

## Comparative evaluation of surface roughness of addition silicone impression material after immersion in disinfectants with sodium hypochlorite, noni and aloe vera: An in-vitro study.

Monika Swetha.V<sup>1</sup>, Jailance Lathief<sup>2</sup>, Shiney Boruah<sup>2</sup>, V Vidyashree Nandini<sup>3</sup>.

<sup>1</sup>Intern, SRM Kattankulathur Dental College and Hospital.

<sup>2</sup>Assistant professor, Department of Prosthodontics and Implantology, SRM Kattankulathur Dental College and Hospital.

<sup>3</sup>Professor and Head, Department of Prosthodontics and Implantology, SRM Kattankulathur Dental College and Hospital.

### ABSTRACT

**Aim:** To evaluate the surface roughness of casts retrieved from addition silicone impression material after immersion in three different disinfectant solutions.

**Materials and methods:** This in vitro study was conducted on 45 samples with addition silicon impression material (Neopure) and divided into 3 groups. Group 1 samples (n=15) were stored in 1% sodium hypochlorite (control group) and group 2(n=15) and group 3(n=15) were immersed in solutions of noni and aloe-vera juice respectively. Surface roughness (Ra) measurements after immersion were measured using surface roughness tester (optical Profilometer). Data were analysed statistically.

**Results:** statistical results shown that there is no significant change in the surface roughness after immersion in different disinfectants like 1% sodium hypochlorite (NaOCl), noni and aloe-vera

**Conclusion:** Surface roughness values of addition silicone after immersion in 1% NaOCl, noni and aloe-vera was similar and statistically there's no significant difference between the groups.

**Keywords:** Addition silicone, aloe vera, noni, optical profilometer.

**Address of correspondence:** Dr V Vidyashree Nandini MDS., DNB., Professor and Head, Department of Prosthodontics and Implantology, SRM Kattankulathur Dental College and Hospital, SRM Institute of Science and Technology, Potheri 603203, Chengalpattu, Tamil Nadu, India.

**Email address:** - [vidyashv@srmist.edu.in](mailto:vidyashv@srmist.edu.in) **Phone no:** 9444901719. **DOI:** 10.5281/zenodo.10416721

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### Introduction

Modifications to the physical properties of molds made from impressions treated with various disinfectants was a prevalent issue leading to ill-fitting dental prosthetics in the mouth and on the molds.<sup>[1,2,3]</sup> When blood and saliva come into touch with impression materials, they may transfer pathogenic bacteria to the dental molds.<sup>[4,5]</sup> To get rid of these germs, the impressions are routinely rinsed under running water.<sup>[5]</sup> Nowadays, the purpose of disinfecting impressions is to remove bacteria from the impression's surface in both laboratories and clinics.<sup>[6,7,8]</sup> Because of the chemical or physico-chemical interactions between the disinfecting agent

and the impression materials, one effect of disinfection is the change in the size or dimensions of the impression.<sup>[1,2,3]</sup> In accordance with 1998 protocol from the World Dental Federation (FDI), it is recommended that impressions be disinfected before they are sent to the laboratory.<sup>[9]</sup> Disinfectants spraying onto impressions are a common method, but immersing the impression in disinfecting solutions is more appropriate and commonly embraced approach for disinfection. Common chemical disinfecting solutions include 1% sodium hypochlorite, 2.4% glutaraldehyde, iodophor & phenol. It's also crucial to remember that none of these cleaning agents are entirely safe

for use with impression materials and may change their dimensional stability.<sup>[1,2,3,10,11]</sup> Additionally, casts and die systems constructed from gypsum and dental stone need to maintain strength, wear resistance, dimensional stability, and ability to accurately reproduce surface details.

There is a belief that immersing impressions in disinfectants for duration longer than what the manufacturer recommends can lead to alterations in the impression material, and these changes may be transfer to the resulting cast.<sup>[3,12,13,14]</sup> Increasing the length of time an impression material is immersed in disinfectants may have an effect on gypsum casts' hardness, dimensional stability, and accuracy in recreating surface details, among other qualities. Ultimately, these changes could affect the precision of the final dental restorations.

Although these characteristics have been the main focus of most previous research, the effect of disinfectants on the surface texture of dental casts has not received as much attention as it should.<sup>[7,14]</sup> The aim of this investigation was to evaluate the dimensional alteration of silicone impression material subsequent to its immersion in disinfectants containing 1% sodium hypochlorite, noni, and aloe vera (Fig. 1). The type of disinfectant and the length of immersion would not significantly affect the castings' surface roughness, according to the null hypothesis.

