



## Stability of Denture Base Acrylic Resin to Tea, Coffe and Turmeric Solutions: An in Vitro Study

Nitin Gautam<sup>1</sup>, Monica Kotwal<sup>2</sup>, Rimsha Ahmed<sup>3\*</sup>, Anupama Gaur<sup>4</sup>, Sunny Sharma<sup>5</sup>

<sup>1</sup>Associate Professor, Department of Prosthodontics, IGGDC, Jammu and Kashmir, India.

Email: nitingautam212@gmail.com,

Orcid ID: 0000-0001-6661-6850

<sup>2</sup>Assistant Professor, Department of Prosthodontics, IGGDC, Jammu and Kashmir, India.

Email: monicakotwal16420@gmail.com

Orcid ID: 0009-0009-6217-8895

<sup>3</sup>Registrar, Department of Prosthodontics, IGGDC, Jammu and Kashmir, India.

Email: rimzahmed1989@gmail.com,

Orcid ID: 0000-0003-4207-6436

<sup>4</sup>Professor and Head, Department of Public Health Dentistry, RUHS CODS, Jaipur, Rajasthan, India.

Email: anupama.sharma11@yahoo.com,

Orcid ID: 0000-0002-5704-6849

<sup>5</sup>Registrar, Department of Prosthodontics, IGGDC, Jammu and Kashmir, India.

Email: sny87sharma87@gmail.com,

Orcid ID: 0000-0001-9191-8842

\*Corresponding author

Received: 15 December 2022

Revised: 20 January 2023

Accepted: 01 February 2023

Published: 28 February 2023

### Abstract

**Background:** The color stability of commercially available denture base acrylic resins (Lucitone-199, DPI and Travelon-HI) was studied in vitro. **Material & Methods:** The specimens were exposed to tea, coffee and turmeric solutions at  $37 \pm 1$  °C. Colour measurement of the specimens from each brand of denture base acrylic resin recorded by spectrophotometer. The specimens were washed under distilled water and dried before measuring the colour on 0, 10, 20 and 30 days of immersion and color differences were calculated. **Results:** Statistically the colour change was significant between and within the groups of different heat cure denture base acrylic resins. **Conclusion:** Where as Lucitone-199 heat cure showed the highest colour variation in tea and coffee followed by DPI and Travelon-HI.

**Keywords:-** Denture, Turmeric Solutions, Acrylic Resin to Tea.

## INTRODUCTION

Almost all complete dentures are fabricated by using an acrylic resin, a low cost material that requires relatively easy manipulation and construction methods. However, it is not the ideal material in every aspect. Discoloration of acrylic resins results in esthetic problems, and a denture base polymer should have good esthetics with a smooth and glassy surface and be capable of matching the natural appearance

of the soft tissues. For the best esthetic effect, the material should be translucent. Color and translucency should be maintained during processing, and these resins should not get stained or change color in clinical use. The color stability criteria may provide important information on the serviceability of these materials.

The most important dimension of aesthetics is colour. Apart from the other properties of



acrylic resin, developing its colour to match with the colour of oral mucosa and teeth makes it the material of choice for its universal application in denture prosthesis. In denture prosthesis though the denture teeth are aesthetically more important and are noticed significantly the denture base is equally important for its aesthetics in many patients if not all. Denture base has to be in contact with various food materials and beverages in the oral cavity. Its material (acrylic resin) is likely to absorb various contaminants. Color stability is a required characteristic of denture base resins, as specified by various national and international standards and may provide important information on the serviceability of these materials.<sup>[1]</sup> Therefore the purpose of this study was to determine the color stability of denture base material to the food articles, turmeric, tea and coffee.

### **Aim and objectives**

The aim of the study was to evaluate the colour change of certain brands (commonly used in India) of denture base acrylic resin when they were contacted with tea, coffee and turmeric solutions. The objective of the study was to compare the effect of these solutions on the different brands of denture base acrylic resin in terms of change in their colour.

