



COMPARATIVE EVALUATION OF LINEAR DIMENSIONAL CHANGE IN THREE AUTOPOLYMERIZING ACRYLIC RESIN TRAY MATERIALS AT FOUR DIFFERENT TIME INTERVALS- AN IN VITRO STUDY

Science

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ABSTRACT

One of the key steps is recording accurate final impression. Self-cure tray material is used for the fabrication of custom tray which is used in final impression. Therefore the stability of tray material is of utmost importance. This study compares the linear dimensional change in SR Ivolen, Asian Special instant tray material and M P Sai tray material with the help of Profile Projector

KEYWORDS

tray material, autopolymerising, dimensional change, acrylic resin

INTRODUCTION

One of the most important steps in making of a complete denture is making of a final impression with custom tray. Accuracy and dimensional stability of custom made trays is essential for accurate recording of the tissues in the final impression.

A custom tray is defined as "An individualized impression tray made from a cast recovered from a preliminary impression. It is used in making a final impression" – GPT 8¹

Various researches have been carried out which indicate that volumetric polymerization shrinkage of autopolymerizing resin is 7%.² In addition to volumetric shrinkage, linear shrinkage also results which affects the dimensional stability.

To increase the dimensional accuracy, manufacturers have been adding chemical modifiers since the advent of acrylic resins.³ Various authors provide different time intervals between fabricating a custom tray and using it for making an impression. This time interval reduced after tray materials were used for fabrication of custom trays which came onto 9 hours^{3,4} while some mentioned that 40 minutes should elapse between fabrication of a custom tray and its usage.⁴

These findings showed that there should be a definite co relation between the dimensional stability and the polymerization time given for a tray material Hence, this study was planned to ascertain the linear dimensional change at four different time intervals (1hour, 2 hours, 6 hours, 24 hours)

AIM:

To evaluate and compare linear dimensional change in three autopolymerizing acrylic resin tray materials (Sr-Ivolen Tray Material, Asian special Instant tray material, M.P.Sai tray material) at four different time intervals (1 hour, 2 hours, 6 hours and 24 hours)

OBJECTIVES:

- To evaluate the linear dimensional change in Sr-Ivolen tray material at time intervals of 1 hour, 2 hours, 6 hours and 24 hours.
- To evaluate the linear dimensional change in Asian special Instant tray material at time intervals of 1 hour, 2 hours, 6 hours and 24 hours.
- To evaluate the linear dimensional change in M.P.Sai tray material at time intervals of 1 hour, 2 hours, 6 hours and 24 hours.
- To compare the linear dimensional change in three autopolymerizing acrylic resin tray materials at time intervals of 1 hour, 2 hours, 6 hours and 24 hours.

MATERIALS USED IN THE STUDY

- Sr-Ivolen Tray Material (Ivoclar Vivadent AG, Schaan, Liechtenstein) (Photograph 1)
- Asian Special Instant tray material (Asian Acrylates, Mumbai, India) (Photograph 1)
- M.P.Sai tray material (MP Sai Enterprise pvt. Ltd, Mumbai, India) (Photograph 1)
- Cold mold seal (DPI, Mumbai, India)
- Petroleum jelly
- Type IV dental stone Ultrarock (Kalabhai)
- Dental plaster (Kalabhai)



Photograph 1

ARMAMENTARIUM

Stainless steel circular die of 50 mm diameter and 2 mm thickness (Photograph 2)

- Porcelain jar (Photograph 3)
- Glass slab (Photograph 3)
- Acrylic resin mixing spatula (Photograph 3)
- Bard parker blade no.11 with Handle no. 3 (Photograph 3)
- Measuring scoop (Photograph 3)
- Camel hair brush (Photograph 3)
- Measuring cylinder (Photograph 3)
- Flask and clamps



