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EFFECT OF GLUTARALDEHYDE AS A DISINFECTANT ON DIMENSIONAL STABILITY AND SURFACE CHANGES OF IMPRESSION MATERIALS -A SYSTEMATIC REVIEW

C. NAGAPPAN[1*], C. MUTHU SURYA BANU[2], J. RAGHUNATHAN[3], R. KAMALA KANNAN[4], N.C. ARUN PRASAD[5], VISALAKSHI RAMANATHAN[6]

1: Reader, Department of prosthodontics and crown & bridge, Karpaga Vinayaga Institute of Dental Sciences

2: Post Graduate, Department of prosthodontics and crown & bridge, Karpaga Vinayaga Institute of Dental Sciences

3: Senior Lecturer, Department of prosthodontics and crown & bridge, Karpaga Vinayaga Institute of Dental Sciences

4: Head of the Department, Department of prosthodontics and crown & bridge, Karpaga Vinayaga Institute of Dental Sciences

5: Senior Lecturer, Department of prosthodontics and crown & bridge, Karpaga Vinayaga Institute of Dental Sciences

6: Senior Lecturer, Department of prosthodontics and crown & bridge, Karpaga Vinayaga Institute of Dental Sciences

***Corresponding Author: Dr. C. Nagappan**

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ABSTRACT

Purpose: The purpose of this systematic review is to analyze the effect of the dimensional stability and surface changes in the dental impression materials after disinfecting with glutaraldehyde. **Materials and Methods**: The PubMed, Google scholar, and science direct databases were searched related to English language articles published from the year 2000 to 2020. Journals were searched from cross-references and were collected using keywords such as impression material, dimensional stability, the surface wettability of impression material, dimensional accuracy, and disinfection in impression materials. **Conclusion**: The effect of glutaraldehyde disinfectant on the dimensional

stability and surface changes of impression material has a direct relation with the concentration of the disinfectant used and the length of exposure of the impression to the disinfectant that determines the extent of damage on impression material. Hence the manufactures should draw a standardized protocol for disinfection of impression materials by considering both efficiency and its effect on properties of impression materials.

Keywords: Disinfectant, Glutaraldehyde, Impression materials, Dimensional stability, Surface changes

INTRODUCTION:

The oral cavity is the major gateway for the human body. Hence, microorganisms found in the human oral cavity can lead to a number of oral infectious diseases[1]. It is an important requirement to protect dental professionals and dental technicians from exposure to such microorganisms that might cause serious illness.[2] So, the dental office should set a goal to follow strict infection control. Infection can be caused by various means in a dental setup one such way of spreading infection is through dental impressions. So, disinfecting the impression is of utmost important, as it can lead to cross contamination[3-9].

Traditionally impressions were washed under running tap water, which did not get rid of microorganisms[10-15]. Hence proper disinfection is needed. It can be achieved by using various disinfectants. Two important factors are to be considered during the disinfection of impression materials, they are the efficiency of the disinfectant and the effect of the disinfection procedure on the properties of impression materials. [15-20]. Already a systematic review was done by Alzian *et al* in which they have compared the effect on properties of impression material in different disinfectants and sterilization methods. In this current study we are going to see the effect on the dimensional stability and surface changes after disinfecting with glutaraldehyde in different impression materials. Because glutaraldehyde has a broad spectrum of activity against bacteria and their spores, fungi, and viruses and moreover it has a high level disinfection. Compared to other disinfectants like sodium hypochlorite which has corrosive properties can damage the properties of impression materials[21].

Therefore, the purpose of this systematic review is to analyze the effect of glutaraldehyde on various impression materials.

Inclusion Criteria

Articles published from 2000 to 2020

Articles in English language.

Articles related to disinfection of impression materials and dimensional stability of impression materials.

In vitro studies

Exclusion Criteria

In vivo studies.

