilm formed on the denture surfaces. However, because acrylic resins are thermo-sensitive materials, the use of chemical disinfectants is necessary [4].

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Chemical cleaning consists of immersion of the prosthesis in solutions containing chemical agents. The chemical agent must be safe to be used in disinfection since it might be released in the oral cavity when prosthesis is back into the patient mouth, they should be biocompatible, inexpensive, effective against pathogenic microorganisms, non-toxic and harmless to the structure of the prosthesis and have no cytotoxic effect when used for denture chemical disinfection. [4] [5].

The safety of the use of solutions as chlorhexidine, sodium hypochlorite, vinegar and hydrogen peroxide is reported in the literature [6]. In the last few years, chlorhexidine has been one of the most studied antimicrobial substances and has shown great efficacy in disinfection of removable prosthesis [5] [7].

The use of a cleansing tablet on the other hand as disinfectant materials for removable dental prosthesis showed good efficacy in reducing bacterial contamination. In 2010, Silva-Lovato assessed the efficacy of cleaning tabs on plaque removal and antimicrobial action on complete dentures. It was observed that cleaning tabs showed a significant lower percentage of biofilm and a reduction of yeast colonies on the prosthesis compared to the control group. Based on their results, the authors concluded that the use of cleaning tabs can be recommended as a standard cleaning protocol [8].

A recent study showed a decrease of total bacterial load and of specific bacteria when the dentures were stored in water with an effervescent denture cleaner tablet and reduced the total bacterial count on acrylic removable dentures [9], they significantly reduced the total bacteria count, and this effect was more pronounced in case of ultrasonic cleaning.

The purpose of this study is to evaluate bacterial contamination of acrylic complete denture received from dental laboratory before being delivered to the patient, and to compare the effectiveness of disinfection with 2% chlorhexidine mouth wash and Kin denture cleaner tablet.

MATERIALS AND METHODS:

The study is an in vitro experimental method, the sample consists of 45 acrylic upper complete dentures, the newly made 45 dentures were taken from the dental lab after finishing and polishing stored in plastic bag filled with tap water. The first part of the study the whole sample underwent bacterial examination by taking randomized swab from the denture surface and seeded on a nutrient agar plate. Nutrient agar was used as it is a general culture media for Gram negative and Gram positive bacteria, the seeding was done by spreading of 0.01 ml of the bacterial growth on the nutrient agar surface, and then incubate in an incubator* in 37CO for 24 hours, then bacterial colonies number were counted and recorded. The level of contamination was demonstrated by the number of colony forming units (CFUs) from the positive samples.

After taking the swab from each sample in the initial stage of examination, the samples were returned back to their sealed bags. In the second stage of bacterial contamination, the 45 samples were divided into three groups, each of 15 dentures, then the second part of the study accomplished. Group 1 was immersed in solution prepared from Kin denture cleaner** tablet after been dissolved in distill water according to manufacturer's instructions for 10 minutes , group 2 was immersed in 2% chlorhexidine for 10 minutes, and Group3 was immersed in 2% chlorhexidine for 20 minutes.

In the second stage of samples examination, each sample were taken out of their sealed bags, washed with distill water, and then immersed in the allocated disinfectant material. A swab was taken from each sample and was seeded on nutrient agar, the same procedure of the initial stage of incubation and bacterial colonies counting were followed.

The baseline conditions of the prosthesis for all test period were as standardized as possible and all measures were taken to achieve an optimal disinfection of the prostheses at the star
t of each test period.

Data were analyzed with a computer-run statistical program (IBM SPSS Version 23). The recorded data were first included in the normality test which indicates the data as parametric data, accordingly independent sample t-test at the significance level of 0.05 was applied to the groups to determine statistical difference between two means.

* JRAD type incubator.

** Kin denture cleaner tablet ingredient: Potassium Peroxy monosulfate (Caroate), Sodium Carbonate, Citric acid, Sodium Lauryl Sulfate, other ingredients.

RESULTS

Obvious differences were recorded in the mean and the standard deviation of all the samples at the initial stage, and after immersion in disinfected materials for different time intervals Table -1 and 3. The efficacy of 2% chlorhexidine mouthwash and Kin denture cleaner tablet in the reduction of the number of Colony Forming Units (CFU) is described in Figure -1.

The result revealed significant differences in the total bacterial colony count after immersion in 2% chlorhexidine and the denture cleaner tablets, as compared to their count at the initial stage ($P < 0.05$), according to one sample student T-test., Table -2 and 4 respectively. Significant reduction in the total bacterial colony count was noticed after 10 minutes immersion in 2% chlorhexidine mouthwash as compared to samples immersed in the denture cleaner tablet ($P < 0.05$) as depicted in Table 4.