Photograph 2



Photograph 3

EQUIPMENTS

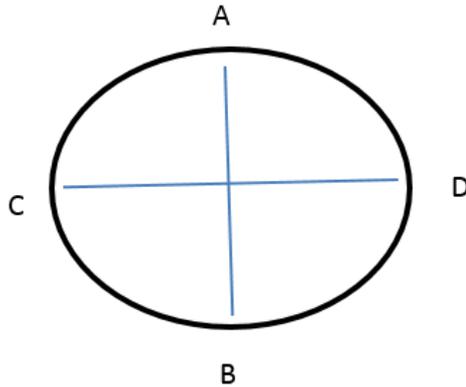
- Weighing Electronic scale (Model- SF-400 A)
- Profile Projector. (Model ppt 200 GG make) (Photograph 4)



Photograph 4

A stainless steel die (50mm in diameter and 2 mm in thickness) with reference points A, B, C, D was fabricated.

Making of the reference points:



Die stone was mixed with water in the ratio 7ml water to 32 gm of die stone (Ultrarock, Kalabhai) and the stainless steel die was invested in the mix to make the mould.



Photograph 5

The mould along with the stainless steel disc was pressed into the dental plaster such that it flushes in line with the upper edge of the base flask. It was then allowed to set for one hour. (Photograph 6).

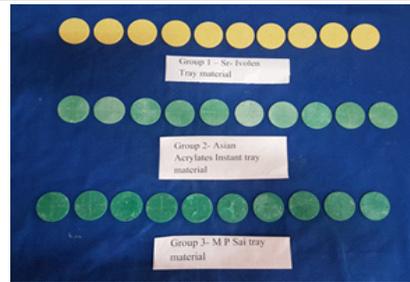


FABRICATION OF DISC SAMPLES:

Manipulation of Tray material: Tray material was weighed on a weighing electronic scale and mixed.
 SR Ivolen- 24gm/6 ml
 Asian acrylate- 20gm/5 ml
 MP Sai- 11gm/5 ml

The flask was opened after completion of the individual polymerization time. The tray material samples were finished to remove any irregularities.

10 samples were fabricated for each group from these three materials (Photograph 7) and the linear dimensional change was measured.



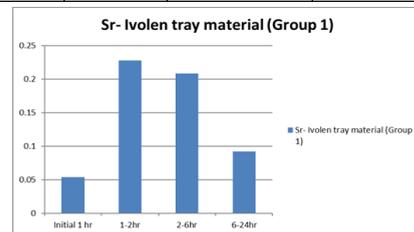
Photograph 7

RESULTS

The values obtained were subjected to statistical analysis using One way analysis of variance (ANOVA) was used for intergroup comparisons and Bone Ferroni was used for intragroup values. The p-values less than 0.05 are considered to be statistically significant.

Table 1: Mean score of Sr- Ivolen tray material at different time intervals (Group 1)

	Mean	Std. Deviation	F	Sig.
initial-1 hour	.054000	.0142984	4.971	.050
1-2 hours	.228000	.0376534		
2-6 hours	.208000	.2449853		
6-24 hours	.092000	.1104335		



Graph 1: Comparison in mean score of Sr- Ivolen tray material at different time intervals (Group 1)

Table 2: Comparison of mean score of Sr- Ivolen tray material at different time interval (Group 1)

(I) factor1	(J) factor1	Mean Difference (I-J)	P value
1	2	-.174*	<0.001*
	3	-.154	.080
	4	-.038	.317
2	1	.174*	<0.001*
	3	.020	.812
	4	.136*	.008
3	1	.154	.080
	2	-.020	.812
	4	.116*	.025
4	1	.038	.317
	2	-.136*	.008
	3	-.116*	.025

Table 3: Mean score of Asian special Instant tray material at different time intervals

Descriptive Statistics				
	Mean	Std. Deviation	F	Sig.
initial-1 hour	.352000	.0632104	340.021	.000
1-2 hours	1.504000	.1803207		
2-6 hours	1.010000	.0791623		
6-24 hours	.304000	.0556177		



