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ORIGINAL ARTICLE

Comparison of Mean Dimensional Stability of Self Disinfecting Alginate Impressions with Alginate Impression Disinfected Through Immersion Method

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ABSTRACT

Objective: The aim of this study was to compare the mean dimensional stability of self-disinfecting alginate impressions with alginate impression disinfected through immersion method.

Materials and Methods: A total 394 edentulous patients were randomly allocated in two groups: Group A (self-disinfecting alginate (mixed with chlorhexidine), Group B (soaked in disinfectant (immersed in chlorhexadine). Impressions from patients in group A were subjected to self disinfection via chlorhexidine mixed with alginate powder, Group B: Alginate impressions obtained from patients were subjected to disinfection with chlorhexidine via immersion method. Post disinfection anteroposterior and medio-lateral dimensions were recorded using electronic digital caliper. The data was analyzed using SPSS version 10.0. Student-t test was applied for anteroposterior and mediolateral dimensions. The confidence interval was 95% and $p<0.05$ was kept as statistically significant.

Results: The mean age in group A was 64± 3.75 years, while the mean age in group B was 62± 2.17 years. In group A, 89(45%) patients were male and 108(55%) patients were female. While in group B, 93(47%) patients were male and 104(53%) patients were female. Mean anteroposterior dimension (AB) in group A was 35.82± 0.06mm. Where mean anteroposterior dimension (AB) in group B was 35.91±0.07mm. Mean Medio lateral dimension (BC) in group A was 35.66± 0.05mm. While Mean Medio lateral dimension (BC) in group B was 35.73±0.06mm.

Conclusion: This study concludes that mean dimensional change values in self disinfecting alginate was similar to that of an alginate impression immersed in 0.2 percent chlorhexidine solution.

Keywords: Alginate impression, self disinfecting alginate, alginate impression, immersion,disinfection.

INTRODUCTION

Infection control is a must in all the fields of medicine including dentistry. There is a higher potential of cross infection during various dental procedures which makes standard infection control compulsory [(1,2)]. Oral cavity is a niche for a large number of microorganisms including both opportunistic and pathogenic [(3)]. Impressions, casts, other intra-oral records and patient's oral prosthesis or other appliances may be contaminated with oral micro-flora or other organisms of varying pathogenicity from patient's saliva and/or blood [(4)]. Dental impressions polluted with salivation and/or blood represent a potential danger in the spread of various contagious infections among dental specialists, patients, technician, other ancillary staff and research center personnel [(5)]. In this manner cleansing of the impression is an essential maneuver in anticipation of sicknesses for the different dental treatment procedures [(6)].

Various materials and techniques are utilized for disinfection. A more current and more secure method is that unless demonstrated, otherwise all patients are viewed as contagious illness bearers considering highly thorough flushing and cleansing important for all impressions. International Dental Federation and American Dental Association have concocted rules for disinfection of impressions, chomp enlistments and machines on routine premise to minimize cross infection [(7,8)].

Amongst the numerous accessible impression material, Irreversible Hydrocolloid i.e. Sodium Alginate, is a standout; the most regularly utilized dental impression material. Its lower cost, good viability, wide accessibility and simplicity makes it a routinely utilized impression material [(9)]. But because of its property of imbibition of fluid (salivation and/or blood) it conveys an essentially higher quantities of microorganisms [(10,11)]. Disinfectants can affect the impression materials, for example, dimensional accuracy, loss of surface areas of interest of impression and the resultant cast [(12)]. Subsequently a cleansing method ought to be precisely picked in term of security to impression and the resultant cast. Two of the most broadly used methods are spray and immersion. However, both have certain disadvantages [(13).] Reasons being; time utilization, additional cost, loss of surface subtle elements and dimensional changes. [(14)]

To address these issues the idea of self disinfecting irreversible hydrocolloid has been devised. [(13,14)] Most of the techniques to accomplish self sanitization have been through augmentations into the powder, while increases of disinfectants into the fluids have been investigated lesser. [(13)] Chlorhexidine gluconate (0.2%), sodium peroxysulphate (1%) and sodium dichloroisocyanaurate (0.0002%) have been utilized separately as water substitutes for blending an alginate [(14)]. However not every single disinfectant arrangement is a reasonable substitute for water [(15,16)].

