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ORIGINAL ARTICLE

The effect of sodium hypochlorite disinfectant on the linear dimensional stability of alginate impression material.

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ABSTRACT… Objective: To compare changes, in linear dimension of Alginate impression by disinfection with immersion in 0.525% Sodium Hypochlorite solution and no disinfection. **Study Design:** Randomized Control Trial. **Setting:** Department of Prosthodontics, Punjab Dental Hospital Lahore. **Period:** April 2018 to September 2018. **Material & Methods:** Sixty alginate impressions were made of a stainless steel die and were randomly divided into two groups. The 30 control group impressions were poured only after rinsing with tap water, whereas the 30 experimental group impressions were first immersed in 0.525% Sodium Hypochlorite solution for 10 minutes and then poured after rinsing with tap water. The distance between two engraved lines C and D on die were measured in the casts of both groups. **Results:** The mean difference of mean dimensional changes between both methods was 0.01mm. **Conclusion:** The disinfection of the alginate impression material by immersion in 0.525% Sodium Hypochlorite solution does not cause significant effect on dimensional stability of alginate impression material.

Key words: Dental Impressions, Dimensional Stability, Disinfection.

INTRODUCTION

Alginate has been widely used in dentistry as an impression material for obtaining both study and working cast. The good acceptance of alginate as an impression material is because of its capability of recording impression surfaces with acceptable accuracy, its hydrophilic nature, setting mechanism, operator and patient friendly nature and cost effectiveness. However, it is necessary to disinfect the impression because it has tendency to embed micro-organisms from blood and saliva.[1,2] In 1998, FDI guidelines suggested that all impression materials should undergo disinfection before dispatching to the dental laboratories.[1,3]

Immersion and spray are two methods of disinfection. Immersion technique cover all surfaces of impression materials in one time, while spraying is not capable of disinfecting all impression surfaces effectively.[4] Chemical agents recommended for the disinfection of dental impressions include sodium hypochlorite, glutaraldehyde, iodophor and phenol. However, there may be an undesirable side-effect associated with the disinfection process due to chemical or physicochemical interaction between the set material and the disinfecting solution.[5]

Sodium hypochlorite is the recommended disinfectant for alginate.[3,5,6] It is considered to be a good surface disinfectant, non-irritating and efficient against wide spectrum of microorganisms.[5] Badrian H et al. investigated the antimicrobial effect of sodium hypochlorite 0.525%, Deconex, and Epimax. They concluded that the use of 0.525% sodium hypochlorite spray on the surface of alginate effectively disinfect 96.6% of the samples.[6] Significant dimensional changes have already reported with higher concentration of NaOCl,. With 2% sodium hypochlorite, de Moura found a mean change

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in linear dimension of 0.39 mm, SD ± 0.0498.[7] Panzia in his study found decrease in dimension after disinfection with 1% sodium hypochlorite for 15 min (p=.05).[8]

Since none of the mentioned disinfection protocols have been accepted as gold standard and many removable partial dentures are constructed on working casts obtained from alginate impressions, thus copy properties of impression material along with good quality of dental stone reproduction help obtaining more reliable casts to execute cases successfully. Therefore any linear dimensional change in the impression due to disinfection will affect the fit of the dental prosthesis. Moreover most of the literature available used sodium hypochlorite in 2% concentration for alginate disinfection.[7,9,10] However Badrian (as mentioned above) concluded that even much less concentration of 0.525 % sodium hypochlorite has effective anti-microbial action.[6] Thus, the aim of this study is to determine mean change in linear dimension of alginate impression surface after disinfection with 0.525% Sodium Hypochlorite so as to find out the best of dental prosthesis.

MATERIAL & METHODS

It is a randomized control trial study was conducted at Punjab Dental Hospital from April 2018 to September 2018 having primary objective to evaluate the effect of disinfection of commercially available irreversible hydrocolloid impression materials with 0.525% sodium hypochlorite on the dimensional accuracy of dies produced using type 3 dental stone. In this study sixty alginate impressions were made of a stainless steel die, fabricated according to ADA specification no 19.[7] The dimensions of the die are 38 mm diameter of the body, 29.97mm diameter of the raised column and 31 mm height of the body and 3 mm height of the raised column (Figure-1). The distance b/w Lines C and D on the raised column is 25mm. As shown in figure 2. Impression material used was CAVEX CA-37 Normal Set.

