牙科彈性印象材料在臨床使用上温濕度之影响

本校講師 兼
診所主治醫師
趙國雄

本校兼任講師
林景輝

Introduction

The use of hydrocolloidal alginate materials polysulfide rubber materials in dentistry is increasing daily and obtaining accurate and delicate impression of prepared cavities has been justified for many year. The chief advantage of those materials over the other well known types of impression materials is their ability to recover their shape and original dimensions after passing over undercuts and similar irregularities in teeth. But the disadvantage of hydrocolloidal materials are their lack of dimensional stability. Unless dies and casts are processed within a short period after the impression has been removed from the mouth, inaccuracies of form and dimension will occur.

One of the factors causes their deformation are the temperature rising and humidity changing. This fact has considerable clinical importance, it demonstrates the necessity of deforming the impression rapidly when it is removed from the mouth if the original dimensions are to be preserved. In order to examine more closely the influence of humidity and temperature in clinical deformation for those impression material, the testing method of elastic strain and permanent deformation were followed by the procedure described in new A.D. A.S. No. 19. The condition performed under two different temperatures and relative humidities According to this procedure, seven pecimens of each kind of impression materials were tested at given condition respectively. Each result is an average of seven determinations and its rang individual determination did not differ by more than 0.1% The results of this experimental series appear from Table 1,2 and 3. However, the evidence is clear that the clinical significance car be detected in those impression materials within 2 hrs or less, even when stored in different environment. It was the purpose of this research to evaluate how the influencing was the humidity and temperature under impression, and to compare how influenced with those materials for their deformation in clinical practicing.

Procedure

1. Materials

a) An alginate hydrocolloidal impression material (Technicol, made in Japan) The batch number CR.8

b) Polysulfide rubber base impression materials (Surflex, made in Japan) The batch number CR.86

c) A silicone rubber base impression materials (Flexcon, made in Japan) The batch number CJ,30

2. Condition

a) Two storage temperatures were used: (1) $30\pm2^{\circ}C$ and (2) $20\pm2^{\circ}C$.

b) Two storage media: 50-55% (in open air) in humidity and approximately 100% relative humidity were employed at all temperatures

3. Preparation of specimens

The testing specimens, which was shown in Fig. 1, have been made by placing a ring 2.5 cm inside diameter and 1.5 cm heigh, on a flat glass by filling the ring slightly more than one-half full with testing materials mixed according to the manufactures instruction. A metal mold 1.3 cm inside diameter, 2.5 cm outside diameter and 2.0 cm heigh was placed immediately inside the ring and was forced into the material until the mold touches the plate and the material has exuded on to the top of the mold. A flat glass or metal plate was pressed on the top of mold to remove excess material.

The specimen which to be tested at 100% in humidity waited two minutes after the start of mix. The mold and its accompanying plates were protected by a loosely rapped moistened cloth gauze and placed in the decicator which wast full of water in the bottom, where the specimen to be tested at 50-55% in humidity was placed in the open air. According to the condition of aging time and temperature of this study, the mold and plates were then removed from the decicator after the start mix. Drawing from the mold, the testing specimen have gotten ready for testing.

4. Method

Mesurement of elastic strain and perminent deformation were determined on testing specimens by the procedure described American Dental Association Specification No. 19 for elastomeric impression material According to this procedure, it was done in the following way.

30 minutes after the start of mixing, specimens prepared as specified in 3 were placed in a suitable instrument (Fig. 2) and were subjected to stresses of $100 g/cm^2$, $1000 g/cm^2$ $0 g/cm^2$ and $100 g/cm^2$ in that order, with each load on the specimen for one minute The strain is calculated from the difference the length of the specimen under the initial $100 g/cm^2$ stress and $1000 g/cm^2$ stress.

The permanent deformation is calculated from the difference in the length of the specimen under the initial and final $100 g/cm^2$ stresses, The reading are made 30 seconds after the application of the lood. The materials were also tested at times other than one hour after mixing[2], The results are shown in Table 1,2 and 3.

