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DIMENSIONAL ACCURACY OF ALGINATE IMPRESSION MATERIAL USING KORSOLEX DISINFECTANT THROUGH CAD CAM

[1]Kausalyah Krisna Malay, [2]Vinay Sivaswamy, *[3]Dhanraj Ganapathy

ABSTRACT

INTRODUCTION:*Alginate is an elastic, irreversible hydrocolloid impression material. It is most frequently used in dental practice. Disinfecting the impression material is a vital step to prevent cross contamination. The aim of this research is to evaluate the effect of Korsolex, an alkaline glutaraldehyde based disinfectant on the dimensional stability of commonly used impression material, alginate.*

OBJECTIVE: *To determine an economic yet effective method of disinfecting impressions that can be used routinely in clinical practice.*

METHODOLOGY: *The study was conducted with 45 samples of alginate impression made on a Type III gypsum model. The samples were equally divided into three groups of 15 each (Control, Post immersion 10 mins, Post immersion 20 mins). Impressions in the control group were washed with tap water. The two test groups were immersed in Korsolex disinfectant solution for 10 minutes and 20 minutes respectively. Casts were made from all the impressions and predetermined points were measured on the casts. The casts were scanned using an optical scanner of a CAD/CAM milling machine. The distance between premolars and molars were measured in the virtual casts using CAD/CAM analysis software*

RESULTS: *Results revealed that at 10 minutes time interval, there is no dimensional change seen whereas at 20 minutes time interval there was a slight change which is clinically significant, but statistically it is insignificant when immersed for more than 20 minutes.*

CONCLUSION: *There is no significant dimensional change in alginate after 10 minutes of immersion in korsolex, whereas changes in dimensional stability are seen after 20 minutes of immersion with korsolex. This disinfectant is ideal for 10 minutes immersion only.*

KEYWORDS: *Impression, dimensional accuracy, CAD CAM, alginate, korsolex.*

[1]*Graduate Student, Department of Prosthodontics, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Chennai, India.*
[2]*Senior Lecturer, Department of Prosthodontics, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Chennai, India.*
[3]*Professor and Head Department of Prosthodontics, Saveetha Dental College and Hospitals, Saveetha Institute of Medical And Technical Sciences, Chennai – 600077 Tamil Nadu, India.*

I. INTRODUCTION

Alginate is an elastic, irreversible hydrocolloid impression material. Irreversible hydrocolloid impressions form an inseparable part of indirect restorations. Alginate is one of the most frequently used dental materials; and alginate impression is a simple, cost-effective, and indispensable part of dental practice. Yet very few people can make alginate impressions just right the first time. For many years, alginate impression material has been a staple of most dental practices.[1] They form a major bulk of our clinical practice even today; therefore, it becomes mandatory to understand the material and follow certain fundamental guidelines for flawless, predictable impressions and hence avoid repeat impression/restorations. The purpose of this article is to provide clinical do's and don'ts while using alginate material for impressions. Irreversible hydrocolloid can be used in preliminary impressions, provisional crown-and-bridge impressions, study models, opposing dentition impressions.Alginates are used for impressions in orthodontic models, sports mouth guards, and bleaching trays; and more. [2] A study has shown that alginate impressions can be used as final impressions for indirect restorations when the preparation margins are chamfer.

The powder contains sodium alginate, calcium sulfate, trisodium phosphate, diatomaceous earth, zinc oxide, and potassium titanium fluoride. On mixing the powder with water, a sol is formed, a chemical reaction takes place, and a gel is formed. Here, sodium alginate reacts with calcium sulfate, resulting in sodium sulfate and calcium alginate. This reaction occurs too quickly often during mixing or loading of the impression tray. Hence it is slowed down by the addition of trisodium phosphate to the powder. [3] Trisodium phosphate reacts with calcium sulfate to produce calcium phosphate, preventing calcium sulfate from reacting with sodium alginate to form a gel. This second reaction occurs in preference to the first reaction until the trisodium phosphate is used up, and then alginate sets as a gel. There is a well-defined working time during which there is no viscosity change. Alginate materials possess the qualities of good surface detail and faster reaction at higher temperatures. They are elastic enough to be drawn over the undercuts but tear over deep undercuts and are not dimensionally stable on storing due to evaporation. [4]