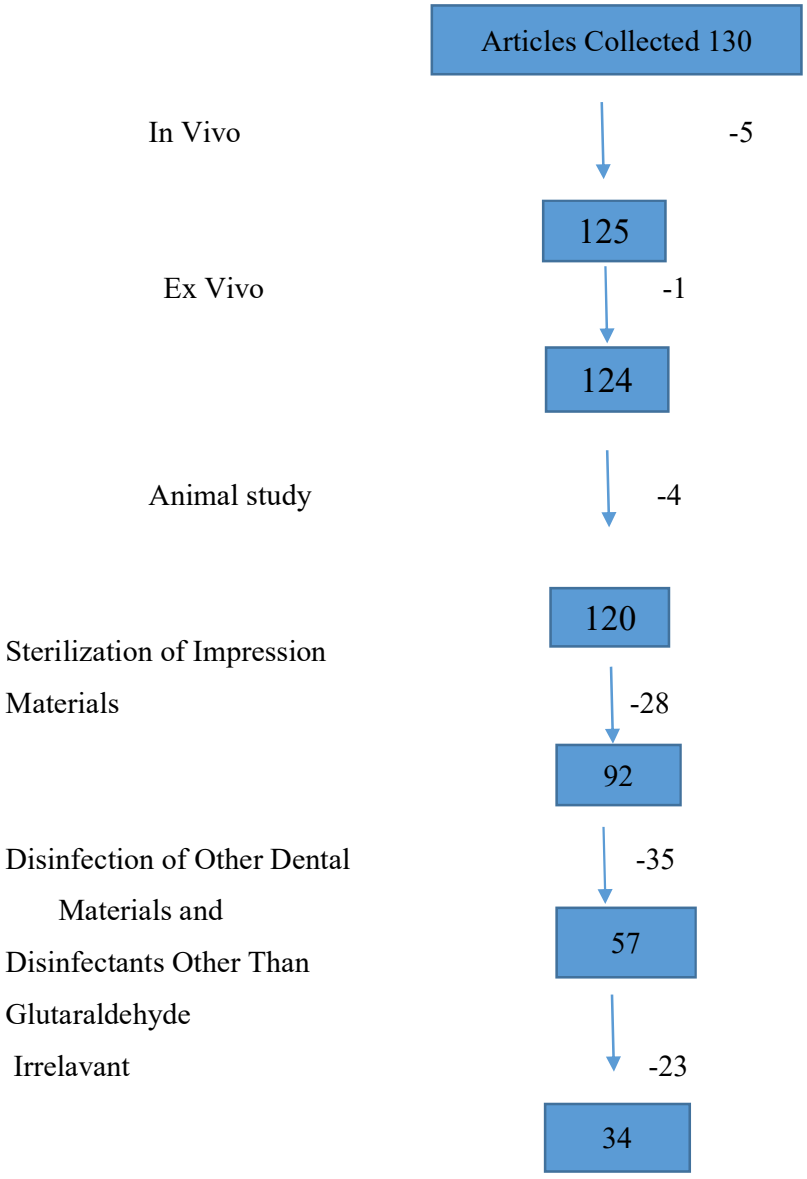
Animal studies

Articles other than English language.

Materials and Methods:

The PubMed, Google scholar and science direct database was searched according to the inclusion and exclusion criteria. Journals were searched from cross-references and were collected using keywords such as Disinfectant, Glutaraldehyde, Impression materials, Dimensional stability, Surface changes.

Totally 130 articles were collected in that the articles were omitted in the following way **(Flow Chart 1)**.



Flow chart 1: Shows the number of articles included in the systematic review

DISCUSSION:

The impression material can be disinfected by either spraying and then sealing in a bag or immersion method. Microbiological growth was recorded in 77% of impressions rinsed only with water.[31] So, to remove the potentially infectious substance they recommend rinsing impressions under running water for 10-15 seconds, followed by application of a disinfectant.[32] The spray technique has a similar antimicrobial activity when compared to the immersion method. However, the spray does not affect the dimensional stability as that of the process of immersion.[19] But disinfecting by immersion method is more effective than the spraying method. This may be because of promising disinfection of all surfaces of the impression and the relatively long exposure time of the impression materials to the disinfectant by immersion than by spraying method. Spraying leads to the pooling effect and its effect is localized.[22,33] As the bacteria were also observed inside, with a depth of about 0.1–3.0 mm in the alginate impression and blood invaded into a depth of about 0.7–2 mm from the surface of alginate impression.[34] According to ADA specification criteria, Number 19 the elastomeric impression material should not exceed more than 0.5% of its dimension.[14] Ismail *et al* states that disinfecting zinc oxide eugenol impression with 2% glutaraldehyde for 10 or 60 minutes has no change in dimension stability.[22] Hamedi *et al* states that disinfecting alginate by immersion method for 8 minutes has lead to dimensional changes whereas the spray method for 8 minutes has not produced any significant dimensional changes [25]. Soganci *et al* states that disinfecting polyether and addition silicone with 2% glutaraldehyde by 10 minutes immersion has no dimensional changes.[9] Usama Nassa *et al* states that disinfection of vinyl polyether silicone with 2.5% buffered glutaraldehyde for 30 minutes has dimensional stability and is within ADA specification after prolonged immersion.[26] Caravalhal *et al* states that disinfecting addition silicone, polyether, and polysulfide with 2% glutaraldehyde for 5 or 10 minutes has no change in dimension stability but after 20 minutes of immersion in disinfection causes dimensional changes and it shows how immersion time has influence on dimensional change of different impression materials. [25] Yilmaz *et al* states that the dimensional changes for polyether impression materials were lower than the maximum linear dimensional changes recommended by ISO 4823. [24] Alzain *et al* states that disinfecting polyether and vinyl polysiloxane with 0.5% glutaraldehyde by spray method for 10 minutes improved their wettability as