## Materials and methodology

This in-vitro study involved 45 samples divided as three groups (n=3), each containing 15 samples. Standard impression trays with ANSI/ADA No. 25 were utilized for the study. The low viscosity addition silicone impression materials base and catalyst were mixed according to the manufacturer's instructions, and 45 impressions were taken using a typhodont model (Fig. 2). The samples were

then divided into group of 3, with each group containing 15 samples (Fig. 3). After taking the impressions in typhodont, each impression was filled with type IV gypsum (100 grams of gypsum combined with 19–24 millilitres of water), and the casts were removed from the impressions (Fig. 4) and impressions were rinsed with water. With the use of an optical profilometer (Fig. 5), the surface roughness (Ra) of casts was determined. Later on, the same impressions were subjected to a disinfecting solution for one hour at 25°C on each group.

The study groups were as follows: (Fig. 3)

- I. Impressions were immersed in 1% sodium hypochlorite (NaOCl) which served as control for 1 hour.
- II. Impressions were immersed in noni which served as natural disinfectants for 1 hour.
- III. Impressions were immersed in aloe Vera (Himalaya Organic) which served as natural disinfectants for 1 hour.

One hour after taking the impressions from disinfecting solutions, each impression was filled with type IV gypsum (100 grams of gypsum combined with 19–24 milliliters of water), and the casts were removed from the impressions (Fig. 4). The casts' surface roughness (Ra) was determined. Each specimen's surface had three randomly selected spots, and the surface roughness at each location was assessed separately using an optical profilometer (Fig. 5). After obtaining the raw data, the data was statistically analysed using the paired samples test and Kolmogorov-Smirnov test.

## Results:

In current study, the data obtained was statistically analysed using the SPSS (IBM SPSS Statistics for Windows, Version 23.0,

IBM Corporation). The significance level was maintained at 5% ( $\alpha = 0.05$ ). Kolmogorov-Smirnov tests were done to reveal if the variables followed normal or non-normal distribution. The data in the current study revealed a normal distribution. Therefore, paired sample test was applied to analyse the data. The Results showed that there was no significance difference in surface roughness of the cast after immersion of impression in different disinfectants like sodium hypochlorite, noni, aloe vera. Surface roughness values (Ra) obtained were recorded for each sample of immersion in sodium hypochlorite (NaOCl), Noni and aloe vera the values obtained were recorded. The values obtained did not show any significant changes between both the storage medium. There is no statistical difference between the groups as the  $p < 0.05$ .

The means surface roughness of pre immersion group ( $0.6845 \pm 0.0615$ ) greater than after immersion in sodium hypochlorite group ( $0.6021 \pm 0.4685$ ) (Table 1a). Pair Sample test revealed statistically significant difference in the surface roughness of pre immersion group and after immersion in sodium hypochlorite group (p value-0.00) (Table 1b).

The mean surface roughness of pre immersion group and after immersion in noni is  $0.6853 \pm 0.00779$  and  $0.6389 \pm 0.4657$  respectively (Table 2a). Therefore, the mean surface roughness of pre immersion group is greater than immersion in noni. However, Pair Sample test revealed statistically significant difference in the surface roughness of pre immersion group and after immersion in sodium hypochlorite group (p value-0.00) (Table 2b).

The mean surface roughness of pre immersion is  $0.6831 \pm 0.00751$  and after immersion in aloe-vera juice is  $0.6391 \pm 0.05536$  (Table 3a). Thus, the mean surface roughness of pre

immersion group is greater than immersion in aloe vera. However, Pair Sample test revealed statistically significant difference in the surface roughness of pre immersion group and after immersion in sodium hypochlorite group (p value-0.00) (Table 3b).

Comparison among all the three groups reveals that surface roughness of after immersion group sodium hypochlorite is minimal compared to noni and aloe vera (Graph 1).

### Discussion:

The study found that after immersing the impression in several disinfectants, there was no change in the dental cast's surface roughness. Disinfectants shouldn't alter impression materials' physical characteristics since this will affect the casts as well and lead to inaccurate physical characteristics. Addition silicone disinfection through immersion in sodium hypochlorite at 1%, noni and aloe vera, were effective in reducing the microbial load of the dental impression. This method of disinfection was noted for its ability to achieve microbial reduction without significantly altering the dimensional stability of the impression. Disinfection of dental impressions through immersion is considered one of the safest methods of disinfection. This is important because the disinfection process should not compromise the safety of dental professionals or patients.