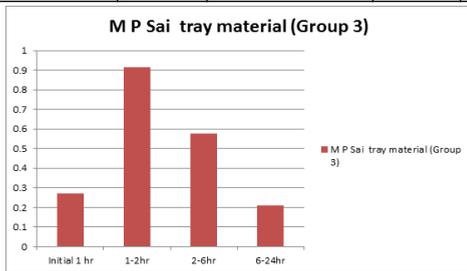
Graph 2: Comparison in mean score of Asian special instant tray material at different time intervals (Group 2)

Table 4: Comparison of mean score of Asian special Instant Tray material at different time intervals (Group 2)

(I) factor1	(J) factor1	Mean Difference (I-J)	P value
1	2	-.152*	<0.001*
	3	-.658*	<0.001*
	4	.048*	<0.001*
2	1	1.152*	<0.001*
	3	.494*	<0.001*
	4	1.200*	<0.001*
3	1	.658*	<0.001*
	2	-.494*	<0.001*
	4	.706*	<0.001*
4	1	-.048*	<0.001*
	2	-1.200*	<0.001*
	3	-.706*	<0.001*

Table 5: Mean score of M P Sai tray material at different time intervals (Group 3)

	Mean	Std. Deviation	F	Sig.
initial-1 hour	.269000	.0344642	292.236	.000
1-2 hours	.916000	.1210326		
2-6 hours	.576000	.0991295		
6-24 hours	.211000	.0284605		



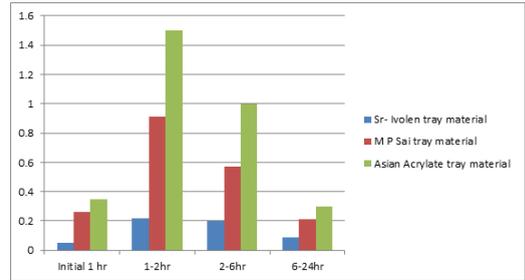
Graph 3: Comparison in mean score of M P Sai tray material at different time intervals (Group 3)

Table 6: Comparison of mean score of M P Sai tray material at different time intervals (Group 3)

(I) factor1	(J) factor1	Mean Difference (I-J)	P value
1	2	-.647*	.000
	3	-.307*	.000
	4	.058*	.000
2	1	.647*	.000
	3	.340*	.000
	4	.705*	.000
3	1	.307*	.000
	2	-.340*	.000
	4	.365*	.000
4	1	-.058*	.000
	2	-.705*	.000
	3	-.365*	.000

Table 7: Mean score of three different tray materials at different time intervals

	N	Mean	Std. Deviation	F	P value
initial-1 hour	Group1	10	.054000	131.704	<0.001*
	Group2	10	.269000		
	Group3	10	.352000		
	Total	30	.225000		
1-2 hours	Group1	10	.228000	251.868	<0.001*
	Group2	10	.916000		
	Group3	10	1.504000		
	Total	30	.882667		
2-6 hours	Group1	10	.208000	63.524	<0.001*
	Group2	10	.576000		
	Group3	10	1.010000		
	Total	30	.598000		
6-24 hours	Group1	10	.092000	21.043	<0.001*
	Group2	10	.211000		
	Group3	10	.304000		
	Total	30	.202333		



Graph 4: Comparative graph showing mean dimensional changes in the three different tray materials

Table 8: Comparison of mean score of three different tray materials at different time intervals

Dependent Variable	(I) grp	(J) grp	Mean Difference (I-J)	P value
initial-1 hour	1	2	-.215000*	<0.001*
		3	-.298000*	<0.001*
	2	1	.215000*	<0.001*
		3	-.083000*	<0.001*
	3	1	.298000*	<0.001*
		2	.083000*	<0.001*
1-2 hours	1	2	-.688000*	<0.001*
		3	-1.276000*	<0.001*
	2	1	.688000*	<0.001*
		3	-.588000*	<0.001*
	3	1	1.276000*	<0.001*
		2	.588000*	<0.001*
2-6 hours	1	2	-.368000*	<0.001*
		3	-.802000*	<0.001*
	2	1	.368000*	<0.001*
		3	-.434000*	<0.001*
	3	1	.802000*	<0.001*
		2	.434000*	<0.001*
6-24 hours	1	2	-.119000*	.003*
		3	-.212000*	<0.001*
	2	1	.119000*	.003*
		3	-.093000*	.025*
	3	1	.212000*	<0.001*
		2	.093000*	.025*