### **MATERIAL AND METHODS**

In this study, 3 brands of acrylic resin materials, which were conventional heat-cured denture base acrylic resins, were selected. Specimens were prepared in rectangular blocks (20 x 10 x 1.5 mm dimensions) in a plastic mold to meet the demands of the measuring instrument. Fifteen specimens were made for each material

studied. They were allowed to undergo short-time polymerization in a water bath at 720 C for 1.5 hours, followed by 30 minutes boiling in 1000 C water. Fifteen specimens of each brand were prepared and polished using no. 600 silicone-carbide sand paper.

Solutions of tea, coffee, and turmeric were prepared by adding 8 g of colorant to 400 ml boiling distil water. It was allowed to cool for 10 min and then filtered through a piece of gauze. Each solution was divided into four parts so that 5 specimens of each brand of acrylic resin were immersed into the specific solutions. Specimens were designated according to the acrylic resin and solution. Total 12 closed containers were taken to accommodate the twelve groups of specimens. Each container with 5 specimens was kept in incubator at  $37 \pm 1$  °C temperature. Fresh solutions were taken after 10 and 20 days.

The specimens were washed under distil water and dried before measuring the colour on 0, 10, 20 and 30 days of immersion. Colour measurement of the specimens from each brand of denture base acrylic resin recorded by spectrophotometer (Minolta cd-3200). The mean of colour change of each material was calculated with the use of C.I.E.  $L^* a^* b^*$  uniform colour scale. The magnitude of total colour difference is formulated by  $\Delta E$ . The stained specimens evaluated for the standard colour value was tested with white as a standard, which is applicable for testing the colour variants. The data collected for the change in colour were evaluated and compared for the different groups using One-way Analysis of Variance and Bonferroni (post hoc) test. Spectrophotometer readings reveal the difference in the colour of each material after 10, 20 and 30 days of immersion in tea, coffee and

turmeric solution. Statistically the colour change was significant between and within the

groups of different heat cure denture base acrylic resins

## RESULTS

**Table 1:** The mean values and standard deviations (SD) of the colour change ( $\Delta E$ ) of the resins in tea, coffee and turmeric after 10, 20 and 30 days

	<b>Lucitone</b>	<b>Travelon-HI</b>	<b>DPI</b>
TEA 10 Days	2.59 ± 0.11	3.10 ± 0.44	1.78 ± 0.38
20 Days	4.20 ± 0.37	4.13 ± 0.28	3.11 ± 0.29
30 Days	5.48 ± 0.11	4.14 ± 1.03	4.54 ± 0.03
COFFEE 10 Days	2.10 ± 0.41	2.05 ± 0.34	1.99 ± 0.05
20 Days	3.67 ± 0.65	2.69 ± 0.41	2.54 ± 0.47
30 Days	3.37 ± 0.17	3.95 ± 0.49	3.07 ± 0.27
TURMERIC 10 Days	9.21 ± 0.32	08.34 ± 0.17	17.17 ± 0.2=91
20 Days	13.53 ± 0.4	13.56 ± 0.33	18.43 ± 0.25
30 Days	19.29 ± 0.36	21.09 ± 0.32	24.65 ± 0.38

## DISCUSSION

CIE Lab system is a uniform 3-dimensional system that determines color changes.<sup>[2,3]</sup> It is widely used in determining chromatic differences and is more advantageous than Munsell color system as instrumental measurement eliminates the subjective interpretation of visual colour comparison. In this system, the 3 dimensions of color have been arranged at almost equal intervals. Through the evaluation of color differences that express various combinations of differences in 3 dimensions of color space, mathematical data are obtained. This system was preferred for our study. In this study, spectrophotometric measuring techniques were used to determine the color of 3 types of acrylic resin in 3 test media.<sup>[4,5,6]</sup>

Staining of the specimens reaches the plateau after certain period of time.<sup>[6]</sup> Like Scotti et al,<sup>[7]</sup> we also kept the time interval of 10 days for

measuring the colour change. The effect of turmeric solution was maximum in terms of change in colour of all the acrylic resin specimens.  $\Delta E$  values are maximum followed by tea and coffee. It appears that colorant of turmeric is more polar. Um and Ruyter mentioned in their study that 'whenever the colorant is more polar and there by more hydrophilic it stains more as denture base resins are hydrophilic attracting more water soluble dyes on the surface.

