

# DISINFECTION OF ACRYLIC RESIN CURED BY CONVENTIONAL WATER BATH TECHNIQUE <sup>+</sup>

تطهير مادة الاكريلك المبلمرة بواسطة الحمام المائي الاعتيادي

Anaam sh.AL-hadad \*

## Abstract:

Performing a through disinfection of any dental prostheses before it is transferred to a dental laboratory is the key to prevention of accidental infection of the dentist and dental laboratory personal. This means that a dental prostheses must not only be disinfected on the surfaces but also on the interior material. 12 samples of acrylic plates of 48 mm × 25 mm × 3 mm in dimension were prepared by water bath curing method. The samples were immersed in broth culture of four identified bacteria for 24 hours.

Later on, all the specimens were grouped and immersed in three or different disinfectant solution which were Iodophor, chlorhexidine, and sodium hypochlorite. They were prepared and used in accordance with manufacturer's recommendations. The control group was normal saline solution. Cultures were made from smooth, rough and interior surface of acrylic samples. Any bacterial growth when existed, was identified by microbiological test. In this study the results demonstrated that bacteria can penetrate acrylic resin plates cured by this technique. However, the only effective disinfectant was 0.525% solution of sodium hypochlorite 10 minute immersion. It disinfected the exterior as well as the interior surfaces of acrylic resin plates of 3 mm thickness.

## المستخلص:

ان تعقيم او تطهير أي من التعويضات السنية قبل تحويلها الى المختبر تعتبر هي المفتاح للحماية من التلوث واصابة الطبيب والعاملين في المختبر، وهذا يعني ان التعويضات السنية يجب ان تعقم في العمق وليس تطهيراً للسطوح الخارجية فقط. لقد تم تحضير ١٢ نموذجاً من مادة الاكريلك على شكل صفائح ذات لتلك النماذج قد تمت باستخدام الحمام المائي (curing) ملم. كانت عملية البلمرة 3×25×3 ابعاد ٨ ساعة الاعتيادي، ثم ان النماذج قد غطست في وسط مايكروبي لأربعة أنواع معروفة من البكتيريا لمدة ٢٤ ساعة، بعدها تم تقسيم النتائج الى مجاميع لتوضع في ثلاثة أنواع من المطهرات هي: ايوذوفور، كلورهيكسيدين، صوديوم هايبيوكلورايت و وضعت المجموعة الرابعة من النماذج بمحلول السلاين والتي استعملت بمثابة المجموعة الضابطة. كانت عينات زراعة البكتيريا تؤخذ من السطوح الملساء والخشنة والمناطق الداخلية والعميقة للنماذج. وعند ظهور أي نمو لأي نوع من البكتيريا كان يتم تشخيصه بواسطة الاختبارات المايكروبيولوجية.

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\*Assistant professor / College of Dentistry/Kufa university

ان هذه الدراسة أثبتت إمكانية اختراق البكتيريا لمادة الاكريلك المبلعمة بواسطة الحمام المائي الاعتيادي، و أظهرت بان محلول الصوديوم هايپوكلوريت هو الأكثر فعالية لتطهير السطوح الخارجية والعميقة من ٣ملم عند غمرها بها لمدة ١٠ دقائق. الاكريلك ذات سمك

