International Poster Journal IPJ of Dentistry and Oral Medicine

Int Poster J Dent Oral Med 2008, Vol 10 No 01, Poster 389

Release of benzoyl peroxide from acrylic denture base materials

Language: English

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Date/Event/Venue:
05. - 08. April 2000
International Association of Dental Research (IADR), 78th General Session & Exibition
Washington,DC, USA

Introduction

The number of patients with hypersensivities on dental materials increases continously. One of the most important allergens is benzoyl peroxide (BPO). It promotes oxidation and disintegrates by supply of energy in two radicals. BPO has wide antimicrobial properties and good keratolytic qualities. It is used in acne treatment and is added as a desinfectant in creams, lotions and several medical shampoos. BPO can be found in most ulcus cruris therapeutics and is part of various bone cements. However, benzoyl peroxide is part of the promoting system of acrylic denture materials, of synthetic rubber and resins. Allergic reactions to BPO have been well known for a long time and have been often described : 1959 Smith, 1968 Eaglestein, 1977 Leyden. The general population shows an average rate of sensitization of 1-3 %. The allergenic potency of BPO has been proven in various investigations : 1970 Poole, 1977 Leyden, 1985 Buehler. All authors pointed out that benzoyl peroxide is a powerful sensitizer.

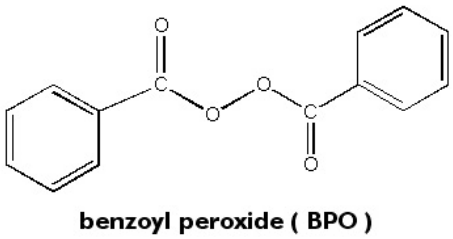


Fig.1 Benzoyl peroxide (BPO)

Objectives

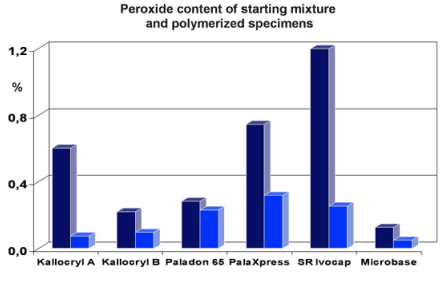
Aim of this study was to describe the BPO content of acrylic denture base materials after different storages as well as after different chemical treatments.

Material and Methods

ACRYLIC DENTURE BASE MATERIALS & MANUFACTURERS

Kallocryl A™	cold curing	Speiko - Dr. Speier Ltd. / German Dental Industry, Germany
Kallocryl B™	hot curing	Speiko - Dr. Speier Ltd. / German Dental Industry, Germany
Microbase™	microwave curing	Dentsply DeTrey Ltd., Germany
Paladon 65™	hot curing	Heraeus - Kulzer Ltd. / Laboratory Products Division, Germany
PalaXpress™	cold curing	Heraeus - Kulzer Ltd. / Laboratory Products Division, Germany
SR Ivocap™	hot curing	German Ivoclar Dental Ltd., Germany

Tab.1 Tested acrylic denture base materials



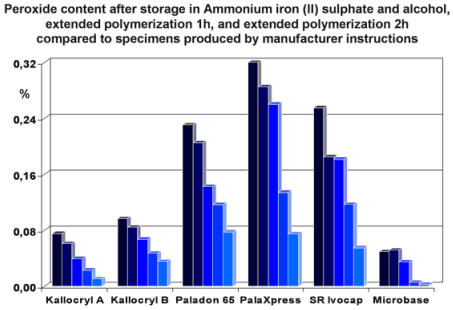


Fig.2 Peroxide content of starting mixture and polymerized specimens

Fig.3 Peroxide content after storage in Ammonium iron (II) sulphate and alcohol, extended polymerization 1h, and extended polymerization 2h compared to specimens produced by manufacturer instructions

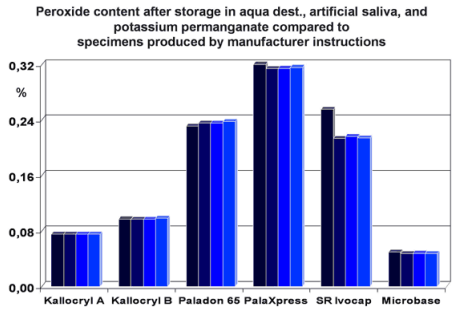


Fig.4 Peroxide content after storage in aqua dest., artificial saliva, and potassium permanganate compared to specimens produced by manufacturer instructions

