



## Comparative evaluation of stain removal and flexural strength of denture base acrylic resin by using two different denture cleansers: an in – vitro study.

### Dental Science

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### ABSTRACT

The purpose of this study was to comparatively evaluate the effect of two denture cleansers on the stain removal and flexural strength of denture base acrylic resins. 300 samples of heat cure acrylic resin were fabricated and were first inserted into the stain solutions and were finally inserted into two denture cleansers - Fittydent and Clinsodent for 8 hours with distilled water as control. The samples were tested for colour evaluation and flexural strength after 1st, 2nd and 3rd month on uv/vis spectrophotometer and universal testing machine respectively. There was evident color change as well as there was decrease in the flexural strength in all the samples. The study concluded that denture cleansers cause a decrease in the flexural strength of the heat cure acrylic resins as well they cause a change in their color over a longer period of use.

### KEYWORDS:

Denture base resins, Flexural Strength, Denture Cleanser and Stains.

### 1. INTRODUCTION

Complete dentures serve to replace missing or lost natural teeth and their associated structures. Since most complete dentures are made with acrylic resin teeth and denture base material of polymethyl methacrylate.<sup>1</sup>

Adequate cleaning of a well-polished denture with hand soap and a properly designed denture brush is the denture-cleansing method recommended by the American Dental Association. Mechanical methods are the most common and effective procedures for biofilm removal on prosthesis surfaces. The use of chemical denture cleanser soaks is the second most popular method.<sup>1,2</sup> It is of clinical importance to determine whether denture cleansers alter the properties of acrylic resins. A frequently reported problem by chemical cleansers' users is a whitening effect on the denture base.<sup>3</sup>

### 2. MATERIALS AND METHOD

For the study, 300 samples of heat cure acrylic resin of 20 mm x 10 mm x 2.5 mm dimensions were fabricated and were divided into 2 groups – one experimental group and control group.

In the experimental group 210 samples were used and were divided among the groups for a time duration of 90 days, as the testing was to at the end of 1st, 2nd, and 3rd month.

90 samples were also used for the control group and were also tested at same time.

For the fabrication of 300 samples, pre fabricated metal die of 20 mm x 10 mm x 2.5 mm was used and putty index was formed. Then modelling wax (DPI) was taken, melted and was poured into the putty index that was formed. The denture base resin patterns were then fabricated according to manufacturer's technique.



Fig 1: Finished and polished samples

### Initial Evaluation

The initial color evaluation (CIE L\* a\* b\* value) of samples was done by color spectrophotometer and initial measurement of flexural strength of the samples was done by a three point bending test on a Universal Testing Machine. The readings were obtained and a mean was recorded.

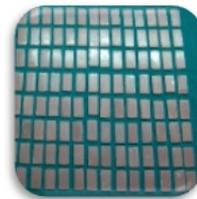


Fig 2: Stained samples after 3rd month

### Immersion of Samples

250 ml of each of solution was poured in different beakers and samples were dipped into the solutions. The samples were then exposed to 3 different stains daily for 15 minutes for three times a day in 5 hours interval and were finally exposed to denture cleansers for 8 hours. The solutions were changed after every 24 hours.

### Final Evaluation

Final color changes were evaluated using the CIE L\*a\*b\* colorimetric system. The color change ( $\Delta E$ ) of each specimen was calculated as follows:

$$\Delta E = [(\Delta L^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2]^{1/2}$$

The final color evaluation and final flexural strength changes were evaluated at the end of 1st, 2nd and 3rd month under the same instruemnts.

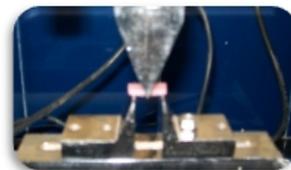


Fig 3: Sample kept in universal testing machine for testing



**Fig 4: Sample kept in color spectrophotometer for color evaluation**

**STATISTICAL TOOLS EMPLOYED**

One Way Analysis of variance (ANOVA) was performed to compare the mean values.  $p < 0.05$  was taken to be statistically significant.

**1. RESULTS**

It was seen that:

- The denture cleansers are effective in removing stains from acrylic resins on long term basis which was more in 3rd month as compared to 1st and 2nd.
- From the study it was seen that fittydent was more effective in removing stain that clinsodent which was followed by distilled water (control)
- From the study it was also seen that the denture cleansers causes a decrease in the flexural strength of the heat cure denture acrylic resins which was more in 3rd month as compared to 1st and 2nd.
- The study also showed that fittydent causes more reduction in the flexural strength of heat cure denture acrylic resins followed by clinsodent and distilled water (control).

**TABLE 1: SHOWING THE MEAN VALUES OF COLOR DIFFERENCE AFTER 3RD MONTH**

		Mean	N	Std. Deviation	Std. Error Mean	t-value	p-value
1st Month							
Pair 1	Tea Fitty dent 1m	277.27	10	29.35	9.28	0.149	0.885
	Coffee Fitty dent 1m	274.08	10	54.88	17.35		
Pair 2	Tea Fitty dent 1m	277.27	10	29.35	9.28	-0.085	0.934
	Tobacco Fitty dent 1m	278.49	10	27.86	8.81		
Pair 3	Coffee Fitty dent 1m	274.08	10	54.88	17.35	-0.18	0.861
	Tobacco Fitty dent 1m	278.49	10	27.86	8.81		
Pair 4	Tea Fitty dent 1m	275.77	10	41.72	13.17	-0.327	0.535
	Control Fitty dent 1m	287.81	10	25.91	9.93		
Pair 5	Coffee Fitty dent 1m	272.11	10	28.36	9.72	-0.751	0.498