DISCUSSION

Fehling AW et al (1986) stated that the dimensional change was significant upto 40 minutes but the changes occurred throughout 6 hours.⁵

Barua AK et al (1989) concluded that custom trays made of French-Chalk filler were dimensionally more stable and can be used just 10 minutes after adaptation.⁶

Pagniano RP et al (1982) stated that the most rapid linear dimensional change of the autopolymerizing acrylic resin tray materials occurred in the first hour after mixing.⁴

Various authors suggested contradictory results in respect to this study. Eames WB et al (1980) made a conclusion that trays which were not allowed to cure for 24 hours, underwent shrinkage.⁷

Peyton FA (1975)² mentioned in a chapter that dimensional change may occur for 24 hours and therefore should not be used during that period.

Graph 1 showed mean linear dimensional change of Sr-Ivolen tray material. It was highest during the time interval of 1-2 hours (0.22 mm) and gradually decreased till 24 hours.

Graph 2 showed mean linear dimensional change in Asian special Instant tray material. The range of dimensional change increased drastically. Almost a change of 0.3 mm was seen even during the time interval of 6-24 hours.

Graph 3 showed mean linear dimensional change in M P Sai tray material. The linear change seen was highest during the 1-2 hour

interval (0.91 mm). The shrinkage continued upto 24 hours, which agrees to the results as stated by Hitge ML et al.^{8,9}

Graph 4 shows the mean linear dimensional change in three tray materials, greatest change was seen with Asian special Instant tray material. Between 1-2 hours, the linear change seen was 1.5 mm. The least dimensional change was seen with Sr-Ivolen tray materials followed by M P Sai tray material. The results support the previous study in which the comparison of 12 different autopolymerizing tray materials were made.¹⁰

CONCLUSION

Within the limitations of this in-vitro study, the following conclusions can be drawn:

- All the three materials showed linear shrinkage and linear dimensional change upto 24 hours, but the maximum change was upto 2 hours.
- Changes in linear dimensional stability were very minor with all the three materials after 2 hours.
- The best dimensionally stable material was Sr-Ivolen tray material followed by M P Sai tray material. Asian special Instant tray material proved to be least stable.

REFERENCES

1. The glossary of prosthodontic terms-8 J Prosthet Dent 2005;94(1): 10-92.
2. Peyton FA. History of resins in dentistry. Dent Clin North Am 1975;19(2):211-22.
3. Phoenix RD. Denture base resins. Anusavice KJ Phillips. Science of dental materials. 11th edition. New Delhi;2003. Pg 739-52.
4. Pagniano RP, Scheid RC, Clowson RL, Dagefoerdo RO, Zardiackas LD. Linear dimensional change of acrylic resins used in fabrication of custom trays. J Prosthet Dent 1982;47(3):279-83.
5. Fehling AW, Hesby RA, Pelleu GB. Dimensional stability of autopolymerizing acrylic resin impression trays. J Prosthet Dent 1986;55(5): 592-97.
6. Barua AK, Kharat DD. French chalk filled chemically activated acrylic resin tray material. J Indian Dent asso 1983;55:224-5.
7. Eames WB, Sieweke JC. Seven acrylic resins for custom trays and five putty-wash systems compared. Oper Dent 1980;5(4):162-67.
8. Hitge ML, Vrijhoef MMA. The dimensional stability of complete denture impression trays J Dent 1988;16:227-32.
9. Hitge ML, Vrijhoef MMA. Influence of border molding on dimensional stability of complete denture impression trays. J Dent 1988;16:282-5.
10. Mojon P, Oberholzer JP, Meyer JM, Belser UC. Polymerization shrinkage of index and pattern acrylic resin. J Prosthet Dent 1990;64:684-8.