



## RESEARCH ARTICLE

### EFFECT OF DENTURE CLEANSER ON COLOR STABILITY OF HEAT CURED ACRYLIC RESINS: AN IN-VITRO STUDY

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#### ABSTRACT

**Introduction:** Poor denture hygiene is a seemingly common problem encountered by dentists in complete denture patients. It may contribute to halitosis, denture stomatitis and angular cheilitis as the dentures presents additional sites and environment to support the growth of micro-organisms. One of the chief complaints often noticed in denture patients is loss of luster or loss of color in their dentures. The reason for this is due to poor color stability of acrylic resins. The loss of color or roughness in denture acts as predisposing factor for growth of microorganisms, discolorations depicting aging and non acceptability of dentures by patient.

**Materials and Method:** 40 discs of heat cured resin were used with beverages: i.e. Tea, Black cold drink, Turmeric milk and distilled water as control group. All the samples were removed and finished to beilby layer. 4 pet jars were taken and 10 acrylic resin discs were immersed in the respective beverage for 30 days. The samples were removed from their respective jars and washed in denture cleanser (sodium perborate) and their optical density was measured using color spectrophotometer. For measuring color in spectrophotometer, 30% H<sub>2</sub>O<sub>2</sub> was applied on the samples one by one and leached out stain is measured out using L\*, a\*, b\* values. Data collected was analyzed statistically.

**Results:** The optical density of all the samples was analyzed and readings were recorded. Group 2 (2.61) recorded maximum optical density change followed by group 1(1.52), group3 (1.24) and least by group 4 (0.3). Results state f value to be 221.60994 which is significant at p<0.01. Also the nbs unit was calculated for all the groups. Group 2 recorded noticeable where as group 1 and 3 recorded traces. The control group 4 showed traces in nbs unit.

**Conclusion:** The order of \*E values were found to be maximum for turmeric followed by tea, followed by coldrink and least by distilled water group. Turmeric group recorded noticeable where as tea group and cold drink group recorded slight in nbs unit. The distilled water group only showed traces in nbs unit.

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#### INTRODUCTION

The consumption of tea, coffee, cold drinks, and milk are normal in every ones daily practice. The dentures are mostly fabricated from acrylic resins as of their biocompatibility, low cost and easy manipulations (Hong, 2009). Poor denture hygiene is a seemingly common problem encountered by dentists in complete denture patients. It may contribute to halitosis, denture stomatitis and angular cheilitis as the dentures presents additional sites and environment to support the growth of micro-organism (Azevedo, 2006 and Shannon, 1976).

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Its etiology is multifactorial. *Candida albicans* is the primary etiological agent and may be associated with the presence of old bacterial plaque, trauma, continuous use of prostheses, lack of oral hygiene, inadequate diet, use of antibiotics and allergic reaction to the denture base material or cleansing products (Joseph, 2009; Scotti, 1997; Jin, 2003 and Jeon, 2004). Dentures have the capability of replacement of oral structures and creating a natural appearance. The dentures used commercially are of pink, light pink or of red color to depict the gingival and oral mucosa. One of the chief complaints often noticed in denture patients is loss of luster or loss of color in their dentures. The reason for this is due to poor color stability of acrylic resins. The loss of color or roughness in denture acts as predisposing factor for growth of microorganisms, discolorations depicting aging and non

acceptability of dentures by patient. The color is studied in dentistry by Munsell system and International Commission on Illumination system (Phillips, 1991). Usage of beverages causes accumulation of plaque, loss of color stability and growth of microorganisms like candida albicans and actinomyces. Acrylic resins mostly used in dentistry consist of pre polymerized polymethylmethacrylate, dibutyl phtylate as powder and methyl methacrylate as liquid. Various other materials like vinyl resins, butyl resins are there in market but the problem of color stability is still there. Nikawa (Nikawa, 1991) and McNeme (McNeme, 1991) have stated that the daily use of beverages can affect the physical and mechanical properties of denture base materials, like color shift in denture base acrylic resins. This color shift could be an intelligible indicator to operators of ageing or damaging of the materials. The aim of the present study is to compare the color stability of heat cured resins after immersion in beverages. Null hypothesis suggest no difference in color stability of two types of acrylic resins when immersed in beverages.

## MATERIALS AND METHODS

40 discs of heat cured resin were used in the present study. The beverages used were Tea, Black cold drink, Turmeric milk and distilled water as control group. For heat cure resin discs, One disc of 2 cm radius was prepared using modeling wax and was indexed in addition silicone putty.