Staining becomes more intense with time but after 10 days of immersion it differed significantly from all succeeding time interval. This could probably due to the sorption property of the resin which gets saturated with the pigments. Lucitone 199 was found most colour stable in turmeric followed by Travelon-HI, DPI but least in tea and coffee solution followed by DPI, Travelon-HI [Table 1]. One way analysis of variance was applied to check the equality of means of colour change between

the groups (DPI, Lucitone 199, Travelon-HI) related to tea, coffee and turmeric solution. The variation between the groups related to three solutions after 10, 20 and 30 days were found to be statistically significant because at a confidence level of 95 %, the P value obtained was less than 0.05. To further delineate the significant variation between the means of colour change between the four brands of acrylic resins in tea, coffee and turmeric solution, the bonferroni (post hoc) test was performed. The colour change was found to be variable. It could be due to different absorption property of materials and different polarity and hydrophilic nature of staining solutions.<sup>[8]</sup> In actual oral environment there is formation of pellicles of proteins and glucoproteins present in saliva leading to plaque formation on the acrylic resin surface. These soft materials are affected by the colorants in food more quickly and undergo colour changes. In the present study, the changes in colour was examined in a saliva and diet free medium, so the result may not be the same as in oral environment.

## REFERENCES

1. Shotwell JL, Razzoog ME, Koran A. Color stability of long-term soft denture liners. *J Prosthet Dent.* 1992;68(5):836-8. doi: 10.1016/0022-3913(92)90213-t.
2. Crispin BJ, Caputo AA. Color stability of temporary restorative materials. *J Prosthet Dent.* 1979;42(1):27-33. doi: 10.1016/0022-3913(79)90326-3.
3. Cakan U, Kara HB. Effect of liquid polishing materials on the stainability of bis-acryl interim restorative material in vitro. *J Prosthet Dent.* 2015;113(5):475-9. doi: 10.1016/j.prosdent.2014.09.020.
4. Hersek N, Canay S, Uzun G, Yildiz F. Color stability of denture base acrylic resins in three food colorants. *J Prosthet Dent.* 1999;81(4):375-9. doi: 10.1016/s0022-3913(99)80001-8.

## CONCLUSIONS

All the brands of heat cure denture base acrylic resin tested in this study showed statistical significant colour change in tea, coffee and turmeric solution. DPI showed the highest colour variation in turmeric followed by Travelon-HI and Lucitone-199. Where as Lucitone-199 heat cure showed the highest colour variation in tea and coffee followed by DPI and Travelon-HI. Among the solutions tested, turmeric showed the highest staining effect on the specimens, followed by tea and later by coffee. The staining becomes more intense with time i.e.  $\Delta E$  value for colour change increases with time but the rate does not remain the same as after 10, 20 and 30 days, the value does not increases in the same ratio. So while selecting the brand of denture base material its stability to colorants present in the food taken by the patient should also be an important criteria and the manufacturer should also use some scale which shows the stain resistance.

5. Khokhar ZA, Razzoog ME, Yaman P. Color stability of restorative resins. *Quintessence Int.* 1991;22(9):733-7.
6. Chan KC, Fuller JL, Hormati AA. The ability of foods to stain two composite resins. *J Prosthet Dent.* 1980;43(5):542-5. doi: 10.1016/0022-3913(80)90328-5.
7. Scotti R, Mascellani SC, Forniti F. The in vitro color stability of acrylic resins for provisional restorations. *Int J Prosthodont.* 1997;10(2):164-8.
8. Um CM, Ruyter IE. Staining of resin-based veneering materials with coffee and tea. *Quintessence Int.* 1991;22(5):377-86.

Source of Support: Nil, Conflict of Interest: None declare