Table 1. Strain in compression and Permanent deformation for alginate materials.

condition	30 min		60 min		120 min	
	E%	P%	E%	P%	E%	P%
A	10.14	2.50	7.77	1.75	7.10	1.74
B	8.38	1.66	7.66	1.62	6.04	1.33
C	8.30	1.56	6.81	1.46	5.70	1.71
D	7.97	1.40	5.41	1.06	4.80	1.08

E : Elastic strain in compression

F : Permanent Deformation

Notice : Where A.B.C. & D are mentioned as shown in Fig 3.

Table 2. Strain in compression and Permanent deformation for polysulfide rubber materials

condition	30 min		60 min		120 min	
	E%	P%	E%	P%	E%	P%
A	5.58	2.34	5.52	1.42	5.18	1.16
B	5.34	1.68	5.23	1.41	5.00	0.99
C	4.77	1.33	4.58	1.01	4.41	0.96
D	4.41	0.98	4.38	0.96	4.23	0.94

Table 3. Strain in compression and Permanent deformation for silicon rubber materials.

condition	30 min		60 min		120 min	
	E%	P%	E%	P%	E%	P%
C	3.90	0.05	3.74	0.046	3.75	0.045
D	3.69	0.028	3.59	0.025	3.55	0.02

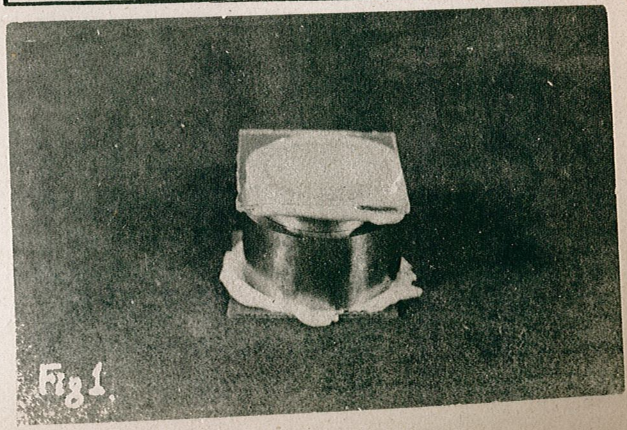


Fig 1.

Result

Results for those three impression materials stood at the two temperatures (30±2°C, 20 ±2°C) in 50-55% and 100% humidity can be seen in Table 1,2 and 3. while the relation between different condition for those impression materials is plotted in Fig. 3,4,5,6,7,8, and 9 individually.

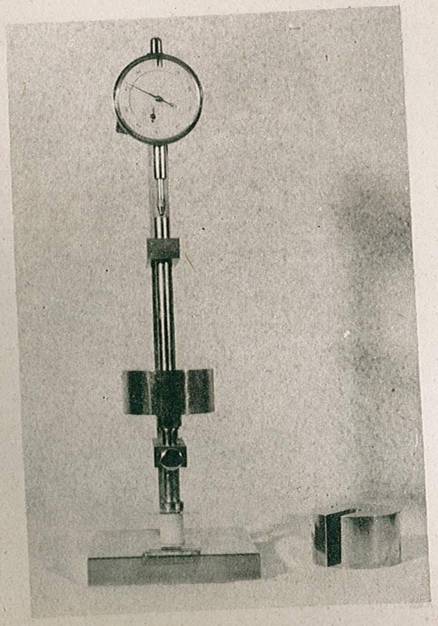
1) From Table 1,2 and 3 we have found that the elastic strain and permanent deformation of impression materials decrease gradually by decreasing temperature relative humidity at a given aging time and it also decrease by prolonging the time.

2) The hydrocolloidal impression materials which is dimensional unstable. From Fig. 3 we found its elastic strain and permanent deformation are keep on changing along the aging times but the polysulfide rubber base materials and silicon rubber base materials are more stable than hydrocolloidals materials as can be seen in Fig. 4 and 5.

3) Although the silicon rubber base materials are the most dimensional stable among the impression materials, but it is difficult to mix at the 30±2°C, under 100% in humidity.

4) The results are shown in Fig. 8 and 9 the hydrocolloidal materials. and poly-sulfide rubber base materials are more dimensional changeable of elastic strain and permanent deformations at low temperatrre than at heigh temperature, but they are most unchangeable under 20°±2°C,100% humidity.