Alginates are non-toxic and non-irritant. Alginate powder is unstable on storage in the presence of moisture or in warm temperatures. Alginate impression materials are hydrophilic in nature, and this property facilitates making of accurate impressions in the presence of saliva or blood. [5] It has a low wetting angle and hence full arch impressions are easily captured. Impressions made with irreversible hydrocolloids are easier to remove than those with elastomeric materials. As their tear strength is low, they can reproduce subgingival contours and anatomy but tear upon removal. They are good for only one pour per impression. Alginate impression materials are easy to use, less expensive, with quick setting time. The setting time can be controlled with the temperature of water used. They are mildly flavoured. [6] Their disadvantages include less accurate reproduction of details as compared with elastomeric impression materials, poor dimensional stability, and that they are messy to work with. The most popular form of alginate is supplied as a powder, which is mixed with water. Many alginates are supplied with a reaction indicator that changes colour of the impression when the material is set; and presently, dustless alginates are preferred. Powder may be available in bulk form in containers or in individual sealed pouches. Paste type of alginate is also available. [7] Paste form is available in two viscosities, tray and syringe viscosities. The paste-type material has a shorter gelation time than the powder-type material. The best surface quality can be obtained with the paste-type material. Studies suggest that a paste-

type material would better meet the requirements of an alginate impression material. Christensen GJ had observed that high points on indirect restorations are a result of inaccurate opposing arch impressions from alginate materials. Predictable alginate impressions can be made by adhering to a protocol. [8] The steps involved are selection of impression tray, mixing and loading of alginate impression material, preparing the mouth, making the impression, removal/inspection of the impression, and storage and disinfection

Irreversible hydrocolloid impression material like Alginate is one of the most common materials used for making an impression of the mouth. Dental impressions can act as a vehicle for the transmission of infectious agents to dental personnel or the dental casts. The risk of infections transmitted by saliva and blood is considered a potential occupational hazard in dentistry. Therefore, all the alginate impressions should be disinfected before being poured with gypsum. The most common method used for disinfection is either by spraying the disinfecting agents on alginate impressions or by immersing the impressions. [9]

Infection control has become an imperative issue in dental practice. The risk of infections transmitted by saliva, blood and plaque is considered a potential occupational hazard as they contain pathogenic microorganisms and viruses which can transmit diseases from simple to highly virulent such as common cold, pneumonia, tuberculosis, viral hepatitis, herpes and acquired immunodeficiency syndrome. In hepatitis B there are over 1000 million viral particles per ml of blood and in AIDS there are up to 100 viruses per ml of blood. Studies show that tuberculosis and hepatitis B microbes can survive up to 7 days or longer at room temperature. Thus increased awareness about the viability of these organisms is very important to take important steps to prevent cross-contamination. Therefore, disinfectant is used in the form spray or immersion technique. Disinfection is defined as the destruction or removal of all pathogenic organisms, or organisms capable of giving rise to infection. Disinfectant solutions that contain chlorine are widely used in research on disinfection of impressions because they act rapidly against microbes, combat a wide range of bacteria, viruses and tubercles, and are also economical and effective. [10]

Dimensional accuracy during impression making is essential to the quality of prosthodontics treatment and impression technique is a critical factor affecting this accuracy. Dimensional accuracy and reproduction of anatomic detail are important requisites for an impression used in the fabrication of dental castings, it is important to study the effect that disinfectants have on the accuracy and reproduction of fine detail of impressions. An accurate impression has a significant role in the success of treatment. If the final cast does not reconstruct the patient's mouth, [11] it would lead to inappropriate adaptation and mandate repeated impressions which ultimately increase the number of visits and costs of treatment. [12]

In this present study, accuracy in dimensional stability of alginate impression after immersing into Korsolex (2% of alkaline glutaraldehyde) disinfectant was studied.

II. MATERIALS AND METHODS

Normal setting alginate (Zhermack, Badia Polesine, Italy) was used as the impression material. Alginate impressions were prepared by chromatic alginate according to manufacturer's instruction.. Korsolex disinfectant was used as a disinfectant agent on alginate irreversible hydrocolloid impression material. The study was conducted with 45 samples of alginate impressions made on a Type III gypsum model. The samples were

equally divided into three groups of 15 each (Control, Post immersion 10 mins, Post immersion 20 mins) [13]. Impressions in the control group were washed with tap water. The test groups were immersed in Korsolex disinfectant solution, one group for 10 minutes and another group for 20 minutes respectively. Casts were made from all the impressions and predetermined points (distance between lingual cusp tips of first premolars and mesiopalatal cusp tips of first molars) were measured on the casts. The casts were scanned using an optical scanner of a CAD/CAM milling machine. The distance between premolars and molars were measured in the virtual casts using CAD/CAM analysis software [14].