Three hot curing acrylic resins, two self curing acrylic resins, and one recently developed microwave curing denture material were investigated. Indirect jodometry was used to detect BPO. The acrylic specimens were produced as recommended by the manufacturers and had an average volume of 125 mm3. All specimens were dissolved in CHCl3 and afterwards benzoyl peroxide was detected by jodometric titration. Our investigations concerned the following problems: The concentration of BPO in the starting mixture as delivered by the manufacturers and in the acrylic specimens after recommended polymerization. The quantity of released BPO under conditions similar to the human mouth. Specimens were stored in water (aqua dest.) for 8 days and in artificial saliva {Fusayama,1963} for 8 days. An influence on the content of BPO should be tested by storage in KMnO4 for 48 hours. The remaining content of peroxide was detected after drying the specimens at room temperature. Methods of specific follow-up treatments to reduce the content of BPO in dental acrylic materials. A reduction is possible by extended polymerization, by superficial extraction with solvents, and by chemical transformation. Recommended polymerization was extended for 1 and 2 hours. Specimens were stored in alcohol for 48 hours. To test the chemical transformation, specimens were stored in (NH4)2Fe(SO4)2 for 48 hours. Ammonium iron (II) sulphate is used in industry to clean chemicals from peroxides.

CHEMICALS			
$C_{14}H_{10}O_4$	dibenzoyl peroxide	$KMnO_4$	potassium permanganate
$CHCl_3$	chloroform	$(NH_4)_2Fe(SO_4)_2$	ammonium iron (II) sulphate

Tab.2 Chemicals used in this investigation

Results

There were significant differences in content of peroxides. The microwave curing resin Microbase contained the smallest, SR Ivocap the highest level of BPO in the starting mixture. The Microbase specimens contained the smallest level of BPO (0,05%) in the ready made specimens. But the self curing resin Kallocryl A also showed a surprisingly low content (0,08%). The highest content of peroxide was found in the self curing resin PalaXpress (0,32%). No reduction of the BPO content was seen after storage in artificial saliva or in aqua dest. Potassium permanganate had no effect on the BPO level in the tested acrylic resins. In the specific follow-up treatments the storage in (NH4)2Fe(SO4)2 caused the smallest effect on the peroxide level (13,5%). After storage in alcohol the peroxide content was reduced by 30,2%. The strongest effect occured after extended polymerization : 1 hour caused a reduction of 61,8 % and 2 hours caused a reduction of 77,5 %.

Conclusions

BPO was found in all tested acrylic denture base materials. The smallest content was found in Microbase, the highest in PalaXpress. According to our experimental results it is unlikely that BPO is released from the tested acrylic resin denture base materials. The best results in reduction of benzoyl peroxide can be achieved by extended polymerization. In case of an hypersensitized patient it is recommended to treat the denture material by extended polymerization or to use an acrylic resin like Microbase. However, because of the individual pathological qualities of an allergic reaction it is hardly possible to predict the exact allergic potential of the investigated resins.

This Poster was submitted by Dr. med. dent. Arne F. Boeckler.

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Poster Faksimile:

RELEASE OF BENZOYL PEROXIDE FROM ACRYLIC DENTURE BASE MATERIALS

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1820

78th General Session of the IADR, Washington, DC, April 5-8, 2000

INTRODUCTION

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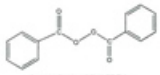
Aim of this study was to describe the BPO content of acrylic denture base materials after different storages as well as after different chemical treatments.



benzoyl peroxide (BPO)

MATERIALS and METHODS

Three hot curing acrylic resins, two self curing acrylic resins, and one recently developed microwave curing denture material were investigated. Indirect jodometry was used to detect BPO. The acrylic specimens were produced as recommended by the manufacturers and had an average volume of 125 mm^3. All specimens were dissolved in $CHCl_3$ and afterwards benzoyl peroxide was detected by jodometric titration.

Our investigations concerned the following problems :

- The concentration of BPO in the starting mixture as delivered by the manufacturers and in the acrylic specimens after recommended polymerization.

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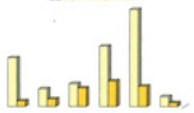
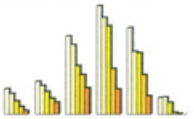
Peroxide content of



Peroxide content after storage in and compared to



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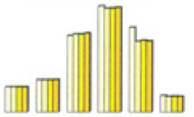

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