Fig 2



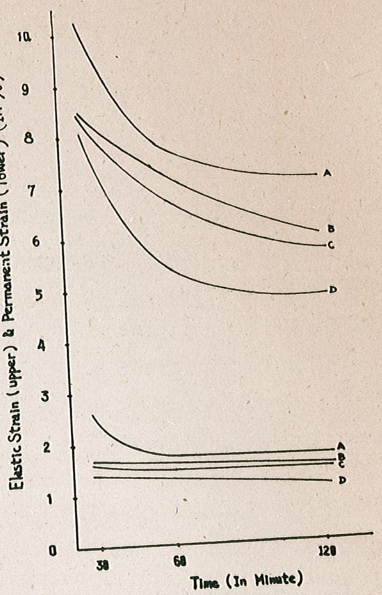


Fig. 3

Fig 3 per cent stain and set of hydrocolloidal materials after aging at 30±2°C, 50-55% humidity For curve A, Set at 30±2°C, 100% humidity for curve B; Set at 20±2°C; 50-55% humidity for curve C; and Set at 20±2°C, 100% humidity for curve D

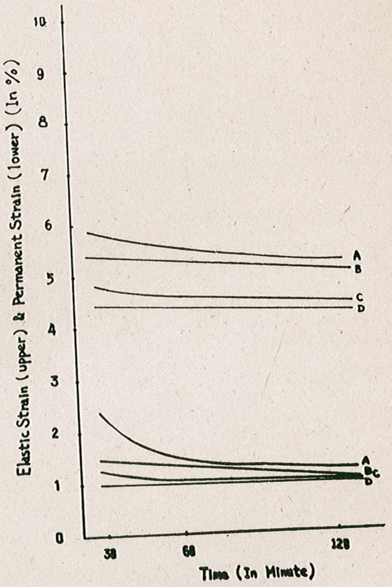


Fig. 4

Fig 4. Per cent strain and set of polysulfide rubber materials after aging at 30°±2°C,50-55% humidity for curve A; Set at 30±2°C, 100% humidity for curve B. Set at 20±2°C, 50-55% humidity for curve C, and Set at 20±2°C, 100% in humidity for curve D

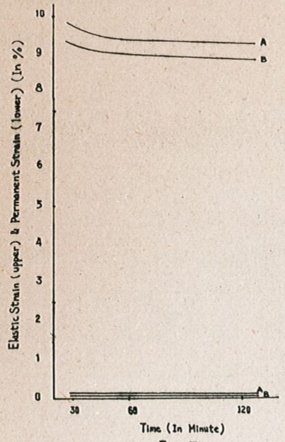


Fig. 5

Fig 5. Per cent strain and Set of silicon rubber materials after aging at 20±2°C, 50-55%humidity for curve A, and Set at 20±2°C, 50-55% humidity for curve B

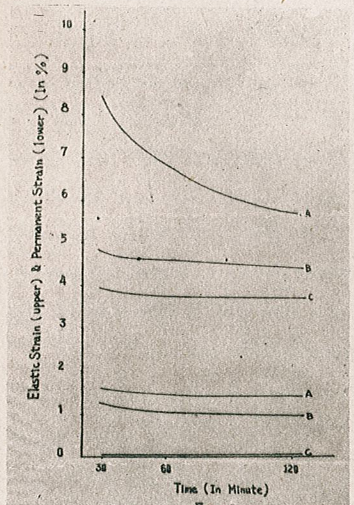


Fig. 6

Fig 6. Comparison of per cent of elastic strain and permanent deformation with hydrocolloidal materials (A) , polysulfide rubber (B), and silicon rubber materials (C), at 22±2°C, 50-55% in humidity.

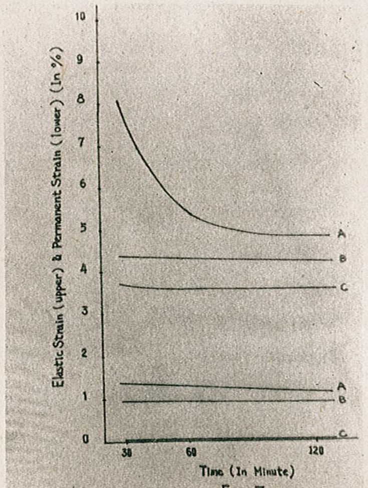


Fig. 7

Fig 7. Comparison of percent of elastic strain and permanent deformation with hydrocolloid materials (A), polysulfide rubber materials (B) and silicon rubber materials (C) at 20±2°C, 100% in humidity.