	Control Fitty dent 1m	280.43	10	27.92	9.81		
Pair 6	Tobacco Fitty dent 1m	276.11	10	25.23	8.61	-0.514	0.633
	Control Fitty dent 1m	289.72	10	26.11	9.11		
Pair 7	Tea Clinsodent 1m	278.36	10	47.90	15.15	0.125	0.903
	Coffee Clinsodent 1m	275.61	10	29.41	9.30		
Pair 8	Tea Clinsodent 1m	278.36	10	47.90	15.15	-0.059	0.954
	Tobacco Clinsodent 1m	279.52	10	26.05	8.24		
Pair 9	Coffee Clinsodent 1m	275.61	10	29.41	9.30	-0.415	0.688
	Tobacco Clinsodent 1m	279.52	10	26.05	8.24		
Pair 10	Tea Clinsodent 1m	278.36	10	47.90	15.15	-0.215	0.835
	Control Clinsodent 1m	282.53	10	26.69	8.44		
Pair 11	Coffee Clinsodent 1m	275.61	10	29.41	9.30	-0.693	0.606
	Control Clinsodent 1m	282.53	10	26.69	8.44		

**TABLE 2: SHOWING THE MEAN VALUE AND STANDARD DEVIATION FOR FLEXURAL STRENGTH FOR 3rd MONTH**

3 MONTH									
TEA									
Group	Count	Sum	Average	Variance	Anova			P value	
					Between groups	Within groups			
Fittydent	10.000	19.7551	1.9755	8.3013	143.2191	2.000	248.0989	27.000	0.0021
Clinso dent	10.000	19.1411	1.9141	2.0327					
Control	10.000	65.7946	6.5795	17.2326					
COFFEE									
Fittydent	10.000	31.1922	3.1192	6.4673	157.6634	2.000	218.7442	27.000	0.0007
Clinso dent	10.000	10.1923	1.0193	0.6050					
Control	10.000	65.7946	6.5795	17.2326					

TOBACCO										
Fittydent	10.000	40.4142	4.0414	33.0318	87.3586	2.000	479.8812	27.000		
Clinsodent	10.000	24.3424	2.4342	3.0557						0.1046
Control	10.000	65.7946	6.5795	17.2326						

#### 4. DISCUSSION

Denture cleansing may be performed by a number of products, which are divided into two main classes: mechanical and chemical cleansers. Staining can be evaluated visually and by instrumental techniques (colorimeter and spectrophotometer). Color evaluations<sup>4,5</sup> by visual comparison has been shown to be unreliable as a result of inconsistencies in color perception specifications among observers. Most commonly used methods to measure color change in dental materials are Colorimeters<sup>2-10</sup> and spectrophotometers. Spectrophotometers have been shown to be more accurate in measuring the color change than colorimeters as spectrophotometers contain monochromators and photodiodes that measure the reflectance curve of a product's color every 10 nm or less. To eradicate possible subjective errors in color assessment, the present study used a spectrophotometer for color measurements<sup>1, 11-17</sup>. Color changes were characterized using the CIE L\*a\*b\* system.

The results of present study are in consistent with Peracini<sup>2</sup> et al, who also detected a significant discoloring effect on heat polymerized acrylic resins with denture cleansing agents.. After immersion for 90 days simulating 180 cycles, the results of this study indicate that heat cure acrylic resin was affected more by Fittydent denture cleanser tablets as compared to Clinsodent denture cleansers tablets. Fittydent denture cleanser tablet is alkaline peroxide denture cleanser. Paranhos HFO<sup>10</sup> et al discovered in their study that color alterations were "noticeable" according to NBS, for the alkaline peroxide denture cleansers. However, they immersed the sample in denture cleanser solution for one and half year period.

The longevity of dentures depends in part on the flexural strength of the acrylic resin after immersion in denture cleansers. The denture cleansers Fittydent Tabs and Clinsodent tablets decreased the flexural strength of the heat-polymerized acrylic resin in comparison with water immersion. Similar findings were reported in previous studies. Maart<sup>15</sup> et al demonstrated a significant reduction of the mean hardness values for the denture base resins tested with sodium perborate solution.

Amongst the two cleansers, Fittydent had the greatest effect on color stability. Similar finding was reported in the study of Hong<sup>12</sup> et al and Nikawa<sup>16</sup> et al. They have used cleanser having alkaline peroxides. The results of present study are also similar with Ghalichebaf<sup>18</sup> M et al who also detected a significant whitening effect with Corega Tabs (alkaline) relative to the other tested cleansing agents. In this study, it was observed that denture cleansers decreased the flexural strength denture base resin in comparison with water immersion. Similar findings were reported in a study carried out by Peracini<sup>2</sup> et al. which also showed a reduction in flexural strength of acrylic resins when exposed to peroxides and hypochlorite.

#### Conclusion

It was concluded that

- The denture cleansers are effective in removing stains from heat cure denture acrylic resins on long term basis and fittydent causes more reduction than clinsodent.
- From the study it was seen that the denture cleansers causes a decrease in the flexural strength of the heat cure denture acrylic resins by keeping them for longer durations.
- The study also showed that fittydent causes more reduction in the flexural strength of heat cure denture acrylic resins followed by clinsodent and distilled water (control).

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