The self disinfection method has been utilized as a part of our study and a correlation between the conventional and substantially more common technique for impression immersion and self disinfecting alginate would be made in reference to the dimensional change. It would be more suitable for complete sanitization of alginate that 0.2% chlorhexidine is utilized for making the alginate impressions. This will guarantee complete sterility and sanitization of the impression. As indicated by a study led by Jian Wang, there was no critical contrast between mean dimensional estimations of Alginate impression utilizing self sanitization strategy and immersion technique; mean dimensional estimation of Alginate impression utilizing immersion technique was 10.36+0.06 (-0.38%) and self purification was 10.37+0.05 (-0.29%) in anteroposterior measurement and 10.34+0.04(0.19%) with submersion technique and 10.35+0.03(0.29%) with self-disinfecting Medio lateral dimension [(16)].

The objective of this study was to compare the mean anteroposterio and mediolateral dimensions of alginate impression using two different techniques.

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MATERIAL & METHODS

This randomized controlled trial was carried out in the department of Prosthodontics, Rehman College of Dentistry, Peshawar from January 2023 to June 2023. A total of 394 patients were selected using WHO formula for sample size with 80% power of test and 95% confidence interval through non-probability convenient sampling technique and divide into two groups 197 in each group; Group A: self-disinfecting alginate, Group B: immersed in chlorhexadine. The age selected was 40-70 years. Edentulous patients with normal palatal width (35-45mm), length (45-55mm) and vault were selected. Tray flanges, impression material detached from the tray and impression from incompletely seated tray were excluded in this study. An approval was taken from the ethical review committee of the hospital. The purpose and benefits of the study was explained to the patients and a written informed consent was obtained. From all edentulous patients, alginate maxillary impressions was recorded. All the obtained impression was then being washed with running tap water for 10 seconds to render them free from saliva or any other fluid/debris from the oral cavity. A standard tripod was constructed having three metal posts on three corners of the tripod 35mm apart; each of which is 3mm in length and 1 mm in diameter as shown in figure1. Alginate impression obtained from the patient was marked closed to the palatal vault area using the same standard tripod for all patients. (figure 2). The marks on the alginate impression obtained through standard tripod was designated as A, B and C Immediately after removal from the disinfectant, measurements were done on the cast obtained after pouring the marked impression after pouring it with dental stone (Dent America) using a standard Vernier calliper in anteroposterior (AB) and Medio lateral (BC) dimensions (Figure 3). All the measurements and disinfection procedures were conducted under supervision. All the disinfection procedures were conducted in uniformly maintained temperature of 18-24 ^{o}C and the alginate material used was from same brand i.e. Algimajor (Major Prodotti Dentari S. p. A, Italy). All the above mentioned information including name, age, gender and address was recorded in a predesigned Performa. Strictly exclusion criteria had followed to control confounders and bias in the study results. The data collected was entered and analyzed in SPSS (version 10). Frequency and percentage were calculated for categorical variables like gender. Mean (+ SD) was calculated for continuous variables like age, Anteroposterior dimension (AB) and Medio lateral dimension (BC). Student t-test was applied to compare the Anteroposterior dimension (AB) and Medio lateral dimension (BC) in both the groups. Also both the parameters were stratified among the age and gender to see the effect modifiers. All the data was presented as tables and/or charts.

RESULTS

Age distribution among two groups was analysed as in group A (self disinfecting alginate (mixed with chlorhexidine), 20(10%) patients were in age range 40-50 years, 75(38%) patients were in age range 51-60 years, 102(52%) patients were in age range 61-70 years. Mean age was 64 years (SD ± 3.75). Whereas group B (soaked in disinfectant (immersed in chlorhexidine), 24(12%) patients were in age range 40-50 years, 75(38%) patients were in age range 51-60 years, 98(50%) patients were in age range 61 70 years. Mean age was 62 years (SD ± 2.17) (Table No.1). Gender distribution among two groups was analysed as in group A (self disinfecting alginate mixed with chlorhexidine). Male subjects were 89(45%)and 108(55%) subjects were female. In group B (soaked in disinfectant (immersed in chlorhexidine), 93(47%) patients were males and 104(53%) patients were female. (Table No.1) Mean anteroposterior dimension (AB) in group A (self disinfecting alginate (mixed with chlorhexidine) was 35.82 mm (SD ± 0.06). Mean anteroposterior dimension (AB) in group B (immersed in chlorhexidine) was 35.91 mm (SD ± 0.07). (Table No.1). Mean Medio lateral dimension (BC) in group A (self disinfecting alginate (mixed with chlorhexidine) was 35.66 mm (0SD ± 0.05). Mean Medio lateral dimension (BC) in group B (soaked in disinfectant (immersed in chlorhexidine) was 35.73 mm (SD ± 0.06). (Table No.1). Stratification of Mean anteroposterior dimension (AB) and Mean Medio lateral dimension (BC) with age and gender are shown in table 2.