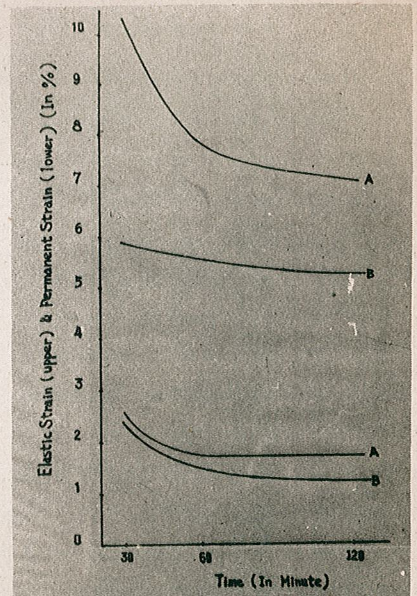


Fig. 8

Fig 8. Comparison of percent of elastic strain and permanent deformation with hydrocolloid materials (A), and polysulfide rubber materials (B). at 30 ±2°C, 50-55% in humidity.

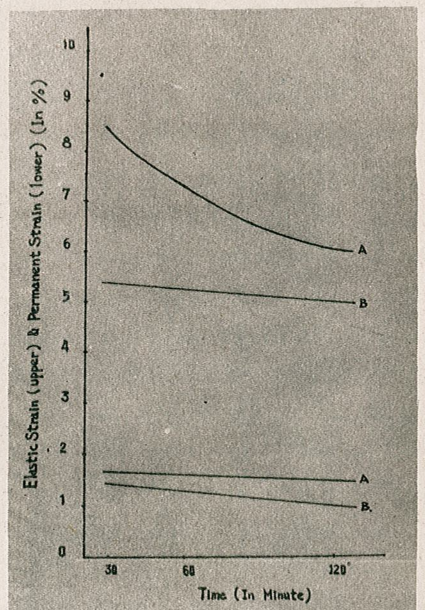


Fig. 9

Fig 9. Comparison of per cent of elastic strain and percent of permanent deformation in with hydrocolloid materials (A) and polysulfide rubber base materials (B) at 30±2°C, 100% in humidity.

Discussion

The irreversible hydrocolloids, and alginate, are used routing in the making of study casts, orthodontic treatment cast, and partial denture casts. Not only have the polysulfide rubber base materials been used successfully as crown and bridge impression materials, but they are also being used as the ,complete denture impression materials. Where the silicon rubber base materials offer most dimensional stable of deformation similar to the polysulfide rubber base materials and are being used successfully as crown and bridge impression materials. In their present form they are too soft and pliable to be used safely as an impression materials for complete dentures[3*]

Though all those impression materials mentioned above, have been justified for many years. The disadvantage of hydrocolloid materials are their lack of dimensional stability. Unless dies and casts are processed within a short period after the impression has been removed from the mouth, deformation will occur. Howerer, the deformation of impression materials in general is dependent on the humidity and temperature at which the material is mixed, the heigher the humidity or lower the temperature, the lower is the deformation. If a material possesses a satisfactory working under the lower temperature and heigher humidity, it would meet the requirments for lov permanent deformation. Because of deeping on changing in elastic strain and permanent deformation, the safest procedure of the hydrocolloidal material is to construct the cast or die as soon as possible after the impression has been obtained at least within 10 minutes45. If a longer period elapses, especially at room temperature under lower humidity, a deformation may occur. The deformations sufficient to cause a misfit of the denture to be constructed on the stone cast obtained from this impression. The practical limit of temperature and humidity in this study was considered to be up to 30±2°C, 20±2°C and 50-55%. 100% in humidity from the start of mixing we have found that the silicon rubber base materials didn't mix under 30±2°C, 50-55% in humidity. Except this condition, the silicon rubber and polysulfide rubber base are more dimensional stable in practical impression works within first 2 hrs. The Fig 4 and 5 shown that the polysulfide rubber base are most dimendional unchangeable of deformation under 20±2°C in spite of humidity. Because the low values for strain in compression and permanent set give sufficient stability in storage for dental impression purposes. And hence we had better perform the practical work under low temperature and heigh humidity. Although the hydrocolloid is a most dimentional unstable one. We have found it was a rather stable under 20±2°C, 50-55% humidity and 30±2°C, 100% in humidity. Because the permanent deformational curve show a straight liue the permanent deformation is apperently affected more than the strain.