The material was packed in the specially designed impression tray and the die pressed into the tray. Flawless impressions (free of voids, distortions, show through and detachments) were recorded by CAVEX CA-37 Normal Set / Dust Free alginate and disinfected by 0.525% Sodium hypochlorite solution from Hamayun Laboratory Supplies (only for non-control group). Impressions which were distorted or detached from the impression tray or having voids or show through were not included in this study. The whole apparatus was kept in water at 37°C during the setting time, to simulate the humid oral environment. and were divided later into two groups using lottery method. Group A (n=30) were rinsed with distilled water for 15 seconds. Group B (n=30) were disinfected with 0.525% sodium hypochlorite solution by immersion methods for 10 mins and then rinsed by distilled water for 15 seconds. After that the impressions were poured in type 3 dental stone. C-D distance (Figure-2) was measured by digital VERNIER caliper on the poured casts and compared with the original distance on the die.

To compare any difference in the dimensional changes in the C-D distance between the two groups, the independent sample T test was applied. No significant difference was calculated for the mean difference in the C-D distance (p = 0.105). As this was lab study, this research was exempted from any review by the ethical review board.

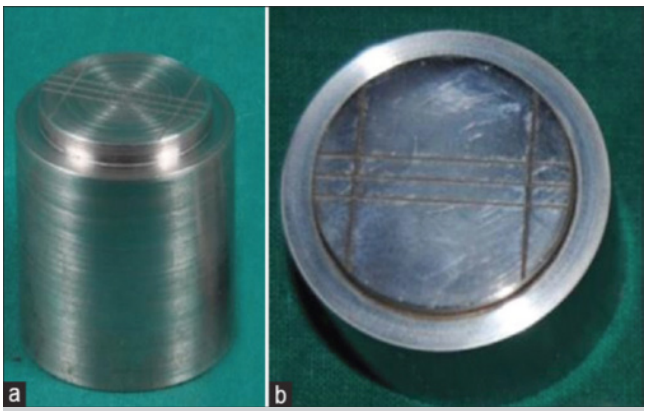


Figure-1. (a) Stainless Steel die ADA spec. 19. (b) Inscribed Lines on die.

RESULTS

This was a controlled trial designed to assess the dimensional stability of the alginate impression material when disinfected by 0.525% Sodium Hypochlorite Solution. C-D distance on the stone dies was calculated using the vernier caliper

Mitutoyo No. 505-633. The dimensional changes in the C-D distance for the control group have been illustrated in Figure-3a. For the experimental group, these measurements have been illustrated in Figure-3b.

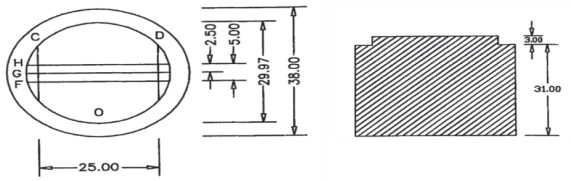
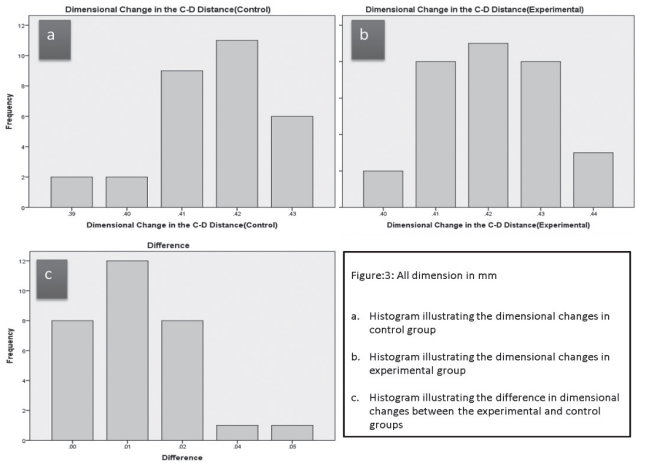


Figure-2. Schematic diagram of stainless steel die ADA spec. 19

The mean difference in dimensional changes in the C-D distance between control and experimental groups have been illustrated in Figure-3c and Table-I.