III. RESULTS

There wasn't any dimensional change after 10 minutes in most of the sample but dimensional change were seen after 20 minutes time in most of the sample.

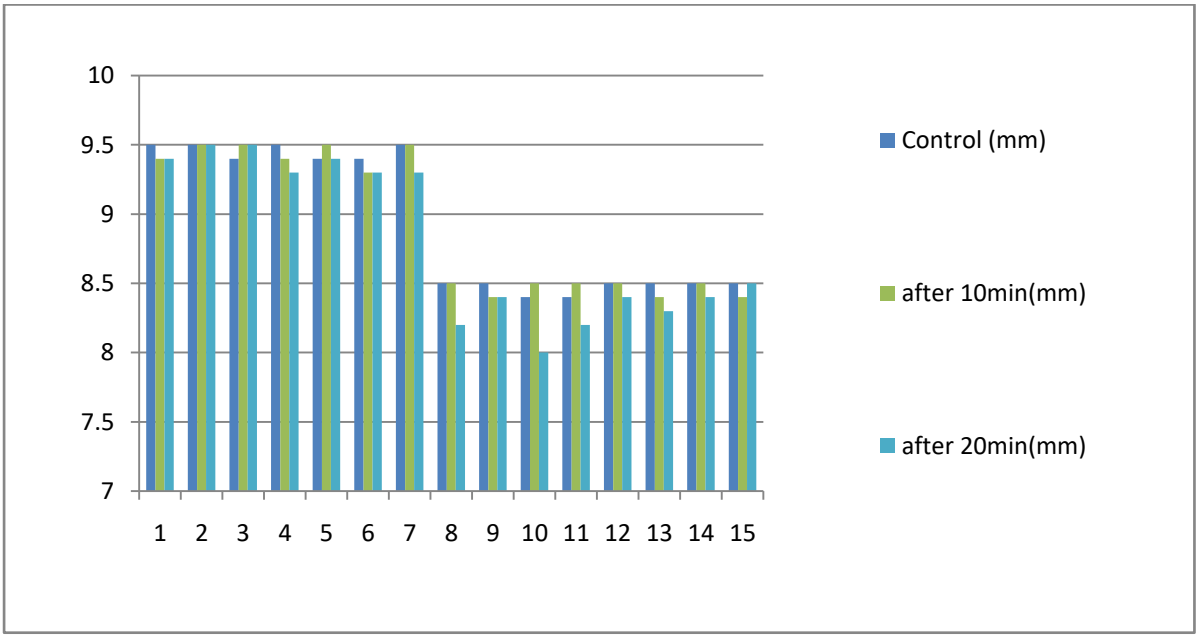

Figure 1 shows value of 15 samples at different time intervals.

The dimensional stability was measured through CAD CAM technology. The mean value of control group was 9.42+- 0.7119 SD, after 10 minutes it was 9.423 +- 0.7285 SD and after 20 minutes it was 9.446 +- 0.8202 SD. The difference was statistically significant when immersed more than 20 minutes. The details are given in table 1.

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Predisinfection	.336	15	.000	.711	15	.000
Post10mins	.328	15	.000	.728	15	.000
Post20mins	.271	15	.004	.820	15	.007

TABLE1: shows the standard deviation value statistically of the dimensional stability of alginate toward disinfectant