There was very significant reduction of the bacterial colonies number to fewer than 20 when the samples were immersed in 2% chlorhexidine for 20 minutes, which could be regarded according to microbiological interpretation almost zero contamination Table 3 and 4.

The efficacy of the disinfectant material in the reduction of the number of Colony Forming Units (CFU) within the three groups is shown in figure 1.

Table 1. Descriptive Statistics of all the samples at the initial stage of microbial examination.

	N	Mean	Std. Dev.	Variance
The samples at initial stage	45	989.444	±353.808	125180.343
Valid N (list wise)	45			

Table 2. One-Sample Test for the initial stage.

t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
				Lower	Upper
18.760	44	0.000	989.444	883.148	1095.740

Table 3. Descriptive Statistics for the 3 groups

	N	Mean	Std. Dev.	Variance
D.C. after_10_min	15	61.533	62.602	3918.981
Ch. after_10_min	15	134.067	36.794	1353.781
Ch. after_20_min	15	16.667	1.799	3.238
Valid N (listwise)	15			

Table 4. One-Sample Test

	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
D.C. after_10_min	3.807	14	0.002	61.533	26.866	96.201
Ch. after_10_min	14.112	14	0.000	134.067	113.691	154.442
Ch. after_20_min	35.872	14	0.000	16.667	15.670	17.663

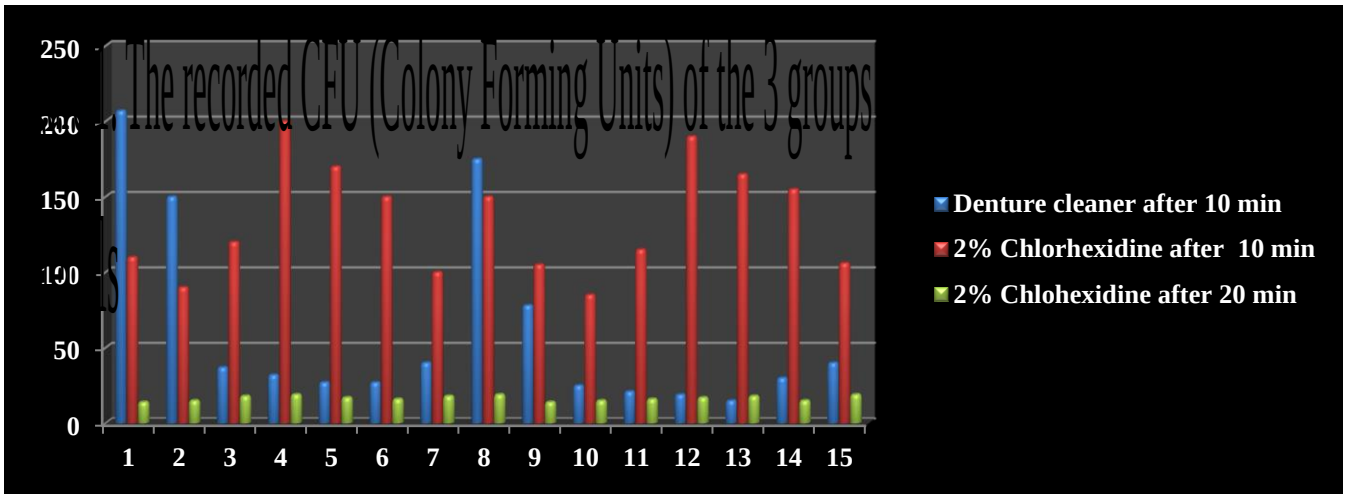

Figure 1. The recorded CFU (Colony Forming Units) of the 3 groups after using of the disinfectant materials.

DISCUSSION

The result of the present study showed that all the samples which was received from the laboratory were highly contaminated with different levels of contaminations, Table-1, this result came in agreement with the result of recent study on acrylic resin removable orthodontics device constructed in dental laboratories, in which 85% of the received orthodontics devices were contaminated before been inserted into the patient mouth [(10)].

The chemical agents used in the present study to reduce microorganism colonization, 2% chlorhexidine mouth wash, and denture cleaner tablet were very efficient in reducing the total microbial colonies count of the dentures when immersed for 10 minutes. This result is in agreement with the results obtained in previous study on overnight storage condition in alkaline peroxide on biofilm formation and maturation

The study revealed that the use of cleansing tablets significantly reduced denture biofilm mass and pathogenicity compared to dry storage and storage in tap water in case of poor oral hygiene [(11)]. The effect of denture cleaner tablet in the previous study was similar to the result of the present study in regard to the use of the denture cleaner tablet which showed a significant difference ($P < 0.05$) when was used as a disinfection material for acrylic resin complete denture.

