Long Term Linear Dimensional Stability of Impression Materials

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3196

INTRODUCTION

A dental impression material serves as a communication medium which allows a dentist or laboratory technician to duplicate the oral topography and allows a stone model to be poured up for constructing prosthetic devices outside of the patient's mouth. The choice of impression material is made based on the impression techniques, detail reproduction, accuracy and patient's comfort. There are several characteristics of dental impression materials which are of interest. Accuracy within the limits of the clinical application is a primary consideration. This includes both the ability to reproduce the size and shape of the oral structure and to copy fine details. The key to pouring a cast accurately is the ability for an impression material to maintain its shape when subjected to temperature changes, moisture, pressure or other stress. The impressions made with these materials must be dimensionally stable for up to one week in general, or longer for some applications. However, most dimensional stability studies focus on a short term. Therefore, there is a need to investigate the long term dimensional stability of the impression materials.

OBJECTIVE

The aim of this study was to evaluate the long term linear dimensional stability of vinylpolysiloxane (VPS), polysulfide and polyether impression materials.

MATERIALS

AlgiNot (ALG, Kerr) LN 404LH76 - vinylpolysiloxane
Permlastic-Regular (PER, Kerr) LN3-3219 - polysulfide
Impregum Garant Soft LB (IMP, 3M/ESPE) LN 164744 - polyether

METHOD

The linear dimensional change was measured using a Titan Zoomatic Measuring Microscope (Model TM-II). Three specimens per product were prepared according to ISO Standard No.4823. Each material was mixed and placed to the stainless steel ring mold (30mmx3mm). The specimen was cured in the water bath at 35±1°C and was demolded after the setting time. Two points on the specimen corresponding to the two marks on the mold were marked with a permanent marker for easy identification. Measurement was made initially and then at predetermined time intervals (24 hours, 10 months, 27 months, 34 months) after the specimen was stored at room temperature. The linear dimensional change of the sample as compared to the ruled test block was calculated and reported in percent (%). Three measurements on each material were made and the dimensional change was averaged. Statistical analysis was performed using one-way ANOVA and Bonferroni's method for pair-wise comparisons to determine significant differences among group ($p<0.05$).

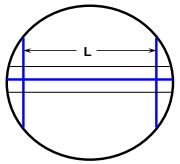

Figure 1. *The surface of the ruled test block.*

Figure 2. *Ruled test block and ring mold.*

(a) (b) (c)

Figure 3. *Sample specimens stored at ambient conditions for >34 months: (a) ALG, (b) PER, (c) IMP.*

RESULTS

	ALG(%)	PER(%)	IMP(%)
24 hr	0.996 ± 0.032[a]	1.342 ± 0.736[b]	1.350 ± 0.034[c]
10mo	1.071 ± 0.073[a]	1.543 ± 0.368[b]	0.783 ± 0.048[d]
27mo	0.938 ± 0.212[a]	1.557 ± 0.328[b]	melted
34mo	1.020 ± 0.181[a]	1.423 ± 0.232[b]	melted

*Means with the same letter within the same column are not statistical different at $p<0.05$.

DISCUSSION

The results of this study were presented in the above table. There were no statistically significant differences ($p<0.05$) in linear dimensional change for ALG and PER at 10, 27 and 34 months, indicating that both vinylpolysiloxane and polysulfide impression materials were very stable at the ambient conditions. However, IMP had a significant difference in linear dimensional change during the same storage periods and at the same storage conditions. The linear dimensional change dropped from 1.35% at 24 hours to 0.783% at 10 months. In the contrary to ALG and PER, the linear dimensional change of IMP could not be measured due to the dramatic change of the sample at 27 months. The sample became very soft and melted down on the wrapping paper. The cause of the melting was not clear. It might be due to moisture absorption from the air or due to degradation of polymer by the oxygen in the air.

CONCLUSION

The vinylpolysiloxane and polysulfide impression materials have a better long term dimensional stability than the polyether impression material when storage at ambient conditions.