## **Introduction :**

Dental appliances that are returned to the dental laboratory for repair or adjustment have been identified as a source of cross- contamination between patient and dental personal[1] ,since oral bacteria that is present in saliva can and do penetrate into the interior of acrylic resin . A previous study stated that new denture should be disinfected before delivery to the patient , and the denture should be disinfected before and after adjustment procedure [2] . The American dental Association (ADA) [3] and the center for disease control [4] have established guidelines that require all dental personal to wear gloves, mask , and glasses . Several studies involving methods of chemically disinfecting prostheses have recommended many disinfectants solution such as : 2% gluteraldehyde chlorine dioxide , Sodium hypochorite[5], and Iodophor . Most of the present - day acrylic resins are supplied in form of a powder and liquid mixed [6]with a ratio of 2-5:1 by weight[7], and can be used with a simple molding processing technique[8]. A large Variety of disease. are caused by many bacteria such as streptococcus pneumoniae , staphylococcus aureus , Escherichia coli, and Mycobacterium bovis [9,10] These bacteria can penetrate into the interior of acrylic resin processed by the conventional water bath . Therefore various methods of disinfecting prosthesis have been investigated. Chau et al [11] found that 10 minutes immersion in 0.525% solution of sodium hypochlorite disinfects three kinds of acrylic resin , both superficially and interiorly . Barker et al<sup>[12]</sup> noted that immersion of acrylic resin for up to 15 hours did not cause any significant color change . Other studies have demonstrated good bactericidal activity of these agent in disinfection of impression material [13,14,15]

## **Materials and Methods :**

Mould were prepared by investing master pattern plate of measured 48 mm × 25 mm × 3 mm in stone , using the conventional dental flasking technique , After one hour , wax elimination was done, then the surface of the mold coated with a separating medium to be ready for packing with acrylic resin. Standard proportion of polymer and monomer [4]were used and the mixture was packed into the stone mold then transferred to the water bath to be cure with slow curing cycle. All the plates were inspected visually for absence of porosity and then they were polished on one side only to luster comparable to the polished side of an acrylic resin appliance . The other side of the plates was not polished to resemble the tissue side of the appliance . The final dimension of the acrylic plates were (48×25×3)mm . The samples were prepared with 3 mm thickness to approximate the thickness of denture base . All the samples were kept in sterile distilled water in sterile closed container . Four broth cultures of four identified microorganisms were prepared , each broth was contained one of the following microorganism :

- a- Staphylococcus aureus
- b- Mycobacterium bovis
- c- Pseudomonas aeruginosa
- d- Escherichia coli

Four samples of acrylic resin were immersed in the broth culture of the four bacteria incubated for 24 hours at 37% in an incubator . The acrylic plates were removed from the culture medium , rinsed with saline solution and then immersed in each disinfectant solution. Three disinfectant solution were tested, 0.5% Iodophor for 10 minutes , 2% chlorhexidine for 10 min and 0.5% sodium hypochlorite for 10 min . Normal saline was used as a control solution for 10 min . All the disinfectant solution were freshly prepared at the time of immersion . The samples were removed from the disinfectant solutions at the indicated time and rinsed with normal saline . contact cultures were made by inoculating swabs from both sides (polished and unpolished) on agar plates . All culture plates were incubated for 48 hours at 37% and resultant colonies were counted .

### **Results :**

As shown in table (1) all the acrylic plates cured by water bath showed luxuriant growth of bacteria from both sides (smooth and rough) and from the interior surfaces . While disinfections of water bath cured acrylic plates with Iodophor solution revealed that staphylococcus aureus and Escherichia coli were recovered from the smooth surfaces of two out of three acrylic plates, while staphylococcus was recovered from the rough and interior surfaces of all three plates . The immersion of acrylic plates cured by water bath with 2% chlorhexidine showed that only one plate out of three exhibited a growth of bacteria . While only Escherichia coli was recovered from the interior surface of the one out of three plate . Also table (1) shows that all the plates of acrylic were effectively disinfected by immersion in 0.5% sodium hypochlorite for 10 min, and non of the tested bacteria were recovered from any surface. Table (2) showed a non-significant difference between the three tested surfaces of the acrylic plates in respect to disinfection with Iodophor, chlorhexidine and sodium hypochlorite

Table (3) showed comparison between the disinfectant solution and the control , and between the disinfectant solutions . statistical analysis of the data were performed utilizing the chi-square test at a level of significance of 0.05 .