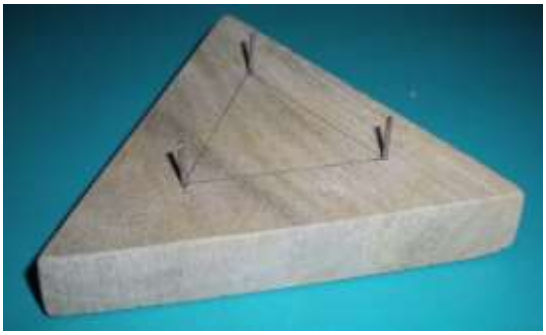

Figure 1. Standard tripod having three metal posts

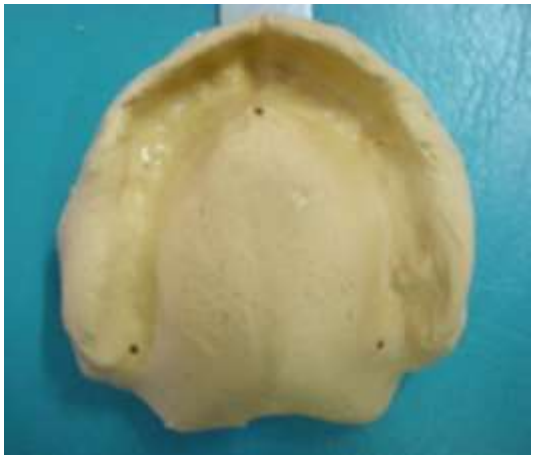

Figure 2: Marked dental impression with tripod

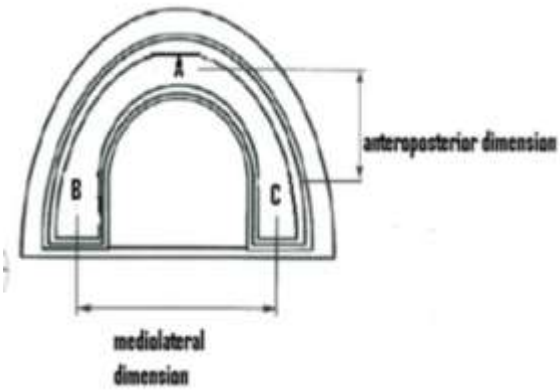

Figure 3: Measurement of Anteroposterior and medio lateral dimensions.

Table1: Descriptive statistics (n=394)

Age & Gender		Group A	Group B
Age	40-50 years	20(10%)	24(12%)
	51-60 years	75(38%)	75(38%)
	61-70 years	102(52%)	98(50%)
Total		197(100%)	197(100%)
Mean and SD		64years ±3.75	62 years ±2.17
Gender	Male	89(45%)	93(47%)
	Female	108(55%)	104(53%)
Anteroposterior Dimension AB		35.82±0.06	35.91±0.07
Medio lateral Dimension BC		35.66±0.05	35.73±0.06

Table 2: Stratification of mean anteroposterior and medio lateral dimension w.r.t age group and gender distribution (n=394)

Dimension and age		Group A (mean ±SD)	Group B (mean± SD)	P value	Dimension & Gender		Group A (Mean ±SD)	Group B (Mean± SD)	P value
Anteroposterior	40-50 years	35.11±0.04	35.20±0.04	0.0001	Anteroposterior	Male	35.13±0.04 35.66±0.05	35.21±0.04 35.73±0.06	0.0001
	51-60 years	35.69±0.06	35.85±0.06			Female	35.51±0.04	35.62±0.04	
	61-70 years	35.02±0.07	35.12±0.07						
Medio lateral	40-50 years	35.49±0.04	35.65±0.05	0.0001	Medio lateral	Male	35.13±0.04 35.66±0.05	35.21±0.04 35.73±0.06	0.0001
	51-60 years	35.57±0.04	35.61±0.05			Female	35.51±0.04	35.62±0.04	
	61-70 years	35.69±0.05	35.86±0.06						

DISCUSSION

This study was conducted to compare the mean dimensional values in alginate impression immersed in chlorhexidine and alginate impression powder mixed with chlorhexidine (self disinfection). The conclusions drawn from studies on dimensional stability of the impressions disinfected cannot be analytically evaluated because the laboratory studies are different considering specimen dimensions, baseline measurements, and method of measurement and reporting. A common method accepted by researchers must be established for more precise evaluations and if direct data comparisons are required [16,17].

