

## Effect of Disinfectants on Elastomers: A Review

<sup>1</sup>Dr. Anuradha, <sup>2</sup>Dr. Abhisheik Sachdeva, <sup>3</sup>Dr. Sonal Shah

<sup>1,2,3</sup>Post Graduate Student (First Year), Department of Prosthodontics and Crown & Bridge, Rama Dental College Hospital & Research Centre, Kanpur, Uttar Pradesh, India

### Corresponding Author:

Dr. Anuradha,

Post Graduate Student (First Year), Department of Prosthodontics and Crown & Bridge, Rama Dental College Hospital & Research Centre, Kanpur, Uttar Pradesh, India

**Email:** anuradhadubey55@gmail.com

### Abstract

Addition silicone and polysulfide impressions were disinfected without a loss in accuracy, whereas polyether impressions were adversely affected. The surface quality of dies was acceptable with disinfection and one disinfectant contributed to an improvement in surface quality compared with the control. A working cast-and-die system of improved dental stone used with cast dental restorations must provide dimensional accuracy, strength, and resistance to abrasion, and must reproduce surface detail. These impressions can act as vehicles of transmission and carry various types of microorganisms, which further cause diseases like Hepatitis B, C, HIV, Tuberculosis etc. This contamination and cross contamination of microorganisms can be prevented by disinfecting the impressions immediately after removing from the mouth and label them as disinfected.

**Keywords:** Addition silicone, Polysulfide Impressions, Disinfection, Strength, Resistance, Abrasion

### Introduction

The making of an impression is a technique that is often practiced in dentistry and mandates selecting apt impression materials and methods for a particular process. After impression-making, casts are procured from the same that are employed as dies/study models to fabricate various appliances, indirect restorations, and prostheses.<sup>1,2</sup> An impression that has set serves as a large resource for microorganisms that comprise bacteria, viruses, and fungal organisms that are retained after being taken out of the patient's oral cavity. In due course, these pathogens are transported to dental plaster and stone as the models are fabricated. Eventually, these models that harbor the pathogens pose the peril of transmitting infection to dental practitioners, personnel involved in transportation and laboratory personnel through indirect contact. Numerous ways of disinfection may be employed to purify different impression supplies.<sup>3,4</sup> A frequent technique is chemical disinfection, in which the surface of the impression is subjected to chemical treatment via spraying/immersion. Owing to suitable physical characteristics, elastomeric impression materials are usually preferred.<sup>5,6</sup> One noteworthy property upon taking out the material from the oral cavity is the elastic revival of the impression material in the absence of deformation. Additionally, the substance must exhibit dimensional stability while disinfection as well as at the time of storage until the cast is poured. This review is an attempt to highlight the important aspects of effect of disinfectants on elastomers.

**Elastomeric Impression Materials: Polysulfide Rubber Impression Material**

Polysulfide rubber impression material consists of Base paste-Low Molecular Weight Polysulfide with two terminal and one pendant SH groups, Fillers (Titanium dioxide), Plasticizer (Dibutyl phthalate) and Catalyst paste-Lead dioxide (Brown) or organic peroxides (Gray) reactor, Fillers (Titanium dioxide), Plasticizer (Dibutyl phthalate). Its Setting Reaction is by condensation polymerization (exothermic + shrinkage) with releasing of H<sub>2</sub>O as reaction by-product. It occurs as a series of simple oxidation reactions. Condensation Silicone Impression Material: Condensation silicone impression material consist of Base paste-LMW silicone polymer with terminal OH groups, Fillers (Colloidal silica or titanium dioxide) (white) and Catalyst paste- Alkyl silicate (Cross linking), Tin dilaurate or Stannous octoate (Activator). Material sets via condensation polymerization reaction. Ethyl alcohol is the reaction by-product.