Table 1. NBS unit

SNo	Critical marks of color difference	Nbs unit
1.	Trace	0.0-0.5
2.	Slight	0.5-1.5
3.	Noticeable	1.5-3.0
4.	Appreciable	3.0-6.0
5.	Much	6.0-12.0
6.	Very much	>12

Table 2. Nbs calculations

Group	*E	*E*0.92 (Nbs unit)
Group 1	1.52	1.39
Group 2	2.64	2.42
Group 3	1.24	1.14
Group 4	0.3	0.27

Table 3. Observations set up

SNo.	Group 1	Group 2	Group 3	Group 4
1.	1.7±0.2	2.6±0.1	0.9±0.3	0.2±0.6
2.	1.5±0.7	2.9±0.1	1.1±0.3	0.2±0.1
3.	1.5±0.4	2.6±0.3	1±0.1	0.1±0.4
4.	1.4±0.4	2.3±0.1	1.2±0.3	0.5±0.3
5.	1.7±0.1	2.5±0.9	1.1±0.9	0.2±0.7
6.	1.5±0.2	2.8±0.1	1.4±0.3	0.1±0.4
7.	1.3±0.9	2.7±0.4	1.3±0.1	0.6±0.2
8.	1.3±0.3	2.3±0.2	1.7±0.2	0.5±0.2
9.	1.7±0.2	2.8±0.1	1.2±0.7	0.1±0.7
10.	1.6±0.9	2.6±0.7	1.5±0.3	0.5±0.3
Mean	1.52	2.61	1.24	0.3

Molten wax was poured in the putty index and 40 discs were prepared of wax. All the samples were flaked and Wax elimination was carried out for the flasks. For heat cured samples, powder and liquid is mixed and placed in flask which was kept for 1 hour in bench press followed by long curing cycle. All the samples were removed and finished to beilby layer. 4 pet jars were taken and 10 acrylic resin discs were

immersed in the respective beverage for 30 days. For normality, 1 gm of Tea and turmeric powder was used in 100 ml of distilled water where as cold drink was used as manufactured. The samples were removed from their respective jars and washed in denture cleanser (sodium perborate) and their optical density was measured using color spectrophotometer. For measuring color in spectrophotometer, 30% H<sub>2</sub>O<sub>2</sub> was applied on the samples one by one and leached out stain is measured out using L\*, a\*, b\* values. Data collected was analyzed statistically.

## RESULTS

The optical density of all the samples was analyzed and readings were recorded. Group 2 (2.61) recorded maximum optical density change followed by group 1(1.52), group3 (1.24) and least by group 4 (0.3). Results state f value to be 221.60994 which is significant at p<0.01. Also the nbs unit was calculated for all the groups. Group 2 recorded noticeable where as group 1 and 3 recorded traces. The control group 4 showed traces in nbs unit.

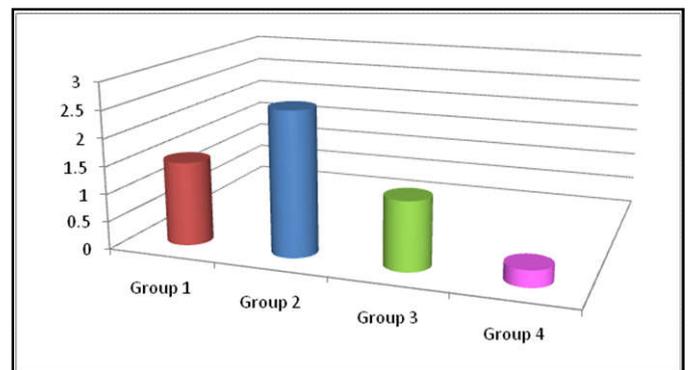
Table 4. Results

	Group 1	Group 2	Group 3	Group 4	Total
N	10	10	10	10	40
ΣX	15.2	26.1	12.4	3	56.7
Mean	1.52	2.61	1.24	0.3	1.4175
ΣX <sup>2</sup>	23.32	68.49	15.9	1.26	108.97
Std. Dev	0.1549	0.2025	0.2413	0.2	0.8563

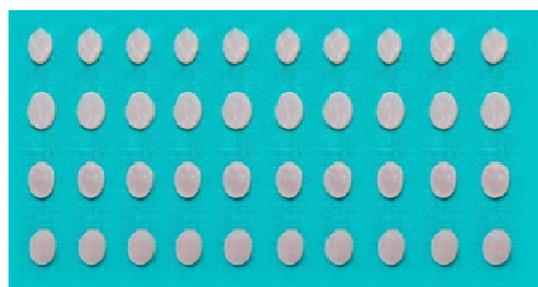
Table 5. Results simplified

Source	SS	Df	MS	F
Between treatments	27.1288	3	9.0429	
Within treatments	1.469	36	0.0408	221.60994
Total	28.5978	39		

Result is significant at P<0.01.