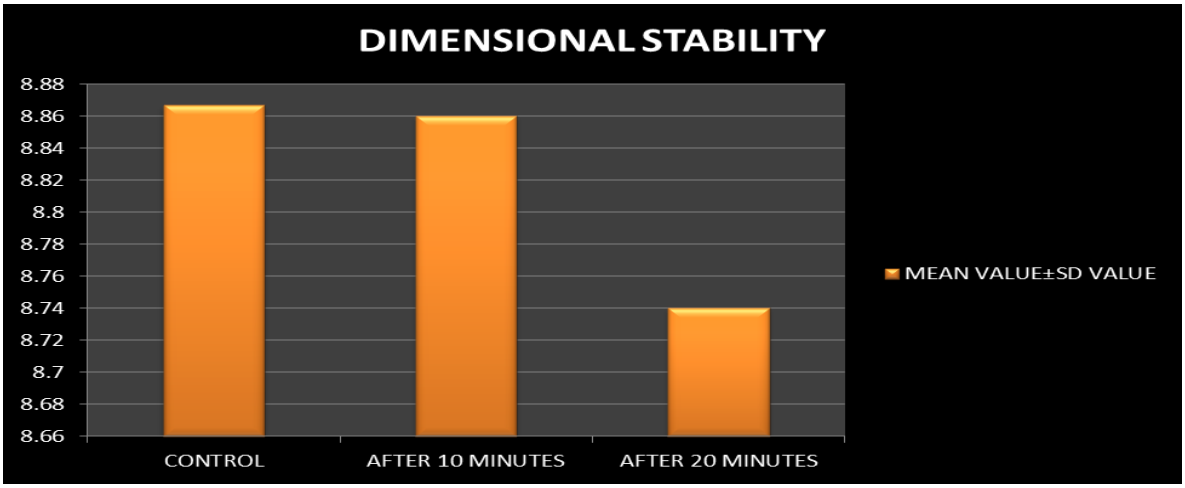

Figure2 shows the mean/SD value of control group, after 10minutes, and after 20 minutes

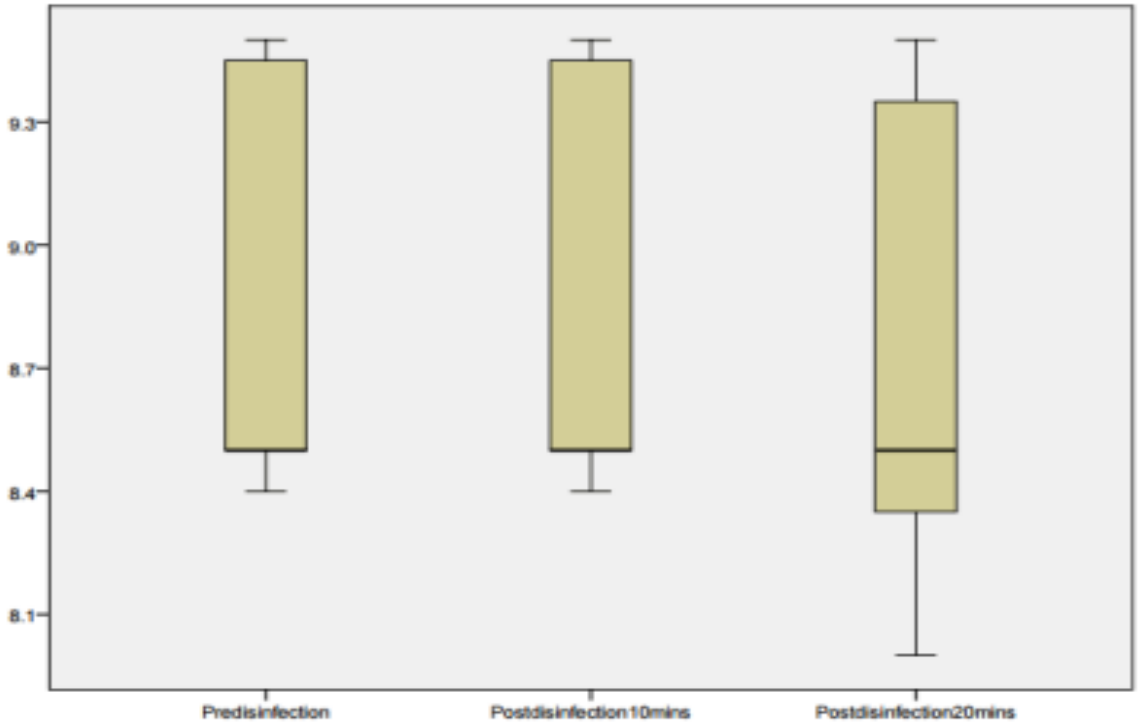

Figure3 shows the differentiation of dimensional stability of alginate before and after immersion in disinfectant

IV. DISCUSSION

Irreversible hydrocolloid is the impression material which when immersed in liquid, undergoes imbibition. In this study, the immersion method was used for the disinfection of impressions. As indicated by the present study, immersion in concentrations of Korsolex disinfectant for 10 minutes is sufficient to disinfect irreversible hydrocolloid impressions like alginate. Dimensional changes produced by chemical disinfection are not likely to affect the clinical performance. Many studies have reported the incompatibility of irreversible hydrocolloid with disinfectant solutions when immersed for more than 10 minutes. [15]

According to the findings of this study, disinfecting with Korsolex disinfectant solution by immersion time of 10 minutes has no significant effect on the dimensional stability seen whereas at 20 minutes time interval there were slight changes is seen. Statistical analyses revealed no difference between the groups. This indicates that immersion in Korsolex for 10 mins and 20 mins did not have much change in the dimensions of the impression. Korsolex is typically an instrument and equipment disinfectant and is bactericidal and virucidal in nature. From the results of this study it can be inferred that its use can be extended to disinfect alginate impressions as well effectively providing an economic method of cross-infection control.