Our study results showed that mean age in group A (self disinfecting alginate mixed with chlorhexidine) was 64 years (SD ± 3.75) while mean age in group B (immersed in chlorhexidine) was 62 years (SD ± 2.17). In group A (self disinfecting alginate mixed with chlorhexidine), 89(45%) patients were male and 108(55%) patients were female. While in group B (immersed in chlorhexidine), 93(47%) patients were male and 104(53%) patients were female. Mean anteroposterior dimension (AB) in group A (self disinfecting alginate mixed with chlorhexidine) was 35.82 mm (SD ± 0.06). Where mean anteroposterior dimension (AB) in group B (immersed in chlorhexidine) was 35.91 mm (SD ± 0.07). Mean Medio lateral dimension (BC) in group A (self disinfecting alginate mixed with chlorhexidine) was 35.66 mm (SD ± 0.05). Where Mean medio lateral dimension (BC) in group B (immersed in chlorhexidine) was 35.73 mm (SD ± 0.06).

According to a study conducted by Jian Wang et al[14] there was no significant difference between mean dimensional measurements of Alginate impression using self disinfection method and immersion method; mean dimensional measurement of Alginate impression using immersion method was 10.36+0.06 and self disinfection was 10.37+0.05 in anteroposterior dimension and 10.34+0.04 with immersion method and 10.35+0.03 with self disinfection in Medio lateral dimension[16].For alginate chlorhexidine gluconate (0.2 percent) is recommended for use as a water substitute due to its proven biocompatibility [15]

A study conducted by I M Hamouda Internal disinfection of irreversible hydrocolloid was the preferred disinfection technique because it allows immediate pouring of the impression after removal of impression from patient's mouth. This study revealed that addition of mouthwashes as a disinfection of irreversible hydrocolloid impression material gave a good inhibition to microorganism than immersion and spray techniques because in addition technique, the disinfecting solution homogenously spread in between the molecules of irreversible hydrocolloid impression material. And the study also indicated that the mouth washes mixed with irreversible hydrocolloid impression material produced larger inhibition zones of growth than immersion and spray techniques. The setting time and viscosity were not adversely affected. The dimensional accuracy of the resultant stone cast was suitable [18].

According to American Dental Association specification number 18, the maximum clinically acceptable permanent deformation is 3%. Sodium hypochlorite significantly reduced the surface detail reproduction, whereas no change in detail reproduction was observed with chlorhexidine [19].

Alajlan used microbiologically experimental methods and observations corresponding to practice the efficiency of the addition of antiseptics to alginate is evaluated. The addition of chlorhexidine to the alginate leads to a considerable reduction of the amounts of germs, but 100% disinfection of the alginates is not always performed. An influence of the alginate materials and the water quality on the antimicrobial efficacy of chlorhexidine has been proved. The always occurring contamination of the impression tray rules out a complete stopping of infection between the patient and the laboratory staff [20].

A study by hanan al harabi showed that mixing the alginate with the disinfectant agents resulted in acceleration of the setting time of alginate compared to the control specimen but non significant change in the 3-dimensional accuracy. Thus working time is decreased making the impression material harder to handle than usual [21].

A study by Ibrahim evaluated whether chlorhexidine mixed with irreversible hydrocolloid powder decreases microbial contamination during impression making without affecting the resulting casts. Chlorhexidine 0.12% or water were compared for alginate mixing. Surface roughness and dimensional stability of the casts were evaluated. Chlorhexidine mixed with irreversible hydrocolloid decreased the percentage of microorganisms when compared with water but did not affect the surface quality or dimensional stability of the casts [22].

The limitation of this study is the accuracy of measurement. The accuracy of measurement was not allocated and the study was two dimensional. Further study evaluating 3 dimensional analyses through microscope is required.

CONCLUSION

Our study concludes that mean dimensional change values in self disinfecting alginate was similar to that of an alginate impression immersed in 0.2 percent chlorhexidine solution for 10 minutes. Chlorhexidine gluconate 0.2 percent aqueous solution is effective and is the disinfectant of choice. The self disinfecting technique is one that can be easily incorporated into routine of general dental practice.

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