To compare any difference in the dimensional changes in the C-D distance between the two groups, the independent sample T test was applied. No significant difference was calculated for the mean difference in the C-D distance ($p = 0.105$).



Control Group (mm)(mean ± SD)	Experimental Group (mm)(mean ± SD)
0.4207 ± 0.011	0.4157 ± 0.011

Table-I. Mean difference in dimensional changes in the C-D distance between control and experimental groups have been illustrated.

DISCUSSION

Various techniques of disinfection of dental impressions have been identified and experimented with varying degree of success, such as chemical disinfection by immersion or spraying by a chemical disinfectant, use of microwave radiation and ultraviolet radiation, etc. Chemical disinfection has been proved to be the most effective method by many researchers.[11,12] Sodium hypochlorite is one of the original and most widely used disinfectant. It has been recommended in concentration of 0.525%, 1%, 2%, as an effective disinfectant for alginate impressions by many studies.[6,7,8]

In a study Hiraguchi et al[13] investigated the effects of disinfection of combined agar/alginate impressions on the dimensional accuracy of stone casts obtained from them. Impressions of master cast, that was designed to simulate an abutment tooth, were prepared by combining each of two brands of cartridge-form agar impression materials with an alginate impression material. The impressions were disinfected by both immersion and spray method by 1% sodium hypochlorite and 2% glutaraldehyde. The dimensional changes in the stone casts were compared to the control group having no disinfection. Results indicated that storage for 10 minutes after spraying with 1% sodium hypochlorite was an appropriate disinfection method for combined agar/alginate impressions, as well as immersion in 1% sodium hypochlorite for 10 minutes. Many studies showed significant dimensional changes occur in alginate impressions with higher concentration of sodium hypochlorite disinfectants.[7,8] Regarding dimensional change, de Moura found a mean change in linear dimension of 0.39 mm, SD ± 0.0498 when the Alginate impressions were disinfected with 2% sodium hypochlorite, & 0.44 mm, SD ± 0.0141 when the disinfectant was replaced by Distilled water.[7] Porrelli stated that Linear measurements are affected choice of reference points of die. He also stated that evaluating the average variations of the structure surfaces that are affected by the operator, local variations can be minimized.[8]

In this study, concentration of 0.525% sodium hypochlorite is used to assess its effect on dimensional stability of alginate impressions and found that with 0.525% Sodium hypochlorite, the linear dimensional changes were non-significant

(p=0.105).

The result of the present study agrees with studies of Rentzia et al[9] and Suha f. Dulaimi.[4] They concluded that the dimensional accuracy of irreversible hydrocolloid impression material was not affected by immersion in 0.525% sodium hypochlorite solution for up to 300 seconds. This however is in conflict with the study of Sharif et al.[14], who incorporates 0.525% NaOCl as mixing water substitutes for dental stone. The significant dimensional change ($p<0.05$) in this study could be explained by the differences in the methodology used in these studies.

It is recommended that impression should be disinfected as a routine procedure by either immersion in glutaraldehyde or sodium hypochlorite solution or by storage in sealed bags after being sprayed by these disinfectant agents.[15] Chemical disinfection of impressions using a disinfectant solution by both immersion and spray technique has been advocated. Although alginate or irreversible hydrocolloid material imbibes blood and saliva. Ulgey et al[16] demonstrated that immersion rather than sonicator activated was more effective, as it covers all surfaces of impressions. Since the linear dimensional changes in the resultant stone casts were not significant, it is safe to say that alginate may be disinfected effectively by immersion in sodium hypochlorite solution without any unwanted dimensional alteration in the resultant stone casts, thus enabling the laboratory technician to manufacture adequately accurate prostheses.

CONCLUSION

Within the limitations of this study it can be concluded that Disinfection of the Alginate impressions by immersion in 0.525% solution of Sodium hypochlorite does not produce any significant dimensional changes.

The limitations of the study were that we used only single type of disinfectant, its concentration and brand of alginate. For future studies the effect of other disinfectants on alginate impression and effect of residual disinfectant on gypsum cast must be explored. Furthermore, this was an in vitro study, thus in vivo study must be performed with replication of clinical setting. Lastly, scanning electron microscope should be used for better measurements.

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