The result of the present study revealed that 2% chlorhexidine mouth wash is more efficient in reducing the total account of microbial colonies as compared to the denture cleaner tablet ($P < 0.05$) when immersed for 10 minutes.

The efficient effect of 2% chlorhexidine as denture disinfectant was showed by another study which concluded that: Chlorhexidine is considered to be the best for dental biofilm control and also used against various dental diseases like stomatitis, gingivitis etc.

Further immersion of the dentures samples for 20 minutes in 2% chlorhexidine mouthwash in the present study support this finding, as the microbial colonies account was reduced to less than 20 colonies Figure-1, this result could be interpreted as a sample with no contamination from microbiological point.

CONCLUSION

Dental laboratory is a main source of microbial contamination. This hypothesis was proved in the study, as all the samples that were collected from the dental laboratory, and before been inserted into the

patient mouth was contaminated. Using of disinfectant protocols is essential and mandatory in the dental clinic, as well as in the dental laboratory and before being inserted into the patient's mouth at any stage during the construction of the a dental prosthesis, especially removable prosthesis, to control cross infection between dental staff, and the patient. Immersion of the dental prosthesis for 10 minutes in 2% chlorhexidine mouth wash and denture cleaner tablet lead to significant reduction in the microbial contamination. 2%chlorhexidine mouth wash was more effective as disinfection material as compared to denture cleaner tablet.

ACKNOWLEDMENT

The author thanks Dr Dlnya Asad Mohamad, assistant Professor of Molecular Biology (Pharma Gene Laboratory, Sulaimani city), for her appreciated assistant in doing the bacterial examination experiment of the research, and her help during the study.

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الخلاصة :

قد يحتمل أن يشكل تلوث أجهزة طب الأسنان في عيادات ومعامل الأسنان خطرًا صحيًا على فريق الأسنان والمريض. هدفت هذه الدراسة إلى تقييم التلوث الجرثومي لأطقم الأسنان الأكريليكية الكاملة كما وردت من مختبر الأسنان قبل تسليمها إلى المريض ، ومن ثم تقييم فعالية التطهير باستخدام 2٪ من الكلورهيكسيدين وحب تنظيف وتعقيم طقم الأسنان ماركة كين.

المواد والأساليب: خضع 45 من أطقم الأسنان الكاملة الحديثة الصنع لفحص البكتيريا للتلوث قبل تسليمها إلى المريض. تم فحص العينات على مرحلتين ، أولا بعد الانتهاء والتلميع. عند جمعها من المختبر وقبل إدخالها في فم المريض ، بعد أن تم غمر العينات في 2 مواد مطهرة مختلفة ، 2 ٪ كلورهيكسيدين غسول الفم وحب كين لتنظيف أطقم الأسنان. بعد المرحلة الأولية . تم تقسيم أطقم الأسنان إلى 3 مجموعات. المجموعة 1 مغمورة في قرص كين دنتير منظف لمدة 10 دقائق ، المجموعة 2 مغمورة في 2 ٪ كلورهيكسيدين غسول الفم لمدة 10 دقائق والمجموعة 3 مغمورة لمدة 20 دقيقة في 2 ٪ الكلورهيكسيدين. تم تحليل البيانات باستخدام برنامج إحصائي يتم تشغيله بواسطة الكمبيوتر (IBM SPSS Version 23).

النتائج: تم العثور على درجة عالية من التلوث البكتيري في البداية في العينة التي تم جمعها من مختبر الأسنان. وقد لوحظ انخفاض كبير في عدد المستعمرات بعد غمر في طقم الأسنان في 2 ٪ أقراص الكلورهيكسيدين وأقراص نظافة لمدة 10 دقيقة. لم يكن هناك تقريبا أي تلوث وجدت مع عينات مغمورة في الكلورهكسيدين 2 ٪ لمدة 20 دقيقة.

الاستنتاج :مختبر الأسنان هو المصدر الرئيسي للتلوث الميكروبي. غمر الأسنان الاصطناعية وأطقم الأسنان في المواد المطهرة ضروري قبل إدخالها في فم المريض. كان 2 ٪ كلورهيكسيدين غسول الفم أكثر فعالية كمادة تطهير بالمقارنة مع قرص نظافة كين.

كلمات البحث: أقراص أنظف طقم الأسنان ، 2 ٪ كلورهكسيدين ، تلوث الجرثومي