glutaraldehyde acted like a surface reducing agent, which improved the wetting potential of the impression materials [28]. Lad *et al* states that disinfecting condensation silicone by 5% buffered glutaraldehyde for 10 minutes by immersion method has no change in wettability. [11] The overall summary of selected studies indicating the effect on dimensional stability and surface changes of different impression materials after disinfecting with glutaraldehyde is given in the **(Table 1)**.

Table 1: Summary of selected studies indicating the effect on dimensional stability and surface changes of different impression materials after disinfecting with glutaraldehyde

Types of Glutaraldehyde	Conc.	Impression Material	Method Of Disinfection	Duration Of Disinfection	Dimension stability/ Surface changes	Changes Seen After Disinfection	Author/Year
Glutaraldehyde	2%	Zinc oxide eugenol	Immersion	10 or 60 minutes	Dimension stability	X	Ismail *et al*(2017)[22]
				8 minutes			Hamedi Rad *et al* (2010)[23]
		Alginate	Immersion	5-8 minutes	Dimension	✓	
		Alginate	Spray		stability	X	
				10 minutes			Soganci *et al*(2018)[8]
		Polyether, Addition silicone	Immersion		Dimension stability	X	
							Shweta shetty *et al* (2013)[9]
		Polyether, Addition silicone	Immersion	10 minutes	Wettability	X	
		Polyether		10 minutes			Yilmaz *et al* (2007)[24]
			Immersion		Dimension stability	X	
		addition silicone, polysulfide, polyether		5 minutes			Carvalhal *et al.* (2011)[25]
			Immersion	10 minutes	Dimension	X	
				20 minutes	stability	X	
				30 minutes		★	
		Condensation silicone		60 minutes		✓	
				20 minutes		✓	Silva *et al*(2004)[1]
Glutaraldehyde	2%		Immersion		Dimension stability	X	Lepe *et al*(2002)[26]
		Polyether, Addition silicone		½ hour			
Glutaraldehyde	2%	Condensation silicone	Immersion		Wettability	✓	Sinobad *et al*(2014)[17]
		Silicone		10 minutes			Pal *et al*(2014)[3]
			Immersion		Dimensional stability	X	Melilli *et al* (2008)[27]
		Addition Silicone Polyether		10 minutes			Alzian (2019)[28]
			immersion		Surface texture	X	
				5 minutes	Dimension stability		Revathy *et al* (2016)[29]
		Addition silicone, polyether	Immersion	10 minutes	Wettability	★	
Glutaraldehyde	0.5%		Spray			X	
		polyether		30 & 60 minutes	linear		Usama Nassar *et al* (2017)[30]
	0.5%		Immersion ,spray		dimensional stability	X	
							Lad *et al* (2015)[10]
		Condensation silicone		30 minutes			
			immersion		Dimensional		
Buffered glutaraldehyde	2.5%			10 minutes	stability	X	
			immersion		wetability		
	5%					X	

NO CHANGE -X SIGNIFCANT CHANGE- ✓ INSIGNIFICANT CHANGE ★

CONCLUSION:

The effect of glutaraldehyde as a disinfectant on the properties of impression material has a direct relation with the concentration of the disinfectant used and the length of exposure of the impression material to the disinfectant that determines the extent of damage on impression material. There is no standardization in measurements and duration of disinfection to be used by the manufacturers. Moreover, in these studies, they have not mentioned the shelf life of disinfectants and how frequently they should be changed, which might also affect both efficacy of disinfectant and properties of impression materials. Hence the manufacturers should draw a standardized protocol for disinfection of impression materials by considering both efficacy and its effect on properties of impression materials.

Clinical Relevance:

Scientific rationale for study: Glutaraldehyde is commonly used as a disinfectant and there is no systematic review regarding the role of glutaraldehyde as a disinfectant for impression materials.

Principal findings: Glutaraldehyde is a effective disinfectant which is both cost effective and does not cause significant dimensional changes in the impression materials.

Practical implications: Glutaraldehyde can be used as an effective disinfectant in dental clinic for disinfecting the dental impression materials.

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