**Table (1): Results of disinfection of water bath cured specimens.**

Group	Sample	1	2	3
Control (Normal Saline)	Smooth	a. b. c. d.	a. b. c. d.	a. b. c. d.
	Rough	a. b. c. d.	a. b. c. d.	a. b. c. d.
	Interior	a. b. c. d.	a. b. c. d.	a. b. c. d.
Iodophor 0.05%	Smooth	a. d.	a. d.	-
	Rough	a. c. d.	a.	a.
	Interior	a.d.	a.	a.
Chlorhexidine 2%	Smooth	-	-	a.d.
	Rough	a.d.	-	-
	Interior	d.	-	-
Sodium hypochlorite 0.5%	Smooth	-	-	-
	Rough	-	-	-
	Interior	-	-	-

a. staphylococcus aureus  
c. pseudomonas aeruginosa

b. mycobacterium bovis  
d. Escherichia coli

**Table (2): Comparison between the tested surfaces of the water bath cured specimens in each disinfectant solution (Chi-square test).**

Disinfectant	Variables	P<0.05
Iodopher	Smooth x Rough	N. S.
	Smooth x Interior	N. S.
	Rough x Interior	N. S.
Chlorhexidine	Smooth x Rough	N.S.
	Smooth x Interior	N. S.
	Rough x Interior	N. S.
Sodium hypochlorite	Smooth x Rough	N.S.
	Smooth x Interior	N. S.
	Rough x Interior	N. S.

N. S.: non-significant

**Table (3): Comparison between the disinfectant solution and the control, and between the solution for the water bath cured specimens (Chi-square test).**

Disinfectant	Variable	P<0.05
Control / biocide	Smooth x Smooth	N.S.
	Rough x Rough	N.S.
	Interior x Interior	N. S.
Control / vocosept konz	Smooth x Smooth	S.
	Rough x Rough	S.
	Interior x Interior	S.
Control / sodium hypochlorite	Smooth x Smooth	H.S.
	Rough x Rough	H.S.
	Interior x Interior	H. S.
Biocide / vocosept konz	Smooth x Smooth	N.S.
	Rough x Rough	S.
	Interior x Interior	H.S.
Biocide / sodium hypochlorite	Smooth x Smooth	H.S.
	Rough x Rough	H.S.
	Interior x Interior	H. S.
Vocosept konz / sodium hypochlorite	Smooth x Smooth	N.S.
	Rough x Rough	N. S.
	Interior x Interior	N.S.

N. S.: non-significant

S.: significant

H. S.: highly significant

### **Discussion :**

All the samples of the control groups demonstrated that bacteria can and do penetrate into the interior surface of acrylic resin this finding suggests that dental appliances that are returned to the dental laboratory for repair or adjustment may be similarly colonized, and this in agreement with Chau et al (1995) , who demonstrated that bacteria penetrate three kinds of acrylic resin within 24 hours immersion in a bacterial broth .

Disinfection with iodophor was not efficient since bacteria were recovered from smooth, rough and interior, surfaces (Table 1).

This indicates that iodophor is not the best choice for adequate disinfection of dental prostheses. The 2% chlorhexidine showed incomplete disinfection which is probably due to short period of immersion (10 min). However the chlorhexidine seems to be more effective than the iodophor solution. Disinfection with sodium hypochlorite revealed that 10 min immersion was effectively disinfected all the plates of acrylic resin both superficially and interiorly since none of the tested bacteria recovered, this confirms the finding of Chau et al (1995), who find that immersion in 0.525% sodium hypochlorite was effective in disinfection of acrylic resin.

### **Conclusion :**

Oral bacteria that present in saliva penetrate into acrylic resin cured by conventional water bath technique. This supports the hypothesis that acrylic resin may be contaminated with bacteria both superficially and within the body of the appliance. The dental appliances that are returned to the dental laboratory for repair or adjustment may be colonized and constitute a potential risk of infection. Therefore it becomes important to ensure that before a dental appliance is repaired, it should be effectively disinfected not only on the external surface but the interior surface as well. 10 min immersion in 0.5% sodium hypochlorite disinfected acrylic resin of 3 mm thickness in the exterior as well as the interior surfaces effectively.

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