Two common techniques for disinfecting dental impressions, which are the spraying and immersion technique.<sup>[10]</sup> In current study we used three commonly available disinfectants in the market: 1% Sodium Hypochlorite (NaOCl), Noni, and Aloe Vera. Lepe and Johnson in their study states that these disinfectants are effective in eliminating HIV and HBV (human immunodeficiency virus and hepatitis B virus) within a short timeframe (10 minutes).<sup>[10]</sup>



This highlights the importance of selecting disinfectants that can effectively kill infection. Additionally, the American Dental Association (ADA) has advised that the immersion approach be used to disinfect impressions because it is a more dependable method.<sup>[15,16]</sup> An optical profilometer is used to measure the surface roughness of cast. Although there is a numerical difference, the study indicated that there is no significant variation in surface roughness within the tested groups after one hour of immersion in disinfection solutions.

As per the research conducted by Melilli et al.<sup>[17]</sup> their results indicate that immersion-based disinfection consistently leads to a substantial increase in the impression material's dimensions. However, a second disinfection, conducted six hours after the initial one, does not result in any noteworthy dimensional alterations. This lack of change is likely attributed to the chemical stabilization of the material that occurs within the initial hours following the impression procedure. Azevedo et al. investigated the effects of two disinfecting solutions on two chair-side relining resins and a heat-polymerizing denture base resin in 2006.<sup>[18]</sup> The disinfecting solutions were 1% sodium hypochlorite and 4% chlorhexidine. The investigation found that the surface hardness and roughness of the materials evaluated showed no discernible deterioration as a result of these cleaning treatments. According to Thouati et al.<sup>[19]</sup> the addition silicone was disinfected in a 5.25% NaOCl solution for 30 minutes and it observed the changes in dimensional stability of up to 0.46%, which is within the range of values obtained in the study for the same disinfectant. In this study it was found that the dimensional stability of the addition silicone did not show any significant change after disinfection and using of specific disinfectant concentration and duration, the addition silicone material remained stable without significant alterations in its dimensions and with longer immersion

times leads to decreased surface roughness. All chemical disinfectants and natural disinfectants showed good results in terms of dimensional stability evaluation and the casts maintained their shape and dimensions effectively during the disinfection process. Though the study was performed under ideal conditions taking various factors into consideration, the study has limitations. In current study sample size was small and only one mechanical property was taken into consideration. Therefore, further studies can be done taking into consideration larger sample size and different mechanical properties for better outcome.

### Conclusion:

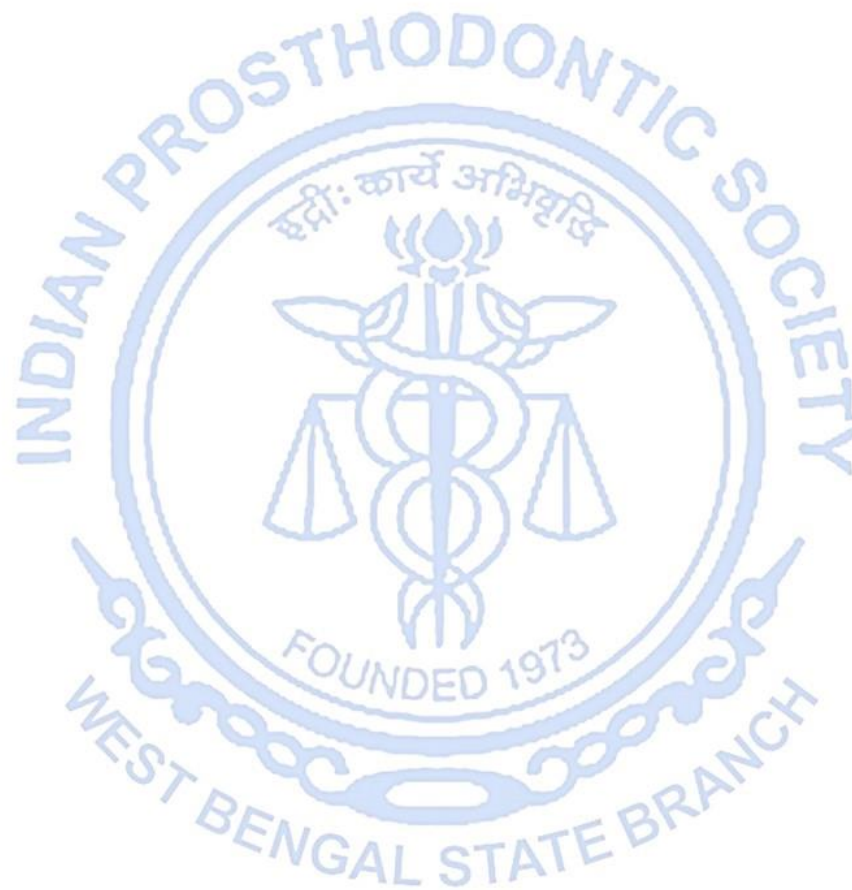
Within the limitation on this study, based on the results obtained both numerically and statistically that the type of disinfectants like sodium hypochlorite, noni and aloe vera had no significant effect on the surface roughness of gypsum casts retrieved from addition silicone impression material.