Graph 1. Mean value of all 4 subgroups



Graph 2. Samples used in study

## DISCUSSION

Gerodontia is a natural cycle in humans. As we age, our transition occurs from dentulism to edentulism. This transition starts new challenges for the patient as he has to learn from the start about chewing, speaking and making a habit to wear artificial substitute. The role of dentures starts by acting as a substitute for natural teeth. Fabrication of dentures started in 16<sup>th</sup> century from the dentures carved from wood, dentures made of wood to the latest dentures made of most compatible materials using the latest technology (Jeon, 2004). Though, we have improved a lot, still post insertion complaints following denture fabrication do exist and is a routine problem among dental practitioners. Dentures are fabricated from heat cured resins and metal bases. Though a number of materials are being marketed, heat cured resins are still the material of choice for usage. The easy manipulation, biocompatibility and low cost promote the material to be used. Two main problems associated with heat cured resins are loss of lusture and roughness in dentures (Jin, 2003). This oldens the denture and patients get disinterested towards the prosthesis. Also, it is documented (Shannon, 1976; Scotti, 1997; Nikawa, 1999), that microorganisms grow more in roughened denture than normal one. Our dietary habits have an effect on physical and mechanical properties of hest cured resins. We in our study compared samples immersed in tea, turmeric, cold drink with distilled water as control to simulate the Indian dietary habits. A single denture cleanser (fitty dent) was used to clean the samples to avoid any bias in the study conducted. Optical density was measured in spectrophotometer. The L\*, a\*, b\* values are noted for samples before and after immersion and  $\Delta L$ ,  $\Delta a$  and  $\Delta b$  were calculated. The levels of color change ( $\Delta E$ ) have been quantified by the National Bureau of Standards (NBS) with the NBS units of color difference. NBS units are expressed by the following formula: NBS unit =  $\Delta E^* 0.92$ . (NBS criteria). The nbs unit was calculated for all the groups. Turmeric group recorded noticeable where as tea group and cold drink group recorded slight in nbs unit. The distilled water group only showed traces in nbs unit. The maximum nbs in amount was found in turmeric followed by tea, followed by cold drink and lowest in Distilled water.

The International Commission on Illumination (CIE)  $L^* a^* b^*$  system is used commonly in dentistry to determine color change in dental materials. Colorimeter instruments measure three parameters of color;  $L^*$  (lightness),  $a^*$  (red/green), and  $b^*$  (yellow/blue).  $\Delta E$  is the color difference between two specimens, as calculated by the following formula

$$\Delta E = \sqrt{(L_1 - L_2)^2 + (A_1 - A_2)^2 + (b_1 - b_2)^2}$$

The  $\Delta E$  values were calculated for all the four subgroups and their initial and final values were recorded. The order of  $\Delta E$  values were found to be maximum for turmeric followed by tea, followed by coldrink and least by distilled water group. Davi *et al.* (Davi, 2012) conducted similar study and found H<sub>2</sub>O<sub>2</sub> to be more effective in denture cleansing than sodium perborate. The results of the present study are in accordance to the study by Jagger (Jagger, 1999) which state that H<sub>2</sub>O<sub>2</sub> is more powerful in stain removal. Sarac *et al* (Sarac, 2007) reported that denture cleansers cause bleaching of the dentures and loss of soluble particles making it loose its optical density. Nikawa *et al* (Nikawa, 1999) conducted a similar study on optical density and found high peroxide content which causes

oxygenation of the resin and decomposition of the dentures. The results of our study are also in accordance with Crispin (Crispin, 1979) and Robin (Robinson, 1987) which state that acidic nature of tea, cold drink, turmeric cause ersion of polish denture resin and finally the change in color. Future studies are directed to carry out the study in in vivo conditions with both acidic and basic mediums. Also, the inclusion of other factors should also be considered in the study.

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