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Comparison of Dimensional Stability and Surface Detail Reproduction of Two Elastomeric Impression Materials Under Dry and Moist Conditions at Varying Time Intervals

Medical science

KEYWORDS : Dimensional stability, Surface detail reproduction, Polyvinylsiloxane impression material, Polyether impression material, Artificial saliva.

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ABSTRACT

Impression materials may contract or expand after impression making. Therefore, this study was conducted to compare the dimensional stability and surface detail reproduction of commercially available Polyvinylsiloxane and Polyether impression materials in dry and moist conditions at different time intervals. A total of eighty impressions of the custom made stainless steel die were made with both the impression materials in the dry and moist condition according to ADA specification 19. The impressions were tested after one hour, 24 hours and 72 hours of impression making, using a travelling microscope. Under dry as well as moist conditions, polyvinylsiloxane showed significantly higher mean dimensional variation as compared to polyether impression material. Under dry conditions, polyvinylsiloxane showed better surface detail reproduction. Under moist conditions, polyether showed better surface detail reproduction.

INTRODUCTION

Impression materials have long been an arena of interest in dentistry. Two of the most popular elastomers used in dentistry are the addition polyvinylsiloxane and polyether impression materials.

The two important considerations towards the successful fabrication of a prosthesis are the dimensional stability and surface detail reproduction of the impression material used. The storage time of impressions is another critical factor which may influence the dimensional stability and surface detail reproduction. Earlier studies have been conducted to compare the dimensional accuracy and surface detail reproduction of impression materials wetted by water1,2,3. But, there is a lot of difference between the properties of water and saliva, which we encounter in the oral cavity.

Keeping in view the above mentioned factors, this study was undertaken to determine and compare the dimensional stability as well as the surface detail reproduction of commercially available polyvinylsiloxane and polyether impression materials under dry and moist conditions using artificial saliva and to compare the changes after one hour, 24 hours and 72 hours of impression making.

MATERIALS AND METHOD:

The test materials used in this study were addition polyvinylsiloxane (Aquasil Monophase - Dentsply) and polyether (Impregum Soft - 3M ESPE) impression material. The study was divided into two parts. In the first part of the study, dimensional stability of the two impression materials was evaluated. In the second part, the surface detail reproduction of the two impression materials was studied. The polyvinylsiloxane impression material was marked as group I and Polyether impression material was marked as group II.

Figure 1 Materials used in the study

Figure –2 Custom made die

Figure - 3 Retrieved impression

A custom made stainless steel die was fabricated according to ADA specification no.19. The die was scribed with 3 horizontal and 2 vertical lines. The horizontal lines were labeled 1, 2 and 3. The intersectional point between the vertical lines and the middle horizontal line was marked 'a' and 'b'. The distance between the points 'a' and 'b' was measured to determine the dimensional stability.

RESULTS

As shown in table 1, under dry conditions, in Group I, mean dimensional variation at 1 hour, 24 hours and 72 hours intervals was found to be 1.62±2.59, 1.71±2.58 and 1.72±2.65x10-2 % respectively whereas in Group II , the mean dimensional variation at 1 hour, 24 hours and 72 hours intervals was found to be 13.1±20.5, 13.9±20.4 and 14.2±20.6x10-2 % respectively. On comparing the data, both the groups showed a statistically sig-

nificant difference (p<0.05) at all the time intervals with Group II showing significantly higher mean dimensional variation as compared to Group I.

Table 1: Proportional Dimensional Variation in two materials at different time intervals under dry conditions
(Values are in % Variation x 10-2)

S. No.	Time interval	Group I (n=20)		Group II (n=20)		Significance of difference	
		Mean	SD	Mean	SD	"t"	"p"
1.	1 hr	1.62	2.59	13.1	20.5	2.479	0.018
2.	24 hr	1.71	2.58	13.9	20.4	2.648	0.012
3.	72 hr	1.72	2.65	14.2	20.6	2.669	0.011

As depicted by table 2, under moist conditions, in Group I, mean dimensional variation at 1 hour, 24 hours and 72 hours intervals was found to be 1.90±2.65, 1.99±2.68 and 2.16±2.75x10-2 % respectively whereas in Group II under the same conditions, the mean dimensional variation at 1 hour, 24 hours and 72 hours intervals was found to be 15.75±20.73, 16.80±20.80 and 22.60±24.18x10-2 % respectively. On comparing the data, both the groups showed a statistically significant between group difference (p<0.05) at all the time intervals with Group II showing significantly higher mean dimensional variation as compared to Group I.

Table 2: Proportional Dimensional Variation in two materials at different time intervals under moist conditions
(Values are in % Variation x 10-2)

S. No.	Time interval	Group I (n=20)		Group II (n=20)		Significance of difference	
		Mean	SD	Mean	SD	"t"	"p"
1.	1 hr	1.90	2.65	15.75	20.73	2.964	0.005
2.	24 hr	1.99	2.68	16.80	20.80	3.158	0.003
3.	72 hr	2.16	2.75	22.60	24.18	3.756	0.001

Effect of time on % dimensional variability in dry and moist conditions in both the groups, an increase in % dimensional variability was observed in both the groups under both the conditions with increasing time but the association was not statistically significant, for either of the group for either of two conditions (p>0.05).

Table 3: Number of lines visible at different time intervals in two groups under dry condition

S. No.	Time interval	No. of visible lines				Significance of difference	
		Group I (n=20)		Group II (n=20)			
		0-1	2-3	0-1	2-3	χ2	P
1.	1 hr	0	20	1	19	1.026	0.311
2.	24 hr	0	20	1	19	1.026	0.311
3.	72 hr	0	20	4	16	4.444	0.035
χ2		-		3.333			
P		-		0.189			

Table 4: Number of lines visible at different time intervals in two groups under moist condition

S. No.	Time interval	No. of visible lines				Significance of difference	
		Group I (n=20)		Group II (n=20)			
		0-1	2-3	0-1	2-3	χ2	P
1.	1 hr	15	5	6	14	8.120	0.004
2.	24 hr	15	5	6	14	8.120	0.004
3.	72 hr	16	4	6	14	10.001	0.002
χ2		0.186		-			
P		0.911		-			

DISCUSSION

In this study, polyvinylsiloxane exhibited greater dimensional stability than polyether under dry as well as moist conditions and the differences were statistically significant at all the time intervals (p<0.05). This behavior of the materials can be explained by the lesser polymerization shrinkage exhibited by polyvinylsiloxane impression material than polyether impression material.[2,3] In the previous studies, Eames et al (1979)[4], Lacy et al (1981)[5], Ciesco et al (1981)[6], Williams et al (1984)7, Johnson et al (1985)[8,] Thongthammachat et al (2002)9, working on the same materials, found the same results.

There are certain limitations to this study. This is an in vitro study, therefore, can not exactly simulate the oral environment. The wettability of the metal die used in the study is certainly different from the oral hard and soft tissues. While in the oral cavity, the impressions are made using an impression tray after application of tray adhesive, the tray and the adhesive were not used in the study. Further in vivo studies need to be carried out using impression trays and more sample size with extended time intervals.

CONCLUSION

On the basis of results obtained and their analysis, following conclusions were drawn:

1. Under dry as well as moist conditions, the polyvinylsiloxane impression material showed better dimensional stability than polyether impression material.
2. With increasing time, a decrease in dimensional stability was observed in both the impression materials under dry and moist conditions.
3. Addition polyvinylsiloxane impression material exhibited better surface detail reproduction than polyether impression material under dry condition, at all the time intervals. Polyether impression material produced better surface detail than addition polyvinylsiloxane impression material under moist condition at all time intervals.

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