**Addition Silicones Impression Materials**

Addition silicones impression materials consist of Base paste-Poly methyl hydrogen siloxane (Hydried or silane terminated silicone), Other Siloxane pre-polymers, Fillers and Catalyst paste-Divinyl poly(dimethyl siloxane), Platinum salt activator (Chloroplatinic acid), Siloxane prepolymers, Fillers. Its setting reaction is addition polymerization (exothermic + shrinkage) with no release of by-product. It occurs as a series of cross-linkage between vinyl-terminated silicon and silane-terminated (hydried) silicon molecules, in presence of the catalyst (platinum salt) to form a 3D polymer network. More dimensionally stable

**Disinfecting Agents**

The destruction or removal of all pathogenic organisms, or organisms capable of giving rise to infection. Glutaraldehyde / Cidex (2% alkaline NaHCO<sub>3</sub>):- It is a high level disinfectant. Especially active against tubercle bacilli, fungi and viruses. Less toxic than formaldehyde. Exposure time: > 10hrs. Phenols: Acts by cell membrane damage thus releasing cell contents and causing lysis. Eg. Cresol (LYSOL), chlorhexidine (SAVLON), chloroxylenol (DETTOL) and hexachlorophen. Phenol is commonly found in mouthwashes, scrub soaps and surface disinfectants. Low efficiency disinfectant Halogens: Bleaching powder or hypochlorite solution mostly used disinfectant for HIV infected material. In concentration of 0.05 or 0.5% used for surface material and instruments disinfection.<sup>7,8</sup> Should be prepared daily because of instability of sodium hypochlorite solution. Active against bacteria, spores, fungi and viruses (HB, HIV) Iodophors & Iodine Active against bacteria, spores & some viruses & fungi. (7.5% Povidone+iodine=Betadine)

**Methods of Disinfecting Impressions**

- \* Spraying
- \* Immersion D

**Elastomeric Impression Materials**

Polysulphide and Addition Silicone: Glutaraldehyde, Iodophor, 0.5% sodium hypochlorite should be used. Polyether: Spraying in iodophor, 0.5% Sodium hypochlorite should be used. Prolonged immersion causes some distortion. Polyether shows dimension Selection of the type of disinfectant for impressions is very important as it can induce changes in accuracy and detail. The addition silicone impressions in combination with any disinfectant other than the neutral

glutaraldehyde produced casts with excellent accuracy and changes on immersion in 2% Glutaraldehyde.<sup>9,10</sup> However, the surface quality was acceptable for all combinations of impression materials and disinfectants and hence disinfectants should be used in impressions prior to cast pouring. The impression materials used for the study were, Dentsply aquasil (addition silicone polyvinylsiloxane syringe and putty), zetaplus (condensation silicone putty and light body), and impregumpenta soft (polyether). All impressions were made according to manufacturer's instructions. Dimensional changes were measured before and after different disinfection procedures. Dentsply aquasil showed smallest dimensional change (-0.0046%) and impregumpenta soft highest linear dimensional changes (-0.026%). All the tested elastomeric impression materials showed some degree of dimensional changes.<sup>11-15</sup> With the present laboratory practice of placing a die spacer on the replicated, prepared tooth surfaces of stone dies to allow space for the luting agent, the necessity of accurate surface reproduction may not appear to In a recent investigation, an enhancement of the surface character of improved dental stone dies after the immersion disinfection of the elastomeric impression was observed as important. After impression-making, casts are procured from the same that are employed as dies/study models to fabricate various appliances, indirect restorations, and prostheses. An impression that has set serves as a large resource for microorganisms that comprise bacteria, viruses, and fungal organisms that are retained after being taken out of the patient's oral cavity. In due course, these pathogens are transported to dental plaster and stone as the models are fabricated. Eventually, these models that harbor the pathogens pose the peril of transmitting infection to dental practitioners, personnel involved in transportation and laboratory personnel through indirect contact. Therefore, it has been recommended by the ADA that dental labs and clinics pursue apt disinfection code of behavior put forth by the Center for Disease Control to avoid cross infectivity amid the dental practitioners, patients, and lab technicians. Numerous ways of disinfection may be employed to purify different impression supplies. A frequent technique is chemical disinfection, in which the surface of the impression is subjected to chemical treatment via spraying/immersion. Several chemical disinfection agents are commercially available in various compositions.

## Conclusion

The present study showed that all the disinfection procedures produce minor dimensional changes of impression material. However, it was within American Dental Association specification. Hence, steam autoclaving and microwave method can be used as an alternative method to chemical sterilization as an effective method.

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