Immersion system is considered to be time consuming by some dentists while ultraviolet chamber which is considered a cleaner and much easier method of disinfection. The American Dental Council on Dental Materials in 1996 [16] suggested the use of disinfectants like glutaraldehyde and sodium hypochlorite for

disinfection. The commonly used disinfectants used in this study were Korsolex (containing 2% of alkaline glutaraldehyde) and sodium hypochlorite (5.25%). Korsolex was diluted to 1:19 as per the manufacturer's instructions. Sodium hypochlorite solution was diluted 1:10. This resulted in 5000 ppm of available chlorine in the prepared solution. ADA recommended 10 min immersion in sodium hypochlorite with available chlorine of 5000 ppm. Manufacturer claim a period of 10 min immersion for 99.8% tuberocidal activity however slight dimensional changes is appreciated in the study [17].

The effectiveness of sodium hypochlorite and glutaraldehyde as a disinfectant is influenced by a number of factors including concentration and age of the solution, disinfection contact time and accessibility of the organisms, presence of organic material, presence of metal catalysts, pH, temperature, and chemical additives to the sodium hypochlorite.

The use of Korsolex for disinfection of irreversible hydrocolloid impressions appears to reduce the effects of syneresis and consequently results in casts with better surface quality than impressions rinsed only with running water. The impression materials used in the study are irreversible hydrocolloid as it is one of the impression materials used frequently in the making of a fixed as well as a removable prosthesis and ZOE paste as the most frequent final impression material in the complete denture.

Storer and McCabe [18] had investigated the effect of 2% glutaraldehyde, sodium hypochlorite (1% available chlorine) and 4% formaldehyde. They concluded that glutaraldehyde was the most suitable form of sterilisation. This was contrary to the findings in this study. The reason could be that amount of available glutaraldehyde for disinfection was much less. The possible explanation for this could be that the material used: Korsolex had formaldehyde and urea plasticizers also present in it. It was containing 7 g of glutaraldehyde which was to be diluted to 1:19 according to the manufacturer's instructions. The material used by the other research workers was pure glutaraldehyde without any other ingredient.

In the study, overall it was noted that the concentration of the microorganism was almost two folds in the alginate control group as compared to the addition silicone group. This could be explained due to the hydrophilic nature of the alginates. Not much difference was found in the persistence of the microflora on the impression surface of both the Indian and International brands of the impression materials studied.

The results of this are in agreement with Look et al [19]; Powell et al. [20] who revealed that the microbial load was two fold in alginate impressions as compared to elastomeric impressions. Study by Samaranayake et al. revealed that organisms transferred in alginate impressions are almost three to five times the number of organisms that were transmitted in case of elastomeric impressions under the same conditions.

Blair and Wassell [21] have suggested that all impressions regardless of the type of material should be immersed in 1% sodium hypochlorite for 10 min. This time is considered to be the minimum required for the effective use of all disinfectants. While Amin et al. [22] found that the best material for disinfection alginate and ZOE paste impression is the sodium hypochlorite concentration 0.5% for 10 min without a change in dimensions. Sheila et al. [23] studied effect alginate impression disinfection with sodium hypochlorite 1% for different time periods of 10 and 30 min, they concluded that the dimensions did not change in all times.

In the research carried out by Taylor et al [24] on dimensional accuracy of alginate impressions by sodium hypochlorite, the dimensional variation in impressions was insignificant, which is not consistent with

our study because of the difference in methods regarding the time of preservation of impressions and sodium hypochlorite dilution. Many studies have advocated the need to store irreversible hydrocolloid impressions in an environment of near 100% relative humidity in order to balance the loss and gain of water between the hydrocolloid and the environment.

The study has an implicated limitation as this *in vitro* study has not complied with the same effect as *in vivo* because it did not completely simulate the oral condition such as the presence of saliva, harbor environment of bacteria, and resiliency of oral tissue [25]. Therefore, in the future, additional clinical studies are necessary to clarify the long-term effect of disinfectants on the dimensional accuracy of impression materials.

V. CONCLUSION

Based on the results of the present study,There is no significant dimensional changes in alginate after 10 minutes of immersion in korsolex, whereas changes in dimensional stability is seen after 20 minutes of immersion with korsolex which is clinically significant and statistically it is insignificant. This disinfectant is ideal for 10 minutes immersion only. Hence, further study are recommended to evaluate microbial count and also with different disinfectant solution to find a solid evidence.

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