The percent strain and permanent deformation set at 37°C and 22°C after aging early in the 15 minutes and 120 minutes respectively for synthetic rubber base was found changrable by Miller[*]. Some specimens showed a definite decrease in strain and permanent deformation others showed an increase and still others showed no immediate change. The fact mentioned above, when the specimens at 20±2°C after aging early in 120 minutes, the strain and permanent deformation have been evenly under hight relative humiditi in this study. So for short periods up to 2 hrs an atmosphere of 100% relative humidity in a closed container is a more standardised environment, and clinically is likely to be satisfactory for synthetic rubber base. But there are no true for hydrocolloial materials. The evidence is clear the change of strain and permanent deformation of clinical significance can be detected in hydrocolloid materials with 120 minutes, or less even when stored in low temperature under 100% humidity.

However, the results in table 2 plus 3, appear to indicate that the rubber impression materials cannot be said to posses complete dimensional stability and undoubtedly more accurrate results will be assured if the cast or die is constructed within the first 60 to 120 minutes after the impression has been withdrown from the mouth. Certainly the dimensional stability of these materials is much superior to that of the hydrocolloidal impression materials. The silicon materials present the advantages over the polysulfide rubber base materials of cleanness in handling, less sensitivity to temperature chang. To insure the highest degree of dimensional stability with the silicon rubber base materials, the impression should be poured within 30 minutes after removal from the patient's mouth.

Conclusion

1. The elastic properties (strain & permanent deformation) of polysulfide rubber and silicon rubber materials tested 30 minutes; after setting under lower temperature and lower humidity, were essentially the same as those of a typical hydrocolloidal impression materials.

2. Delay will probably mean a loss of water from the impression and will result in permanent distortion for hydrocolloidal materials. For those polysulfide rubber and silicon rubber base materials possess complete dimensional stability and undoubtedly more accurate results will be assured if the cast or die is constructed the impression has been withdrawn from the mouth.

3. The longer the aging time, the closer strain -set curve approches a straight line when a shorter the aging time between 30 to 60 minutes the amount of permanent deformation is great between those of three kind materials butthe silicon rubber material exhibited less perpmaneth deformation and greater strains than the polysulfide materials when tested 30 to 60 minutes after begining of the mixing.

4. The impression should be expose to the air for as short a times as possible if the best results are to be obtained. A material possesses a satisfactory working under the lower temperatures and higher humidity, it would meet the requirements for low permanent deformations.

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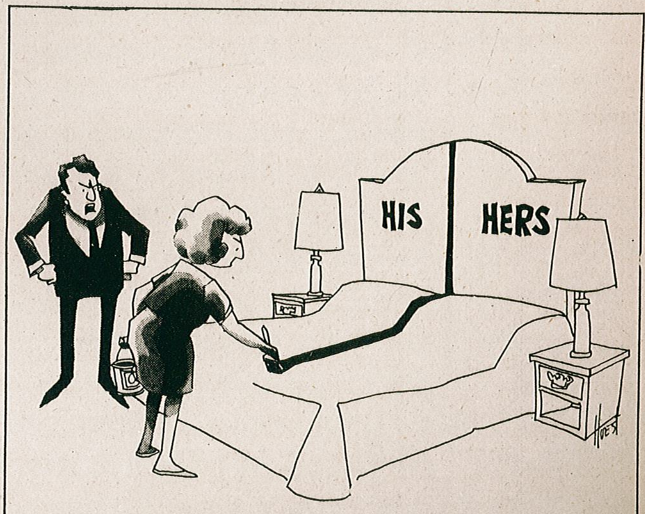

"Now what have I done?"