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impression materials immersed in disinfectants. J Prosthet Dent 1996; 76(1): 8;14.



**TABLES**

	Mean	N	Std. deviation
<b>Pre immersion</b>	0.6845	15	0.00615
<b>Immersion in Sodium hypochlorite</b>	0.6021	15	0.04685

**Table 1a:** Comparison of surface roughness for pre-immersion group and after immersion in Sodium Hypochlorite.

Group comparison	Mean	Std. deviation	P value
<b>Pre immersion – immersion in Sodium Hypochlorite</b>	0.8233	0.4583	0.000

**Table 1b:** Pair Sample test for Surface roughness.

	Mean	N	Std. deviation
<b>Pre immersion</b>	0.6853	15	0.00779
<b>Immersion in noni</b>	0.6389	15	0.04657

**Table 2a:** Comparison of surface roughness for pre-immersion group and after immersion in Noni.

Group comparison	Mean	Std. deviation	P value
<b>Pre immersion – immersion in noni</b>	0.04640	0.04970	0.003

**Table 2b:** Pair Sample test for Surface roughness.



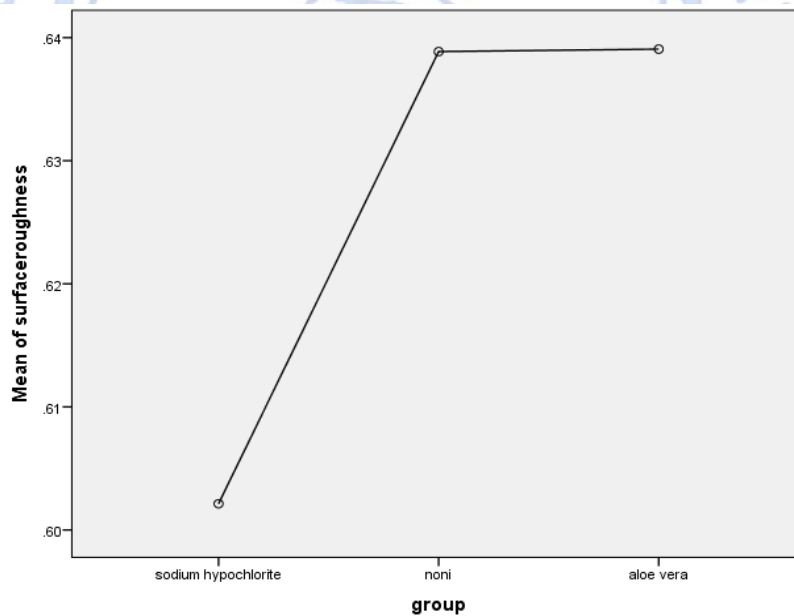
	Mean	N	Std. deviation
Pre immersion	0.6831	15	0.00751
Immersion in aloe vera	0.6391	15	0.05536

**Table 3a:** Comparison of surface roughness for pre-immersion group and after immersion in Aloe vera.

Group comparison	Mean	Std. deviation	P value
Pre immersion – immersion in aloe vera	0.04407	0.05602	0.009

**Table 3b:** Pair Sample test for Surface roughness

### GRAPHS



Graph 1: Comparison of mean surface roughness after immersion in Sodium Hypochlorite, Noni, Aloe vera



**FIGURES**



Figure 1



Figure 2



Figure 3



Figure 4



Figure 5