

## Chemical and antimicrobial effects of incorporated compounds on denture base materials

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### ABSTRACT

Four chemical materials (eugenol, vanillin, chlorhexidine, and thymol) were incorporated separately into the denture base materials. The chemical changes of such incorporation were studied. The antimicrobial effect was assessed after one day to one year. Results showed that vanillin incorporation gave denture base material persistent antimicrobial effect. The chemical study showed some changes on denture base materials vary according to the different chemical materials used.

*Key Words:* Antimicrobial compounds, denture base.

### الخلاصة

تم خلط أربعة مواد (يوجينول وفانيلين وكلور هيكسيدين وثايمول) كلاً على حدة مع قاعدة الطقم. تمت دراسة التغيرات التي رافقت هذا الخلط ومنها التأثير البكتيري بعد مرور يوم إلى سنة. أظهرت النتائج أن مزج الفانيلين مع قاعدة الطقم أعطى أفضل تأثير. أظهرت الدراسة أن مزج المواد المذكورة مع الطقم أظهر بعض التغيرات على قاعدة الطقم بدون أن يؤثر على استخدامه.

### INTRODUCTION

Complete and partial acrylic dentures are widely used in dentistry. These dentures are liable to accumulate food debris, and growth of microorganisms on the polished and tissue surfaces of dentures. This leads to foul smell as well as stomatitis and ulceration. Therefore, a number of denture cleansers have been used to remove debris and disinfectant dentures. These cleansers took different forms such as tablets, powder or solution. Such cleansers contain chemical substances that react with water and liberate materials that remove debris and lyses proteinous and liquid materials. Some of these chemicals are harmful to tissue and denture if left unwashed<sup>(1)</sup>.

This drawback of these chemicals encourages us to use non-toxic material with constant antimicrobial effect that incorporates into denture base materials during processing.

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All trials of incorporation compounds into denture base materials failed. This failure is due to either evaporation of the added compounds during polymerization of acrylic resin or oxidation of the chemical structures during curing which lead to loss of their antibacterial effect. Some compounds when incorporated into denture base change their structures to new chemicals that are harmful to the tissues or failure in polymerization process.

The present study was to use safe and widely used material in dental field to provide constant and stable antimicrobial effect of denture.

## MATERIALS AND METHODS

### Incorporation of Compounds

Acrylic denture base material is usually made by mixing hot cure<sup>(2)</sup> acrylic resin powder with liquid monomer in a ratio of (3:1). Four materials were used in this study to be incorporated with the acrylic powder before mixing with monomer liquid in a percentage of (2%) by weight, in addition to a control. These materials include (0.2%) chlorhexidine<sup>(3, 4)</sup> (1,6- di-N-p-chlorophenyl diquano- hexane), (2%) vanillin<sup>(5, 6)</sup> powder (4-hydroxy-3-methoxy benzaldehyde), (2%) eugenol<sup>(7)</sup> liquid (4-allyl-2-methoxyphenol), (2%) thymol<sup>(7, 8)</sup> powder (2-isopropyl-5-methoxyphenol). Fine stone molds were prepared in a manner of discs (1) cm in diameter and (2) mm thickness. Mixing of acrylic powder and liquid was carried out in the conventional method after addition of (2%) by weight of each of the above materials to the powder acrylic separately. Then packed in the stone mold, in the rapid method for one hour at (165) F and (30) minutes in boiling water, then left to be cooled at room temperature. Deflasking was done and the acrylic disc was removed, finished, polished and left for variable period of time to be tested for antimicrobial activity.

### Microbiological Study

Swab was taken from different areas of the oral cavity and cultured in brain heart infusion broth (BHI) at (37) °C for (18) hours. This will contain approximately (10<sup>7</sup>) bacteria. One ml of this culture was placed on BHI agar plate. Then disc of (1) cm in diameter and (2) mm thickness of acrylic that has been treated with different compounds separately was placed on the agar and incubated at (37) °C for (24) hours. The zone of inhibition was measured.

## RESULTS

Chemical and physical changes of such incorporation were recorded. Color of acrylic change from pink to deep pink following addition and curing of either vanillin or eugenol. The setting time of acrylic was increased in both cases.

### Antimicrobial Effect

The results of antimicrobial effect of incorporated compounds are present in table (1). Vanillin (2%) gave higher antimicrobial effect compared to eugenol (18 mm and 7 mm respectively). While chlorhexidine (0.2%) and thymol (2%) gave similar result to control disc, which remains with no zone of inhibition.

Table (1): Zone of bacterial inhibition (mm) after different periods

Groups	1 Day	1 Month	6 Months	1 Year
Control	0	0	0	0
Chlorhexidine	0	0	0	0
Thymol	0	0	0	0
Eugenol	7	7	6	6
Vanillin	18	18	17	16

## DISCUSSION

Four compounds were used based on their use in dentistry in low concentration; chlorhexidine and thymol did not show any antimicrobial effect after polymerization process despite their known antimicrobial effect if used alone. This probably is due to their evaporation during heating; while vanillin and eugenol showed clear antimicrobial effect especially in vanillin. Heating during polymerization did not affect these compounds (vanillin, eugenol) and as a result of polymerization setting time increased due to incorporation of vanillin and eugenol with the net structure of acrylic. This was proven by change in color of acrylic resin, which may be due to oxidation of the aldehyde group of vanillin to vanillic acid and the oxidation of the double bond in eugenol. The oxidation and eugenol did not affect their antimicrobial activities since their antimicrobial effects were due to phenol group.

Such results showed that vanillin can be incorporated in denture base materials and give constant antimicrobial effects for the denture base especially when we know that vanillin is safe and has nice odour following polymerization, and has no effect on denture base material properties along time.

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